NUTRITIONAL STATUS, KNOWLEDGE, ATTITUDE AND PRACTICES OF PATIENTS RECEIVING MAINTENANCE HEMODIALYSIS IN BLOEMFONTEIN, SOUTH AFRICA

H.C. (Ermi) Spies

2001017603

Dissertation submitted in accordance with

the academic requirements for the degree

Magister Dietetics

in the

Faculty of Health Sciences

Department of Nutrition and Dietetics

University of the Free State

Bloemfontein

South Africa

Supervisor: Prof VL van den Berg

June 2018

DECLARATION

I, H.C. Spies, declare that the dissertation hereby submitted by me for the Magister degree at the University of the Free State (UFS) is my own independent work and has not previously been submitted by me to another university/faculty. I further cede copyright of this research report in favour of the UFS. I hereby declare that all royalties as regards intellectual property that was developed during connection with the UFS, will accrue to the university.

Name: H.C. (Ermi) Spies

Date: 22 June 2018

ACKNOWLEDGEMENTS

This research would not have been possible without the assistance of the following:

My Saviour, Jesus Christ, for guiding me and making my paths straight.

My husband, Petrie Spies for being my pillar of strength and motivation; your love carries me always. My children Miené, Lian and Lizbie – “mamma” is so proud of you.

My family and friends, in particular Huibrecht McLeod, Sollie and Hermien Scheepers, Jackie and Maritha Bosch for your encouragement that was rejuvenating every day.

My study leader - Prof Louise van der Berg, for your valuable scientific advice, belief in me and continuous support.

Me Riëtte Nel, from the Department of Biostatistics, University of the Free State, for your time and expertise that is greatly appreciated.

Me Cecile Verseput, for your practical advice and your dedicated work to improve nutrition education in chronic kidney disease in South Africa.

All the dialysis units and participants, for your willingness to participate and for all your patience and friendliness.

Referencing system:

The Department of Nutrition and Dietetics of the University of the Free State makes use of the Cape Peninsula University of Technology Harvard referencing system:

https://www.cput.ac.za/storage/faculties/business/research/school_of_accounting/soa_harvard_reference.pdf

TABLE OF CONTENTS

LIST OF FIGURES

Page

LIST OF TABLES

Page

LIST OF ABBREVIATIONS

aBWef	adjusted body weight edema free
AMA	arm muscle area
BMI	body mass index
CAPD	continuous ambulatory peritoneal dialysis
CKD	chronic kidney disease
CRP	C-reactive protein
CVD	cardio vascular disease
EP	equivalent person
ESRD	end stage renal disease
FFQ	food frequency questionnaire
Hb	hemoglobin
HBV	high biological value
HDR	household density ratio
HSREC	Health Sciences Research Ethics Committee
K	potassium
KDIGO	Kidney Disease: Improving Global Outcomes CKD Work Group
K/tV	kinetic modelling
KAP	knowledge, attitudes and practices
MHD	maintenance hemodialysis
MUAC	mid upper arm circumference
Na	sodium
NKF-K/DOQI	National Kidney Foundation - Kidney Disease Outcome Quality Initiative

NRC	National Renal Care
PE	Port Elizabeth
PEM	protein energy malnutrition
PO4	phosphate/phosphorus
RRT	renal replacement therapy
SA	South Africa
SBW	standard body weight
TSF	triceps skinfold
UFS	University of the Free State
WBC	white blood cell
WC	waist circumference
WHtR	waist-to-height ratio

TEN KEY TERMS

Nutritional status: The influence of dietary intake to meet, exceed or fail the effective functioning of metabolic functions and healthy body composition; measured with anthropometry, biochemical markers, and dietary patterns (Hammond, 2012:129).

Knowledge, attitude and practices (KAP):

Knowledge: The individual's understanding of a topic;

Attitude: The emotional, motivational, perceptive and cognitive beliefs that positively or negatively influence the behaviour; and

Practices: Long-standing observable, customary behaviour (Macías & Glasauer, 2014:8, 10, 18).

Maintenance hemodialysis (MHD): The use of the hemodialysis machine as artificial filtering to remove uremic waste products in blood, therefore acting as an artificial kidney in renal failure, to maintain life (Escott-Stump, 2012:875).

End-stage renal disease (ESRD): Stage 5 kidney failure, occurs when the kidney is no longer able to function, and that, if not treated, causes the subsequent accumulation of waste products that can lead to death (Nelms & Lacey, 2016:526).

Anthropometry: The measurement of the body (weight, height, circumferences) in order to determine body composition (fat mass, muscle mass and bone mass); related to the standards that reflect growth and development and used to further classify and individual as overnourished or undernourished (Hammond & Litchford, 2012:165).

Dietary patterns: An individual's frequency and amounts of food intake, types of food consumed, and overall estimated energy, macronutrient and micronutrient intakes (Hammond, 2012:137).

Phosphorous/ phosphate (PO4): A mineral in food of which the excess is normally excreted by the healthy kidney. In ESRD excessive dietary phosphate intake can lead to altered

phosphorus-calcium balance that contribute to renal osteodystrophy, as well as arteriosclerosis that increases CVD risk (Wilkens et al., 2012:823).

Dietitian: Regulated healthcare professionals qualified to assess, diagnose, and treat nutritional problems in order to improve or maintain health through appropriate dietary intake (Sucher, 2016:2).

Renal dialysis diet: Recommendations regarding restrictions of foods high in phosphate, potassium, sodium and fluid to prevent secondary complications like pulmonary edema, faulty cardiac muscle action and renal osteodystrophy; furthermore, ensuring adequate intakes of energy and moderate protein to inhibit catabolism and poor nutritional status (Nelms & Lacey, 2016:538-539).

Nutrition education: An instructive, formal process to impart knowledge to a patient to modify food choices and eating behaviour (ADA, 2011:279).

SUMMARY

Background: Internationally, the nutritional management of patients on maintenance hemodialysis (MHD) poses a challenge. This is the first Sub-Saharan study to focus on knowledge, attitudes and practices (KAP) regarding the renal diet required for patients on MHD.

Methods: A descriptive, cross sectional study was performed during 2017 on 75 participants receiving MHD in Bloemfontein, a mid-sized city in central South Africa. Questionnaires were administered during structured interviews, and anthropometry, pre-dialysis biochemistry and information from the patient files were documented.

Results: The participants were mostly men (70.7); median age, 50.5 years; median education level, Grade 12. The etiology of renal failure included hypertension (37.3 %), diabetes mellitus (DM) (6.7 %), or both (10.7 %). Home-languages were mostly Sesotho (46.7 %) and Afrikaans (4 %), and second languages, English (61.4 %) and Sesotho (18.7 %). Most (64 %) lived in overcrowded conditions, 38.7 % received a social grant, and only 24 % were employed full-time. Furthermore, 41.7 % had an income $\leq$R1 500 per month (pm); the median percentage of income available for food per person (pp) pm, was 27.3 % (the suggested in 2017 was 40 %), and 78.9 % were spending <40 % of income pp/pm on food.

Median body mass index (BMI) was 26.4 kg/m^2, with 23 % overweight (<25.0 - <30.0 kg/m^2), 33.8 % obese (>30 kg/m^2) and only 5.3 % underweight (<18.5 - >17.0 kg/m^2). Most (66.2 %) had a weight-to-height-ratio (WHtR) >0.5, indicating increased risk for metabolic comorbidities. Body fat (BF) percentages were above normal (>85th percentile) for 25.4 %. Yet, 56 % had arm muscle areas (AMA) $\leq$ 15th percentile and 29.3 % had body fat (BF) percentages <5th percentile. In fact, of those with AMA $\leq$15th percentile, 31 % (n= 13) had BMI $\geq$25 kg/m^2 (indicating overweight), and 57 % (n= 24) had a normal BMI (>18.5 kg/m^2 to < 24.9 kg/m^2).

Without C-reactive protein (CRP) testing, the low serum albumin levels (<35 g/L) in 49.3 % of participants, as well as hypocholesterolemia (53.3 %, n= 8 out of 15) and low white blood cell counts (WBC) (26.4 %, n= 14), cannot be ascribed to malnutrition with certainty. Yet,

pre-dialysis low serum urea levels (<21 mmol/L) in 52.5 % (n= 32) in the presence of low protein intakes (particularly low high biological value (HBV) protein), could point to malnutrition. Overall, 28 % (n= 21) had low hemoglobin levels (<10 g/dL) and 18.9 % (n= 14), had low TSAT values (<20 %), possibly indicating iron shortage. Serum phosphate (PO_4) levels were >1.8 mmol/L for 25.3 %, and above 1.42 mmol/L for 49.3 %.

Compared to NKF-K/DOQI guidelines, 44.6 % of participants had energy intakes <30 kcal/kg (dry weight/adjusted edema-free body weight [$_aBW_{ef}$]), whilst 46 % consumed >35 kcal/kg. Similarly, 48.6 % had total protein (TP) intakes <1.2 g/kg (dry weight/$_aBW_{ef}$), and 43.2 % consumed >1.3 g/kg. Overall, 40 % had consumed inadequate amounts of HBV protein (<50% of TP). Those participants with inadequate HBV protein intake (<50 % of TP) had statistically significantly lower pp income than those with above adequate intakes of HBV protein (>75 % of TP) (95 % CI [R4 416.70 ; R19 000.00]), and spent statistically significantly less pp on food (95 % CI [R216.70 ; R1 309.50]).

Overall, 49.4 % had poor combined knowledge (<50 %) of restricted foods, mineral content of food, and phosphate binder medication. Participants with tertiary education (28 %) had statistically significantly better knowledge than those with only primary school education (6.7 %) (95 % CI [3.9 % ; 73.5 %]), and to those who had only partially completed secondary school (17.3 %) (95 % CI [6.3 % ; 64.0 %]). Only, 21 % had received written and 30.7 % verbal, nutrition education (NE) in their home language. Overall, 24 % had not received NE in their home and/or second language. Having received NE in a home language and/or second language was associated with statistically significantly higher overall knowledge scores (95 % CI [3.7 % ; 49.5 %]. In addition, participants with lower phosphate intakes (<10 mg PO4/g protein) (23 %), scored statistically significantly better on knowledge regarding phosphate binders, than those (60.8 %) with a higher phosphate intake (>12 mg PO4/g protein) (95 % CI [2.9 % ; 52.5 %]).

Most (60 %) felt negative about the renal diet, and (61.4 %) reported poor adherence practices. Most (77.3 %) reported ≤1 consultation with a dietitian per MHD year (NKF-K/DOQI recommendation: >3).

Conclusion: This sub-Saharan population on MHD presented with substantial overweight and obesity, indicating high risk for cardiovascular complications; yet, excessive body fat levels, masked muscle wasting. Protein intake, particularly, HBV protein intake were below recommendations, and significantly associated with lower income levels. Most participants showed inadequate knowledge (significantly associated with education level and receiving NE in a first or second language), negative attitudes, and poor compliance practices regarding the renal diet and dietitians were inadequately involved in the treatment of these patients.

CHAPTER 1: ORIENTATION AND MOTIVATION

1.1 Introduction

Kidney disease is defined as an abnormality of kidney structure or function which has detrimental implications for the health of an individual (KDIGO, 2013a:15). End-stage renal disease (ESRD), or stage 5 kidney failure, occurs when the kidney is no longer able to function and, if not treated, the subsequent accumulation of waste products can lead to death (Nelms & Lacey, 2016:526). The most common cause of CKD is kidney damage induced by hypertension (HTN) and diabetic nephropathy. Management of ESRD requires a wide array of medications and, where possible, renal replacement therapy (RRT) in the form of dialysis. RRT may replace some of the filtration functions of the damaged kidneys, and does prolong life, but requires strict dietary restrictions for optimal care (Wilkens et al., 2012:813).

In a recent editorial in the South African Journal of Medicine, Meyers (2015:232) explains that the actual prevalence of chronic kidney disease (CKD) in South Africa is not known due to diagnostic difficulties, particularly in rural areas. Based on the fact that 10 % of the world's population is estimated to have some degree of CKD, Meyers predicted that around five million South Africans over the age of 20 years would have CKD, given the high prevalence of hypertension (HTN) (25 %) and diabetes (16 %) amongst South Africans (Naicker, 2009:S13), that the true burden of CKD is almost certainly higher (Meyers, 2015:232).

In terms of ESRD requiring RRT, it was estimated that 1,371 million people worldwide were undergoing dialysis at the end of 2004, of which less than 5 % were in Sub-Saharan Africa (Naicker, 2009:S14; Grassmann et al., 2005:2587). At that time, across all regions in the world, maintenance hemodialysis (MHD) was the most common treatment modality (89 %) compared to continuous ambulatory peritoneal dialysis (CAPD) (11 %) (Grassmann et al., 2005:2587). According to Meyers (2015:232), by December 2012, only 6 952 patients were receiving dialysis in South Africa, although he did not distinguish between MHD and CAPD.

The nutritional impact of CKD and RRT has not been well-researched in South Africa beyond a handful of reports that focused on patients receiving CAPD. Prior to 2000, the only South African studies in this regard were conducted in Durban on patients receiving CAPD. Botden et al. (1997) studied 129 patients on CAPD and found severe hypoalbuminemia amongst 14 % of them. Episodes of peritonitis contributed to the hypoalbuminemia in eight of these patients, who were found to have a mean dietary protein intake (DPI) of 0.852 g/kg/day, as measured by the peritoneal equilibration test, compared to the recommended DPI of 1.2 g/kg/day. After five months of dietary protein prescription of 1.2 to 1.5 g/kg/day, partly delivered through nutritional supplements, serum albumin levels improved by a mean of 20 % in eight of these 18 malnourished patients, although albumin levels had not normalised in any of them.

Amongst 82 patients on CAPD in Durban, Muranda et al. (1997) found that adequacy of dialysis (achieving Kt/V of >2.1), was associated with a reduction in the number of hospital admissions, suggesting improved health status amongst patients who are adequately dialysed. In the same centre, Bradley (1998) subsequently found that amongst 84 patients on CAPD, 76.2 % were malnourished, and loss of appetite was found to be an important etiological factor.

Naicker (2002:757), in summarising the findings of these South African studies prior to 2000, concluded that strategies to optimise dialysis dose, together with services of a renal dietitian, would assist in improving the nutrition of patients with ESRD.

More recently, a study by Abdu et al. (2011:151) amongst 50 patients on CAPD in Johannesburg (37.9 ± 13.4 years; 54 % men), found that although these patients had a normal mean body mass index (BMI), their mean mid upper arm circumference (MUAC) indicated malnutrition. Based on subjective global assessment (SGA) scores, 50 % of these patients were moderately undernourished and 8 % were severely malnourished. SGA is based on a combination of subjective and objective features from the medical history and physical examination. The SGA focuses on gastrointestinal symptoms (anorexia, nausea, vomiting, and diarrhoea), weight loss in the preceding six months, and visual assessment of subcutaneous tissue and muscle mass, thus, relying heavily on the clinical judgement of the examiner (Fouque et al., 2007:85). The SGA scores were also found to correlate significantly

with the anthropometric parameters (BMI, MUAC), whilst there was no significant correlation between the nutritional parameters and dialysis adequacy (measured as Kt/V) (Abdu et al., 2011:151).

In a retrospective study on 152 patients receiving CAPD in Limpopo province, Isla et al. (2014:520) reported an overall high rate of peritonitis (0.82 / year). This was however, not found to be associated with the adverse socio-demographic or socio-economic factors, such as long distances travelled to the dialysis unit, absence of tap water or electricity at home, or unemployment and lack of income, but was speculated to be due to malnutrition. Nutritional status was unfortunately not assessed in this study. BMI, serum albumin levels, hemoglobin levels and more than one episode of peritonitis were also identified as significant predictors of morbidity while still on CAPD, and for having to change the treatment modality to MHD. Therefore, the authors concluded that one of the treatment strategies should focus on preventing malnutrition, as this could contribute to anemia, peritonitis and morbidity (Isla et al., 2014:524).

In East London in the Eastern Cape Province (South Africa), Leclercq (2015:67) studied 26 patients on CAPD. The median age was 38 years, 76 % were women, and 77 % had primary hypertension. Whilst, 35 % were overweight or obese based on BMI, 7 % were wasted based on upper arm muscle area (AMA) and 88 % had below normal albumin levels (<35 g/L). Sodium and potassium levels were well controlled, but 50 % had high phosphate levels (>1.4 mmol/L). Inadequate dietary intakes of energy and total protein were noted in 69 % and 54 % of the participants, respectively. Only 35 % of the participants had an adequate intake of high biological value (HBV) protein.

To date, the only study to report on the nutritional status of patients on MHD in South Africa, was performed on 68 MHD patients in Port Elizabeth (Eastern Cape Province) by Botha (2015:4, 60, 61). The participants were assessed on socio-demographics, and nutritional status based on a self-reported, short form, mini nutritional assessment (SF-MNA). The SF-MNA reported on appetite status in the past three months, weight loss during the past three to six months, mobility, psychological stress or acute disease suffered, BMI (<17-21 kg/m^2), and self-view of nutritional status as being malnourished or having no nutritional problem. Results from the study showed that 52.9 % (n= 36) were at risk of

malnutrition. The risk for malnutrition was significantly associated with the duration of MHD ($p < 0.001$); with those who had been on MHD for zero to six months were at higher risk. The risk for malnutrition was also significantly associated with loss of appetite ($p < 0.001$), self-reported weight loss ($p < 0.001$), and experiencing psychological stress or acute disease ($p < 0.001$). Overall, 85.3 % (n= 58) of the participants had a BMI of above 21 kg/m^2, but the number of the participants that were overweight (BMI >24.9 kg/m^2), were not reported. BMI was not significantly associated with a risk for malnutrition in this study.

In the rest of Sub-Saharan Africa, the most recent study on the nutritional status of patients on MHD, included 113 patients (75 men) in Cameroon (Halle et al., 2014:545). In this study, the median age was 49.4 years, and participants had been on dialysis for a median of 25 months. Overall, 31.6 % had low serum albumin levels, whilst 21 % of patients were underweight (based on BMI), 23.9 % were wasted (based on MUAC), and 21 % of patients presented with a combination of the three abnormalities (a single determinant of malnutrition is deemed unreliable). Prevalence rates for other possible indicators of undernutrition were: low plasma cholesterol levels in 26.3 %, elevated CRP-levels in 28 %, and anemia in 82.7 % of the participants. Female gender, younger age, fewer meals per day, and frequent vegetable intake (which possibly replaced protein intake) were significantly associated with malnutrition risk.

1.2 Problem statement

Protein energy malnutrition (PEM) is common in patients with chronic kidney disease (CKD) and is associated with adverse clinical outcomes, especially in individuals receiving MHD therapy (Ikizler et al., 2013:1096). In the entire Sub-Saharan Africa, including South Africa (SA), only two studies regarding the nutritional status of patients on MHD had been published – one done in Cameroon and the other in Port Elizabeth, South Africa (Halle et al., 2014:545; Botha, 2015). No African studies to date have focussed on patients' compliance with the dietary modifications and restrictions recommended by the NKF-K/DOQI for patients on MHD. This is particularly disconcerting in light of international data that patients struggle to strictly comply with these dietary guidelines. Moreover, several South African surveys have shown that the SA population overall, lack knowledge of general health and nutrition guidelines (Steyn et al., 2000; Kruger et al., 2002 & Shisana et al., 2013). Socio-

demographic factors may also affect patients' adherence to renal dietary guidelines, but this has scarcely been studied in South Africa.

The Food and Agriculture Organization of the United Nations (FAO), that specifically focusses on nutrition-related issues in developing countries, state that studies that "assess and analyse people's nutrition-related knowledge, attitudes and practices (KAP)" are important to gain insight into the determinants that influence people's dietary habits, and therefore provide valuable baseline information to improve the effectiveness of interventions. In addition, KAP studies are indispensable for evaluating nutrition-education defined as activities that explicitly address and aim to improve people's nutrition-related knowledge, attitudes and practices (Macías & Glasauer, 2014:1).

In addition, despite many international studies highlighting the important role that a qualified dietitian can play in assisting patients to manage the required dietary modifications and restrictions, no study has assessed, to what extent this resource is utilised for patients on RRT in South Africa.

The study was therefore designed to describe the nutritional status of South African patients on MHD. In addition, the KAP of these patients regarding the dietary restrictions they need to comply to, as well as the involvement of a dietitian in their treatment, were investigated. Attaining this baseline information may contribute to optimising treatment procedures of patients receiving MHD in South Africa.

1.3 Aim

This study aimed to describe the nutritional status, knowledge, attitude and practices of patients receiving MHD in Bloemfontein, a mid-sized city in the Free State province in central South Africa.

1.4 Objectives

To achieve the aim, the following were determined for each participant:

- Socio-demographic information;
- Medical information;
- Nutritional status, based on:

  - Anthropometry (post-dialysis body mass index [BMI], arm muscle area [AMA] and fat percentage, to assess body composition; as well as waist circumference [WC], and waist-to-height ratio [WHtR], to assess risk of cardio vascular disease [CVD]; and dry weight three months prior the study);
  - Biochemistry (serum levels of albumin, c-reactive protein [CRP], urea, creatinine, phosphate, potassium, sodium, glycosylated haemoglobin, total cholesterol, adequacy of dialysis as Kt/V, and biomarkers of anemia); and
  - Dietary intake (the estimated energy and macronutrient intakes, and the frequency and amounts of food consumed);
- KAP regarding dietary modifications and restrictions required for patients with ESRD on MHD; and
- The involvement of a dietitian in the treatment.

1.5 Layout of dissertation

The dissertation is outlined as follows:

Chapter 1: Introduction and motivation for the study

This chapter outlines the relevant background information and motivation for the study, and defines the aim and objectives.

Chapter 2: Literature review

This chapter explains the anatomy and functions of the healthy kidney, the definition and stages of CKD, RRT, PEM in RRT, medical nutrition therapy for patients on RRT, evaluation of biochemical markers, and the practical aspects of nutrition intervention in patients on RRT.

Chapter 3: Methodology

This chapter describes the methodology followed in this study, including obtaining approvals and permissions for the study, the study design, study population and sample selection, and measurements of the socio-demographics, medical information, nutritional status (anthropometry, biochemical markers, and dietary intake), and KAP to assess adherence to dietary modifications and restrictions for ESRD on MHD, as well as the involvement of a dietitian in the patient care. Validity and reliability issues in the study, the

pilot study, statistical analysis, ethical considerations and challenges encountered during the study, are also described.

Chapter 4: Results

This chapter describes the results of the study.

Chapter 5: Discussion

The results of the study are interpreted and discussed and compared to other SA studies and international findings.

Chapter 6: Conclusions and recommendations

Conclusions are drawn from the results and recommendations are made.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this chapter CKD is reviewed, in particular end stage renal disease (ESRD), during which the kidney is not able to sustain life, and renal replacement therapy (RRT) is needed. The anatomy and functions of the healthy kidney, the definition and stages of CKD, the role of RRT, the development of PEM due to RRT, are explained. Additionally, medical nutrition therapy for patients on RRT, evaluation of biochemical markers, and the practical aspects of nutrition intervention in patients on RRT, will be reviewed. The unique situation in South Africa regarding CKD and RRT is also reviewed.

2.2 Anatomy of the healthy kidney

The kidneys are two fist-sized organs located at the back of the peritoneum. Each kidney weighs on average between 125 – 170 g in men and 115 – 155 g in women, and is 11.0 – 12.0 cm long, 5.0 – 7.5 cm wide and 2.5 – 3.0 cm thick. Each kidney consists of 1.2 million nephrons, which constitutes the microscopic, vital functioning units of the kidney (Nelms & Lacey, 2016:521). The kidneys filter on average 1600 L of blood per day, which is 20 % of cardiac output, and produces 180 L of ultra-filtrate, which is concentrated to an average of 1.5 L of urine that is excreted per day (Wilkens et al., 2012:799).

Each nephron comprises a glomerulus, which is a round-shaped cluster of capillaries surrounded by a membrane, known as the Bowman's capsule. The glomerulus is the central point where filtration of blood occurs. It is situated between the efferent and afferent arteriole, with the efferent arteriole carrying blood away from the glomerulus and the afferent carrying blood to it. Blood is filtrated from the glomerulus across the membranes and into Bowman's capsule. Beyond the capsule, the nephron extends as the proximal tubule, the distal tubule, the loop of Henlé and the collecting duct tubule, all of which are lined with epithelial cells with different functions of secretion and absorption according to location. Each nephron extends into three parts of the kidney, namely the cortex, the outer medulla and the inner medulla. The cortex section of the kidney contains the Bowman's capsule, efferent and afferent arterioles together with the proximal and distal tubules, and

the medulla contain the loop of Henlé, collecting duct and vasa recta (capillary branches of the renal efferent arterioles, parallel to the loops of Henlé) (Nelms & Lacey, 2016:521). The tubules are responsible for determining the final composition of the urine. Active processes of reabsorption regulated by hormones (aldosterone and vasopressin), determines the concentration of electrolytes, pH, volume and osmolality of urine, which varies continuously in order to maintain human homeostasis. Kidney function is assessed based on the glomerular filtration rate (GFR), which is reflected in clearance tests that measure the rate at which the glomeruli clears substances from the blood (Nelms & Lacey, 2016:526). In addition, the glomerulus does not normally filtrate molecules like blood cells and plasma proteins, so that the appearance of albumin in the urine is indicative of damage to the nephrons (KDIGO, 2013a:34).

After being produced by the nephrons, urine that collects in the collecting ducts, passes through the renal pelvis into a single ureter that descends towards the bladder from each kidney. Urine is stored temporarily in the bladder from where it leaves the body via a single urethra (Wilkens et al., 2012:800).

2.3 Functions of the kidney

The healthy kidney has an enormous array of functions in the human body and, therefore, malfunctioning has a major negative impact on homeostasis.

2.3.1 Water homeostasis

Blood osmotic pressure can rise or fall due to a lack or excess of water. Changes in blood osmotic pressure are detected by the hypothalamus, which, in turn, alerts the pituitary gland via negative feedback. When low blood osmotic pressure signals a lack of water in the body, the posterior pituitary gland secretes antidiuretic hormone (ADH) (also named vasopressin) that triggers the tubuli of the nephrons to reabsorb water so that plasma volume and osmolality returns to normal. Subsequently, urine contains less water and is darker in colour. The reverse occurs when blood osmotic pressure increases (Escott-Stump, 2012:860).

2.3.2 Elimination of nitrogenous waste

Metabolism and other bodily functions produces waste products, including nitrogenous waste like urea, uric acid and creatinine; removal of these waste products by the kidney, is vital to prevent their toxic build-up (Escott-Stump, 2012:860).

2.3.3 Control of blood pressure

The distal convoluted tubule of the nephron absorbs sodium ions through a process controlled by the renin-angiotensin system (Figure 2.1). Renin, a proteolytic enzyme, is secreted by the distal convoluted cells when blood pressure is too low. Renin activates angiotensinogen (a blood protein) to convert it to angiotensin I. Angiotensin I, in turn, is converted in the lung capillaries to angiotensin II by the angiotensin-converting enzyme (ACE). Angiotensin II stimulates the secretion of aldosterone through the adrenal cortex, and aldosterone, in turn, stimulates the nephrons to reabsorb sodium ions and water. This increases blood volume and, therefore, raises the blood pressure (Escott-Stump, 2012:860). Angiotensin II can, however, also trigger low-grade inflammation in the blood vessel wall (Raymond & Couch, 2012:761).

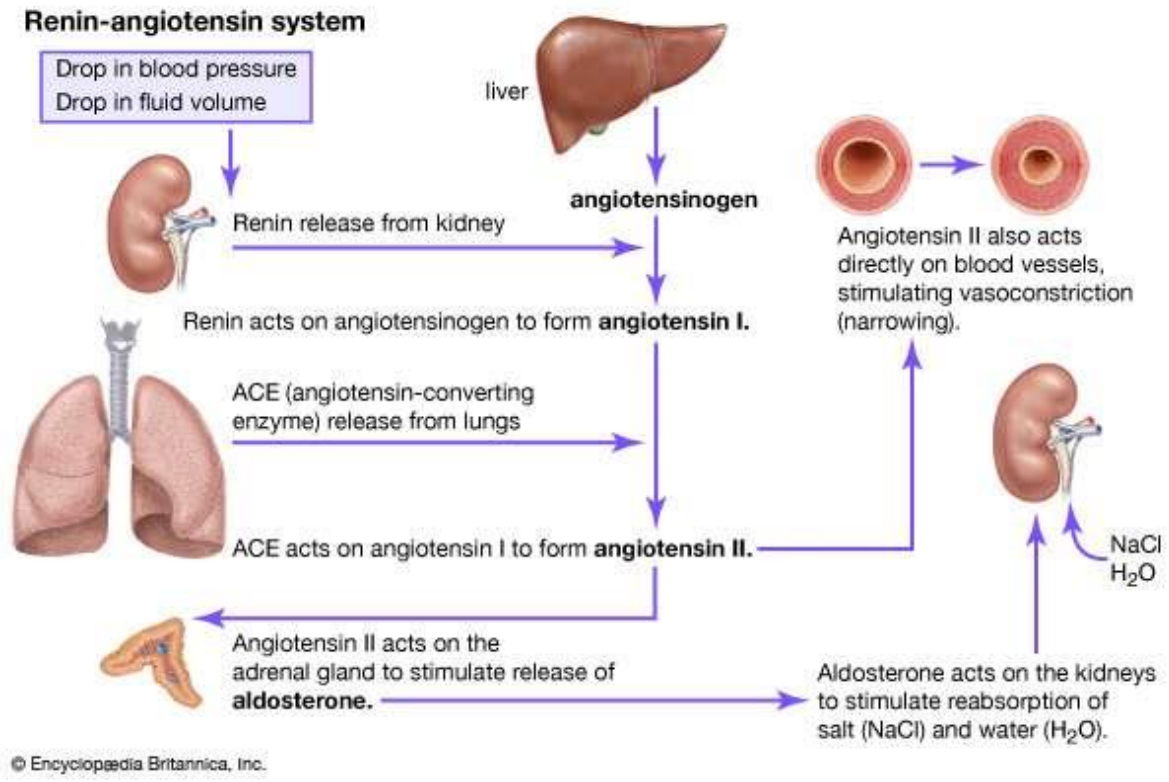

Figure 2.1: Renin-angiotensin system (Encyclopaedia Britannica, 2017:online)

2.3.4 Acid-base balance

The kidneys are responsible for excreting excess hydrogen ions to maintain normal blood and tissue fluid pH at 7.35 to 7.45 (Escott-Stump, 2012:860: Nelms, 2016:146).

2.3.5 Secretion of erythropoietin

The normal kidney produces the hormone, erythropoietin, which signals red blood cell production in the bone marrow. In CKD, erythropoietin production fails, causing chronic renal anemia, characterised by a reduction in red blood cell numbers, without affecting the size and shape of the red blood cells (Escott-Stump, 2012:860).

2.3.6 Activation of Vitamin D

The inactive circulating form of vitamin D, namely 25-hydroxy vitamin D (or vitamin D_2), produced in the lungs, is converted to the active form, 1.25-dihydroxy vitamin D (or vitamin D_3), in the kidney. Vitamin D_3 plays an active role in maintaining calcium-phosphorous balance in the body (Escott-Stump, 2012:860).

2.3.7 Other functions of the kidney

Carnitine synthesis takes place in the kidney and carnitine is needed to transport long chain fatty acids from the cell cytoplasm into the mitochondria for conversion to energy (Escott-Stump, 2012:860).

The kidney also plays a role in gluconeogenesis to convert protein to glucose, as well as in glucose counter regulation (Escott-Stump, 2012:860).

Prostaglandin E_2, a major renal metabolite of arachidonic acid, produced in cell membranes by cyclooxygenase, also impacts renal hemodynamic to cause vasodilation, resulting in increased renal blood flow as well as increased sodium and water excretion (Escott-Stump, 2012:860).

2.4 Chronic kidney disease

Chronic kidney disease is a syndrome characterised by irreversible and progressive loss of kidney function secondary to damage of the nephrons, but the onset of renal failure is not normally apparent until 50 – 70 % of renal function is lost (Nelms & Lacey, 2016:526).

2.4.1 Etiology and pathophysiology

In the United States, diabetes is the leading risk factor for CKD, followed by hypertension (Wilkens et al., 2012:810). In South Africa, the majority of ESRD are due to primary hypertension, which occurs in 25 % of South Africa's black population and is the recognised cause of stage 5 CKD in 40 – 60 % of these patients (Meyers, 2015:233).

Other etiologies and risk factors include: glomerulonephritis, ethnicity (people from African origin are nearly four times more likely to develop CKD than Caucasians), family and hereditary factors (e.g. polycystic kidneys), direct trauma to the kidney, and/or longstanding use of over the counter pain killers (aspirin and ibuprofen) (Nelms & Lacey, 2016:527). Smoking especially heavy smoking (> 30 pack years) increases the risk of CKD overall and particularly for CKD classified as hypertensive nephropathy and diabetic nephropathy (Yacoub et al., 2010:online).

When one half to two thirds of kidney function has been lost, irrespective of the original disease, progressive further loss of kidney function follows. Even if the underlying cause has

been eliminated entirely, kidney function will worsen. In response to a declining GFR, the kidney undergoes a series of adaptations to prevent further deterioration although in the short term this leads to improvement of the filtration rate, in the long term it leads to accelerated loss of nephrons and progressive renal inadequacy (Wilkens et al., 2012:810).

2.4.2 Diagnosis, staging and prediction of prognosis

The Kidney Disease Improving Global Outcomes (KDIGO) 2012 workgroup's, clinical practice guideline for the evaluation and management of chronic kidney disease defines CKD as having a GFR of <60 ml/min/1.73 m^2 for >3 months (categories G3a – G5), and/or presenting with any of the following markers of kidney damage for >3 months: (i) albuminuria (urinary albumin excretion rate [AER] >30 mg/24 hours); (ii) albumin-to-creatinine ratio [ACR] ≥30 mg/g or >3 mg/mmol; (iii) urine sediment abnormalities; (iv) electrolyte and other abnormalities due to tubular disorders; (v) abnormalities detected by histology; (vi) structural abnormalities detected by imaging; and/or (vii) history of kidney transplantation (KDIGO, 2013a:19, 20).

The KDIGO, 2012 guideline, further recommends that CKD is classified on simple laboratory tests (GFR and albuminuria) without first identifying the cause, therefore, enabling detection of CKD by non-nephrologist physicians and other health professionals (KDIGO, 2013a:19).

Normal GFR for an adult is approximately 120 ml/min (Nelms & Lacey, 2016:525). Based on GFR category, five stages of CKD are defined (with stage 3 specifically further divided): stage 1 – kidney damage with normal or increased GFR (≥90 ml/min/1.73 m^2); stage 2 – kidney damage with mild decreased GFR (60–89 ml/min/1.73 m^2); stage 3a – mildly to moderately decreased GFR (45-59 ml/min/1.73 m^2); stage 3b – moderately to severely decreased GFR (30-44 ml/min/1.73 m^2); stage 4 – severely decreased GFR (15-29 ml/min/1.73 m^2); and stage 5 – kidney failure (<15 ml/min/1.73 m^2) (which is inadequate to sustain life and requires initiation of RRT) see Figure 2.2 (KDIGO, 2013a:34; Nelms & Lacey, 2016:526).

Albuminuria is a common, but not uniform finding in CKD. It is the earliest marker of glomerular diseases, including diabetic glomerulosclerosis, where it generally appears before the reduction in GFR. It is a marker of hypertensive nephrosclerosis, but may not

appear until after the reduction in GFR (KDIGO, 2013a:22). Albuminuria is included as an additional expression of severity of disease, not only because it is a marker of the severity of injury, but also because albuminuria itself strongly associates with progression of kidney disease. Numerous studies have identified the adverse prognostic implication of albuminuria irrespective of level of kidney function (KDIGO, 2013a:26).

GFR and albuminuria combined, is also used to predict prognosis of CKD (Figure 2.2) (KDIGO, 2013a:34).

Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012

GFR categories (ml/min/ 1.73m²) Description and range				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30-300 mg/g 3-30 mg/mmol	>300 mg/g >30 mg/mmol
	G1	Normal or high	≥90			
	G2	Mildly decreased	60-89			
	G3a	Mildly to moderately decreased	45-59			
	G3b	Moderately to severely decreased	30-44			
	G4	Severely decreased	15-29			
	G5	Kidney failure	<15			

Figure 2.2: Prognosis of CKD by GFR and albuminuria category (KDIGO, 2013a:34)

The colours indicate prognosis: Green, low risk (if no other markers of kidney disease, no CKD); Yellow, moderately increased risk; Orange, high risk; Red, very high risk. CKD - chronic kidney disease; GFR - glomerular filtration rate.

2.4.3 Treatment

The management of CKD aims to delay the progression of the disease by treating the underlying renal pathophysiology. Progression of CKD is highly individualised, and many patients may remain at the initial stages for months to years. Amongst black South African patients with CKD, however, stage 5 or ESRD occurs at a relatively young age (35 - 45 years) compared with other population groups in whom renal failure resulting from primary hypertension usually only occurs between 60 and 70 years of age (Meyers, 2015:233). At

this stage, harmful wastes build up in the blood, blood pressure rises, and excess fluid is retained, requiring more extensive treatment to replace the function of the kidneys.

2.5 Renal replacement therapy

In ESRD, treatment options include RRT and kidney transplantation (KDIGO, 2013a:20). RRT entails a dialysis procedure that replaces the filtering function of the kidneys to remove excessive and toxic by-products of metabolism, and excess water and electrolytes from the blood. Waste products and electrolytes move by diffusion, ultrafiltration, and osmosis from the blood into the dialysate and are removed from the blood circulation (Figure 2.3) (Wilkens et al., 2012:815). This maintains life, even though metabolic and endocrine functions of the kidney are not totally replaced (Nelms & Lacey, 2016:528). Yet, removal of metabolic wastes and excess fluid is never so thorough that diet therapy is unnecessary (Wilkens et al., 2012:815).

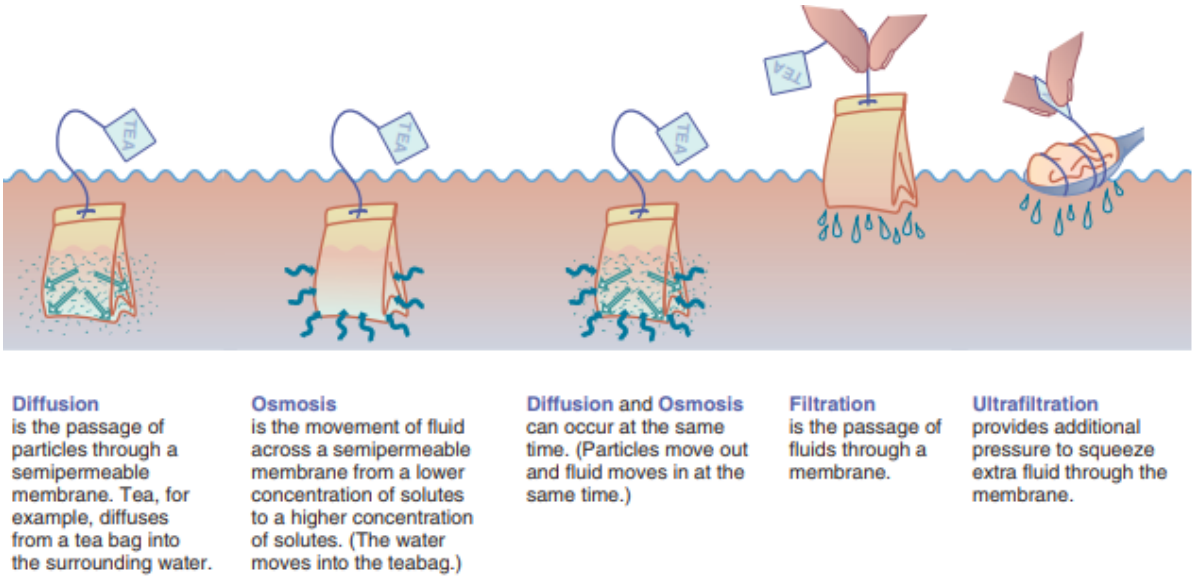

Figure 2.3: Principles of filtration in dialysis (Wilkens et al., 2012:816, Figure 36-3)

2.5.1 The decision to initiate dialysis

Definite indications for dialysis therapy in ESRD include pericarditis, uncontrollable fluid overload, pulmonary oedema, uncontrollable and repeated hyperkalemia, coma, and lethargy (Nelms & Lacey, 2016:528). For less severe symptoms such as azotemia, nausea,

and vomiting, the impact on the patient's quality of life is taken into consideration. Unnecessary delay, however, should be avoided (Nelms & Lacey, 2016:528).

2.5.2 Types of renal replacement therapy

The major types of RTT used for patients with ESRD are MHD and CAPD. The choice depends on underlying pathology and comorbid factors such as cardiovascular disease, age, family support, and proximity to a dialysis centre, and most of the time MHD is the predominant choice (Nelms & Lacey, 2016:528); MHD 89 % compared to CAPD 11 % (Grassmann et al., 2005:2587).

2.5.3 Process of maintenance hemodialysis

In MHD, a selective, semi-permeable membrane, bathed in a fluid of which the electrolyte content is similar to that of normal plasma, is provided by an artificial dialyser (Figure 2.4) (Nelms & Lacey, 2016:529). Before MHD can be initiated, a point of permanent access to the bloodstream is surgically created in the form of a fistula that connects an artery and a vein (Wilkens et al., 2012:815). Another option for access is an artificial vessel called a graft which can be surgically implanted. A graft will be considered if the patient's blood vessels are fragile and a fistula is not possible. Large needles are inserted into the fistula or graft before each dialysis and removed when dialysis is completed, and adequate waste products have been removed from the blood. Temporary access to the blood vessels through subclavian catheters is common until the patient's permanent access (graft or fistula) can be created or mature, however, problems with infection with these temporary catheters make them undesirable (Wilkens et al., 2012:815).

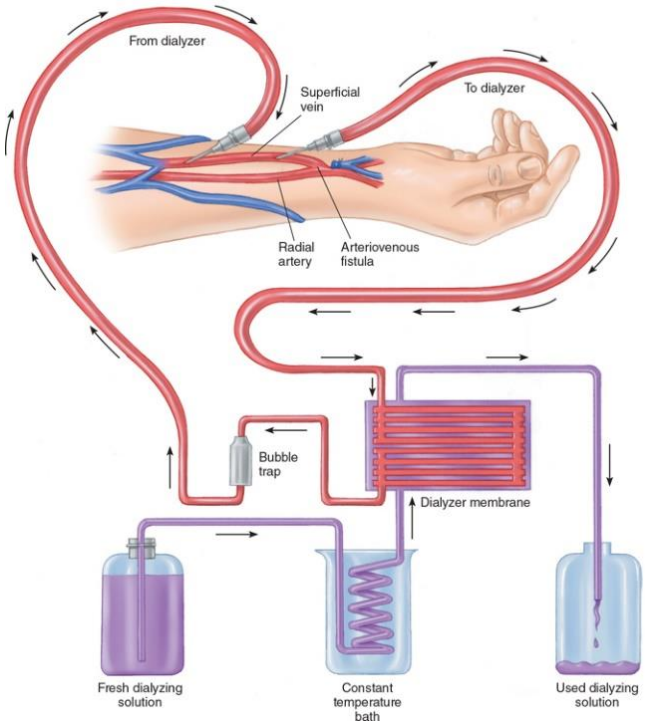

Figure 2.4: The process of maintenance hemodialysis (Nelms & Lacey, 2016:529 *who cited Rhodes & Pflanzer, 2003:782*)

2.5.4 Process of peritoneal dialysis

In CAPD, the semipermeable lining of the patient's peritoneal wall serves as the selective membrane to provide the filter (Figure 2.5). A catheter is surgically implanted in the abdomen and into the peritoneal cavity. The dialysate is a hyperosmolar solution of dextrose that is infused into the peritoneal cavity where excess water is removed from the blood by osmosis and glucose and waste is exchange by diffusion during several hours that the dialysate remains inside the peritoneal cavity (referred to as the dwell time) (Escott-Stump, 2012:875). At the end of the dwell time, this fluid is drained from the cavity and discarded into the toilet, and new solution is infused (Wilkens et al., 2012:815; Naylor et al., 2013:316).

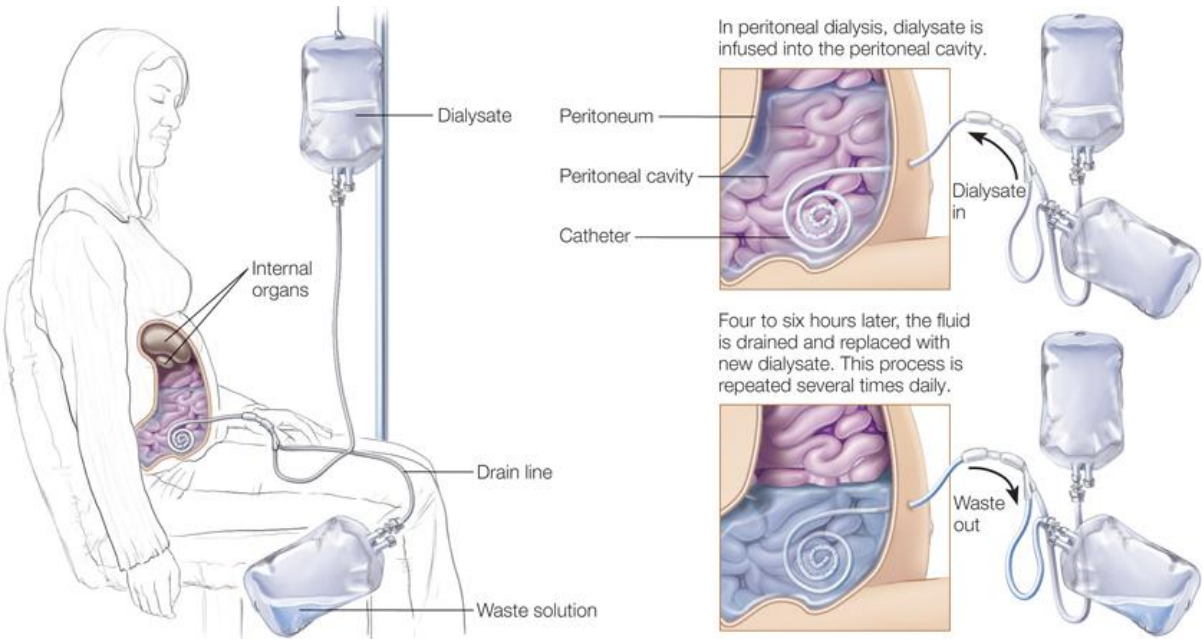

Figure 2.5: The process of peritoneal dialysis (Nelms & Lacey, 2016:531 *who cited Rolfes, Pinna & Whitney, 2006:876*)

2.5.5 Comparison of maintenance hemodialysis and peritoneal dialysis

Advantages of CAPD over MHD are avoidance of large fluctuations in blood chemistry, longer residual renal function, and the ability of the patient to maintain a normal lifestyle. CAPD, however, may be associated with complications such as peritonitis, and hypotension that requires fluid and sodium replacement (Wilkens et al., 2012:815). In addition, overweight is more prominent in the CAPD population than malnutrition, which occurs frequently in patients on MHD (Escott-Stump, 2012:875). This is due to the additional 1 680 – 3 360 kJ per day that patients on CAPD absorb from the glucose in the dialysate (Wilkens et al., 2012:815).

In South Africa, CAPD treatment also requires space to store the dialysis boxes and running water, which in a rural or township setting, can be problematic. A further advantage of MHD, is trained medical personnel who are in control of treatments, which for an uncertain patient, can be comforting.

On the other hand, outpatient MHD usually requires treatment of three to five hours, three times per week, in a dialysis unit. This implies an increased transport cost, whilst employers are not always able to adapt to the treatment hours. In Bloemfontein, a medium sized city

(Free State, SA), the occupational therapy department of the University of the Free State, did a study to investigate the occupational performance of 99 patients receiving MHD (Vermaak et al., 2018). Vermaak et al., (2018) found a decreased occupational performance in daily activities on dialysis days (e.g. work, leisure, mobility, sexual activities, household maintenance, and social participation). The factors that contributed most to the decreased occupational performance were fatigue, long time spent on dialysis process, depression and sleep problems. Furthermore, the majority (62.6 %, n= 62) of participants felt in control; although they did mention activities (e.g. home establishment and maintenance; sporting activities and other leisure activities, MHD were restricting them to participate in). Consequently, MHD seems to have a vast effect on daily life especially on dialysis days, whereas CAPD could be less influential on daily activities.

Newer home MHD-therapies, which are not currently available to most patients, can shorten the duration of treatment by increasing its frequency. Home MHD typically lasts from two to three-and-a-half hours, five to six days a week, or comprises nocturnal dialysis three to six times a week for eight hours while the patient sleeps. With this type of MHD, patients can probably continue earning an income and maintain their previous lifestyles, whilst they also have lower mortality rates that approach that of transplantation (Wilkens et al., 2012:815).

2.6 Protein energy malnutrition

The process of MHD, though life-prolonging, is still artificial and adds other strains on the body. Approximately 40 % of patients undergoing MHD suffer from varying degrees of protein energy malnutrition (PEM) of ESRD (Escott-Stump, 2012:875). A significant number of factors affect nutritional and metabolic status in CKD, leading to multiple adverse consequences (Ikizler et al., 2013:1096). Causes of PEM include uraemia-induced anorexia, the catabolic effects of MHD (chronic low-grade inflammation, amino acid losses through dialysis), comorbid conditions (insulin resistance, diabetes, cardiovascular disease, and depression), and metabolic derangements (metabolic acidosis, low testosterone levels, growth hormone resistance, and hyperparathyroidism) (Ikizler et al., 2013:1096, Escott-Stump, 2012:875). PEM may lead to higher infection rates (which increase the need for protein and energy), frailty, higher depression rates, as well as cardiovascular disease that

all, in turn, can intensify the causes (Ikizler et al., 2013:1097). This catabolic cycle of cause and effect (depicted in Figure 2.6) is especially concerning for the dietitian.

Together with the waste products, protein is also drained through dialysis. Protein losses of 20 – 30 g can occur during a 24-hour period with CAPD, at an average of 1 g/hour (Wilkens et al., 2012:822). With MHD, less protein is lost through the dialysis fluid than with CAPD; nevertheless, amino acid losses still occur (Escott-Stump, 2012:875). Patients on dialysis who have low albumin levels, have much higher mortality rates; thus, emphasis is placed on adequate dietary protein intake (Wilkens et al., 2012:822).

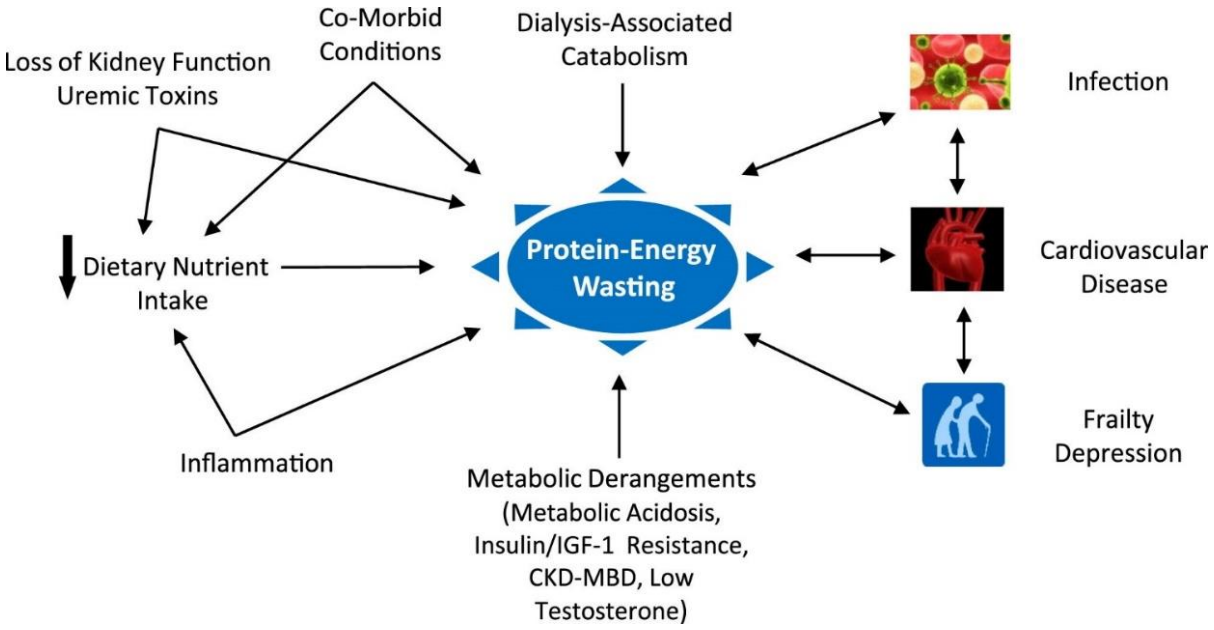

Figure 2.6: The conceptual model for etiology and consequences of protein energy malnutrition (PEM) in chronic kidney disease (Ikizler et al., 2013:1097)

Furthermore, metabolic acidosis can have an influence on increased protein catabolism and decrease in muscle (body protein) (Kopple, 2012:1356), and decreased albumin synthesis with predisposition to hypoalbuminemia (Kraut & Madias, 2016:310). For prevention of body protein degradation a serum bicorbonate ($HCO3^-$) level of >24-25 mEq/L and pH levels as high as 7.43 -7.45 are suggested (Kopple, 2012:1356). Possible dietary strategies to correct metabolic acidosis include: (i) eating less acid producing animal protein (Kraut & Madias, 2016:313); (ii) eating more plant proteins (Kraut & Madias, 2016:313); (iii) eating adequate base-producing fruits and vegetables with a lower potential renal acid load

(PRAL), such as apples, apricots, oranges, peaches, pears, raisins, strawberries, carrots, cauliflower, eggplant, lettuce, potatoes, spinach, tomatoes, and zucchini (Goraya et al., 2013:373); and (iv) prescribing correct phosphate binders (calcium acetate; calcium citrate; sevelamer hydrogen chloride lowers serum bicarbonate, whereas calcium carbonate & sevelamer carbonate increases $HCO3^-$) (Kraut & Madias, 2016:313).

2.6.1 Assessment of protein energy malnutrition

To assess PEM in CKD is often not reliable when using a single marker, for example a patient with a high BMI, which traditionally would be considered nutritionally protective, can have low muscle mass, but high fat mass, and therefore, also present with PEM (Ruperto et al., 2016:44). According to a Spanish study conducted by Ruperto et al. (2016:38) with 80 patients, the combined utilisation of serum albumin, percentage of mid-arm muscle circumference and standard body weight as PEM markers, appears to be useful for nutritional-inflammatory status assessment and adds predictive value to the traditional indicators. Larger studies are needed to achieve the reliability of these predictor combinations and their cut-off values in MHD patients and other populations.

Prevention and treatment after assessment of PEM of CKD should involve an integrated approach to limit protein and energy depletion, in addition to therapies that avoid further losses, and replenish already wasted stores. These include optimising dietary nutrient intake, appropriate treatment of metabolic disturbances such as metabolic acidosis, systemic inflammation, and hormonal deficiencies, and prescribing optimised dialytic regimens. In patients where oral dietary intake from regular meals cannot maintain adequate nutritional status, nutritional supplementation, administered orally, enterally, or parenterally, is shown to be effective in replenishing protein and energy stores. In clinical practice, the advantages of oral nutritional supplements include proven efficacy, safety, and compliance. Anabolic strategies such as anabolic steroids, growth hormone, and exercise, in combination with nutritional supplementation or alone, have been shown to improve protein stores and represent potential additional approaches for the treatment of PEM. Appetite stimulants, anti-inflammatory interventions, and newer anabolic agents are emerging as novel therapies (Ikizler et al., 2013:1096).

2.7 Medical nutrition therapy

The goals of medical nutrition therapy in the management of ESRD should be (Wilkens et al. 2012:817; Nelms & Lacey, 2016:538):

- Prevent deficiency and maintain good nutrition status through adequate protein, energy, vitamin and mineral intake;
- Control edema, blood pressure and electrolyte imbalance by controlling sodium, potassium and fluid intake;
- Prevent or delay the development of renal osteodystrophy by controlling phosphorous, calcium, vitamin D and parathyroid hormone (PTH);
- Enable the patient to eat a palatable attractive diet that fits his or her lifestyle as much as possible;
- Coordinate patient care with families, dietitians, nurses, and doctors; and
- Provide initial nutrition education, periodic counselling and long-term monitoring of patients.

MHD is done at home or at outpatient renal units, thus, patients assume responsibility for their own diets (Wilkens et al., 2012:817). Nutritional assessment and revision of the medical nutrition therapy should be performed every three months (Ikizler et al., 2013:1099) (Figure 2.7).

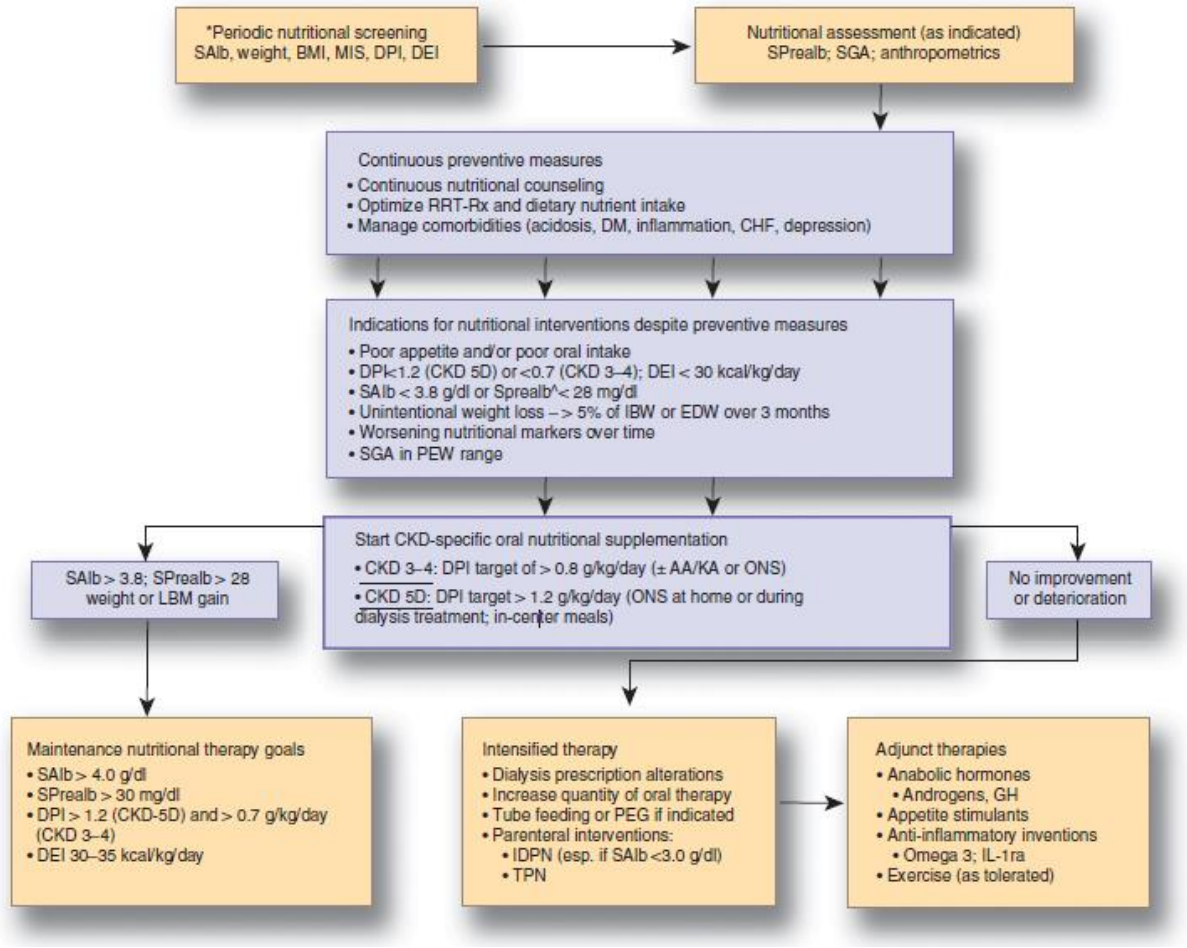

Figure 2.7: Proposed algorithm for nutritional management and support in patients with chronic kidney disease (Ikizler et al., 2013:1099)

Proposed algorithm for nutritional management and support in patients with chronic kidney disease. *Minimum every 3 months, monthly screening recommended. Only for ESRD patients without residual renal function. AA/KA, amino acid/keto acid; BMI, body mass index; CHF, congestive heart failure; CKD, chronic kidney disease; DEI, dietary energy intake; DM, diabetes mellitus; DPI, dietary protein intake; EDW, estimated dry weight; GH, growth hormone; IBW, ideal body weight; IDPN, intradialytic parenteral nutrition; IL-1ra, interleukin-1 receptor antagonist; LBM, lean body mass; MIS, malnutrition–inflammation score; ONS, oral nutritional supplement; PEG, percutaneous endoscopic gastrostomy; PEW, protein energy wasting; RRT-Rx, renal replacement therapy prescription; Serum Albumin, serum albumin (measured by bromocresol green); SGA, subjective global assessment; Serum Pre-albumin, serum pre-albumin; TPN, total parenteral nutrition.

2.7.1 Protein

Dialysis drains body protein, thus, dietary protein intake must be increased accordingly (Wilkens et al., 2012:817). The increased protein intakes should be at least 50 % HBV protein, which is obtained from animal protein and legumes (Wilkens et al., 2012:822). The protein requirements for dialysis are based on edema-free body weight (Nelms & Lacey, 2016:541, Fouque et al., 2007:79). Patients on MHD require 1.2 g/kg/day; and those on CAPD, 1.2 – 1.3 g/kg/day, whilst in the case of peritonitis infection, up to 1.5 g/kg/day is required (Escott-Stump, 2012:877). Serum blood urea nitrogen (BUN) and serum creatinine

levels (discussed later in section 2.8.2 and 2.8.3), as well as uremic symptoms and body weight, should be monitored to assess the adequacy of protein status (Wilkens et al., 2012:822).

Most patients find it difficult to consume adequate amounts of protein, because uremia itself causes taste alterations, especially for red meats, which is a good source of HBV protein. Some patients cannot even tolerate the smell of red meat cooking. Patients may tolerate eggs, tofu, and poultry better. Spices can also be used to hide the taste of the meat, or animal protein may be served cold to minimise the taste and smell (Wilkens et al., 2012:822). Nutritional supplements may be helpful in some patients and occasionally the phosphate restriction need to be lifted to allow the consumption of dairy products to meet the protein needs (Wilkens et al., 2012:817).

2.7.2 Energy

Energy intake should be adequate to prevent protein from being metabolised for energy, sparing it for tissue synthesis and maintenance. Depending on the patient's nutrition status and degree of stress, between 25 – 40 kcal/kg of body weight should be provided as energy. Lower ranges should be used for transplantation, stable older (>60 years) adults and patients receiving CAPD, whilst, the higher ranges apply to nutritionally depleted patients and patients with infection (Wilkens et al., 2012:822; Escott-Stump, 2012:877).

2.7.3 Fluid and sodium

The fluid and sodium balance should be carefully monitored in ESRD patients by assessing blood pressure, edema, fluid weight gains, serum sodium levels, and dietary intake. Mostly, patients on dialysis need to restrict sodium and fluid intakes. Excessive sodium intake increases thirst, resulting in more fluid consumption, that leads to increased fluid gain and result in hypertension. In patients on MHD, fluid and sodium intakes are regulated to allow for body weight gain as fluid, of less than 4 % body weight between dialysis sessions, which mostly constitutes 2 – 3 kg. This goal can usually be attained by limiting sodium intake to 2 – 3 g/day and fluid intake to 750 ml plus individual urinary output/day. Solid food also contains fluid (contributing 500 – 800 ml of fluid/day), but is not included in the 750 ml allowance *per se*. The fluid allowance does however include foods that are liquid at room

temperature (Wilkens et al., 2012:822). Sodium intake of 2 – 3 g/day constitutes that no salt is added during cooking, or at the table, as well as the elimination of salted, smoked or cured meat or fish, salted snack foods, canned foods and high sodium convenience foods from the diet (Wilkens et al., 2012:822). In cases of severe vomiting and diarrhoea sodium intake needs to be revaluated for the time and potential losses could need replacement (Escott-Stump, 2012:877).

2.7.4 Potassium

Potassium effects muscle action, especially of the heart. High levels can cause the heart to stop, whereas low levels can cause symptoms such as muscle weakness and atrial fibrillation (Nelms & Lacey, 2016:535). Potassium intake, thus, usually needs to be restricted, depending on the serum potassium level, urinary output, medications and the frequency of dialysis (Wilkens et al., 2012:823). Potassium intake is restricted to 2000 – 3000 mg/day in patients on MHD, and to 3000 – 4000 mg/day in patients on CAPD (Wilkens et al., 2012:818). Potassium is most common in fruit and vegetables with orange and yellow coloured flesh. Careful attention should be given to commercial low salt food, as it may contain potassium chloride, to mimic the taste of salt. Patients and caregivers who cook should, therefore, be taught how to read food labels (Wilkens et al., 2012:823).

Historically, patients have been instructed to reduce the potassium content of potatoes and other root vegetables by peeling, cutting into small pieces, and soaking overnight in water to leach potassium. Newer studies show that this time consuming method is no longer required as similar results can be achieved by just boiling peeled root vegetables, cut into small pieces, in a large amount of water (Beto et al., 2016:26).

2.7.5 Phosphorous / Phosphate

Phosphorous is normally excreted through urine, but, due to the large molecular weight of phosphorous, it is not easily removed by dialysis (Wilkens et al., 2012:823). Dietary phosphate intake is therefore restricted to ≤1200 mg/day, or <17 mg/kg ideal body weight or standard body weight (Wilkens et al., 2012:823; Nelms & Lacey, 2016:543). This is difficult to achieve due to the need for high protein foods discussed above, as these also contain

high levels of phosphorous. In addition processed meat products often contain “phosphate salts” to enhance shelf life and taste.

2.7.5.1 Phosphorous to protein ratio

Studies have shown that the rate of phosphorus uptake is lower from many plant-based proteins compared to meat-based proteins (Beto et al., 2016:25). This gave rise to the idea of expressing phosphorous content of foods as the ratio of phosphorus content (mg) to protein (g) content, with adjustment for a digestion and absorption factor (aDA) (Beto et al., 2016:25). For patients on dialysis, a ratio of <12 mg PO4/g protein-aDA is advised (NKF/KDOQI, 2009:S87; D’Alessandro et al., 2015:5).

Traditionally, the intake of legumes have been restricted due to high phosphate content, which, before, was not adjusted for digestion and absorption (> 120 mg PO4/portion) (Herselman & Esau, 2005:51-57). The newer studies showed that the phosphorous from the plant protein in legumes is not well absorbed, leading to legumes having low phosphorous to protein ratios, and therefore could be more favourable for dialysis patients, for example (NKF/KDOQI, 2009:S87; D’Alessandro et al., 2015:5):

- peanut butter, smooth: 8.7 mg PO4/g protein-aDA;
- peanut butter, chunky: 7.4 mg PO4/g protein-aDA;
- roasted peanuts: 10.8 mg PO4/g protein-aDA;
- cooked soybeans: 8.5 mg PO4/g protein-aDA;
- cooked black beans: 9.5 mg PO4/g protein-aDA;
- cooked kidney beans: 9.8 mg PO4/g protein-aDA; and
- cooked chickpeas: 10.7 mg PO4/g protein-aDA.

This makes legumes a good alternative to increase protein intake without increasing phosphate uptake, particularly, if the price of animal products is considered.

Interestingly, egg also has a phosphorous to protein ration of 10.5 mg PO4/g protein-aDA, which is within the recommended limits, which was previously considered high in phosphate (NKF/KDOQI, 2009:S87; D’Alessandro et al., 2015:5; Herselman & Esau, 2005:51-57).

2.7.5.2 Phosphate binders

Even with compliance to dietary restrictions, hyperphosphatemia is often unavoidable if the GFR is <20 – 30 ml/min/1.73m^2 (Nelms & Lacey, 2016:543). Phosphate binders (Table 2.1) are therefore prescribed to reduce gastrointestinal absorption of dietary phosphorous (Nelms & Lacey, 2016:543). Calcium salts have replaced aluminium- and magnesium-based binders as the product of choice. Also, aluminium-based binders, if used, should be restricted to short periods of less than one month (Nelms & Lacey, 2016:544).

Table 2.1: Phosphate binders (Nelms & Lacey, 2016:546)

Phosphate binder	Commercial name
Calcium acetate	Phosphosorb, Phos Lo
Calcium carbonate	Tums, Eno Tums, Calci-chew, Caltrate, Calci-Mix, Pehro-Calci, Titrilac, Choz Gum, Oscal 500, Calcium-Hexal
Calcium citrate	Citracal 950, B-cal chew
Magnesium carbonate	MagneBind 200, MagneBind 300
Lanthanum carbonate	Fosrenol
Sevelamer hydrochloride	Renagel
Aluminium hydroxide	Amphojel, AlternaGEL, Dialume, Alu-Cap, Alu-Tab
Aluminium carbonate	Basaljel

Nutrition advice is centred on balancing the phosphate content of the diet with the ingestion of oral phosphate binders. The majority of the binders were studied using the traditional three meals per day model. The mechanism of phosphate binding assumes that the phosphate binder is in the gut in proximity to the food. Many dialysis patients in the United States, however, eat more small frequent meals and snacks, which may decrease the effectiveness of the binders. Recent consumer studies in the United States, have confirmed that 50 % of energy is consumed as “snacks” rather than meals. Therefore, patients who are taking binders, may be missing the impact, if not matched to food consumption patterns (Beto et al., 2016:27). Patients should therefore be instructed to take binders before, during, or immediately after every meal or snack (Nelms & Lacey, 2016:544).

In addition, it has also been estimated that adherence to binder use as prescribed, may be less than 50 % (Beto et al., 2016:25).

2.7.5.3 Phosphorous pyramid as educational tool

Recently, an educational tool has been developed by D'Alessandro et al. (2015:4), which visually illustrates the phosphate content of food (Figure 2.8). This tool has potential to support patients and caregivers in making the right food choices, but studies are needed to validate the yield and to improve and adapt it to different clinical and socio-economic settings (D'Alessandro et al., 2015:5). In South Africa however, the concept of a food pyramid is not well understood (Verseput, 2012:A82), and the pyramid tool could possibly be adapted to a plate model for SA, which could be better accepted.

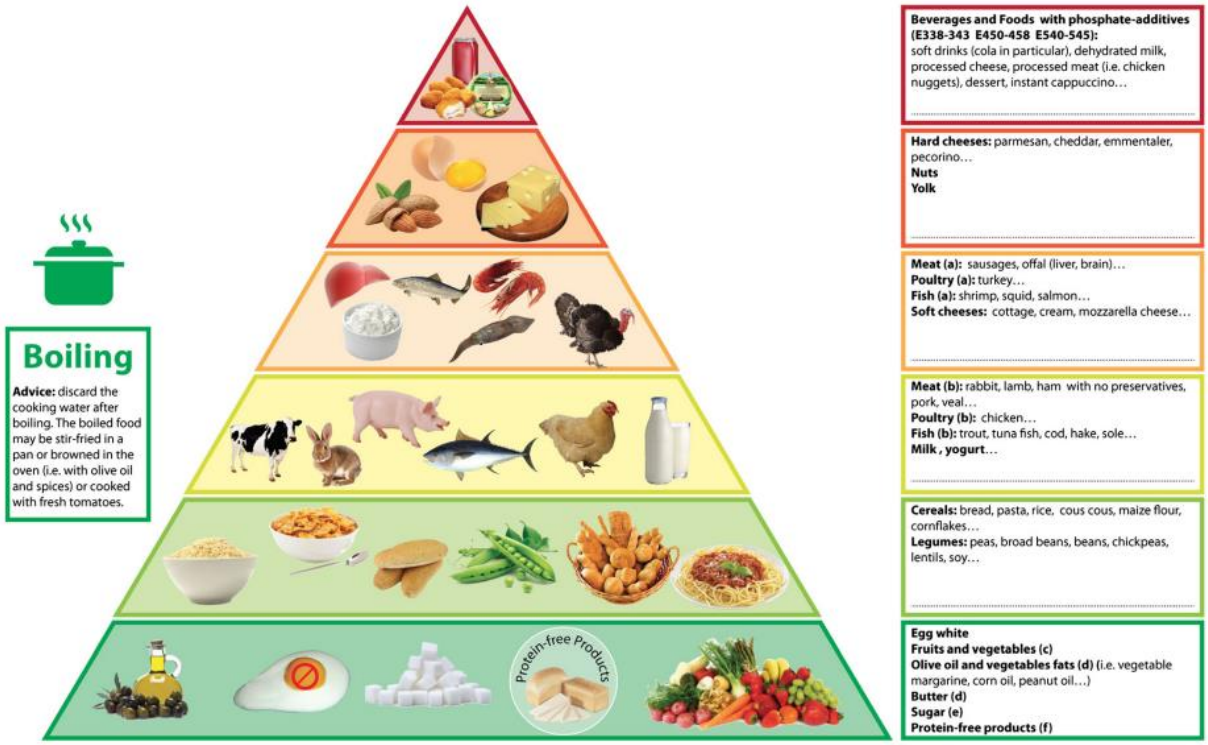

Figure 2.8: Phosphorous Pyramid Educational Tool (D'Alessandro et al., 2015:5)

The phosphorus pyramid. Foods are distributed on six levels on the basis of their phosphorus content, phosphorus to protein ratio and phosphorus bioavailability. Each level has a coloured edge (from green to red, through yellow and orange) that corresponds to recommended consumption frequency, which is the highest at the base (unrestricted intake) and the lowest at the top (avoid as much as possible). a) foods with unfavourable phosphorus to protein ratio (>12 mg/g); b) foods with favourable phosphorus to protein ratio (<12 mg/g); c) fruits and vegetables must be used with caution in dialysis patients to avoid excessive potassium load; d) Fats must be limited in overweight/obese patients, to avoid excessive energy intake; e) sugar must be avoided in diabetic or obese patients; f) protein-free products are dedicated to patients not on dialysis therapy and who need protein restriction but a high energy intake.

2.7.5.4 Calcium

Patients with ESRD may develop metabolic bone disease, referred to as renal osteodystrophy (Wilkens et al., 2012:823-824). With renal failure, the kidneys can no longer convert inactive Vitamin D_2 to active Vitamin D_3 that aids in the absorption of calcium from dietary sources in the gastrointestinal system. Decreased serum calcium levels trigger the release of parathyroid hormone (PTH) from the parathyroid glands, which, in turn, stimulates the release of calcium from the bones by increasing osteoclast activity. Renal bone disease/renal osteodystrophy can present as four types: (i) osteomalacia (softening of bones because of bone demineralisation), (ii) osteitis fibrosa cystica (calcified supporting structures are replaced with fibrous tissue leading to the formation of cystlike brown tumours in and around the bone), (iii) metastatic calcification, or (iv) adynamic (low

turnover) bone disease. Ongoing calcium demineralisation of bones is characterised by dull aching bone pain or tenderness and/or bone fractures (Wilkens et al., 2012:823-824).

The high levels of calcium (mobilized from the bones), and phosphorous can eventually lead to metastatic calcification in non-bone cells e.g. in joints, soft tissue and blood vessels (arteriosclerosis – thickening and hardening of arterial walls). This calcification can also lead to pruritus (itching) (Berger & Steinhoff, 2011:99; Renalsmart, 2008: online). It also causes red eyes which can be painful and irritating, due to an inflammatory response triggered by high serum calcium and phosphate values, and that resides when the serum calcium and phosphate levels decreases (Klaassen-Broekema & Van Bijsterveld, 1992:271). Calciphylaxis occurs when calcium-phosphate is deposited in wound tissues with resultant vascular calcification, thrombosis, non-healing wounds, and eventually gangrene, which can be fatal (Wilkens et al., 2012:823-824).

2.7.6 Lipids

Patients on long term dialysis are at increased risk for cerebral vascular accidents, and atherosclerotic cardiovascular disease is the most common cause of death (Wilkens et al., 2012:824; Nelms & Lacey, 2016:541). Only, 20 % of patients on MHD and 15 % of patients on CAPD have normal blood lipid parameters. Patients on MHD typically display normal, low-density lipoprotein (LDL) cholesterol levels, low, high density lipoprotein (HDL) cholesterol levels, and elevated triglyceride levels. Conversely, patients on CAPD have higher levels of total serum cholesterol and LDL cholesterol, whilst triglyceride levels are especially increased due to glucose absorption form the dialysate (Nelms & Lacey, 2016:541).

Treatment of hyperlipidemia with diet or pharmacologic drugs remains controversial. Although routine treatment of all patients on dialysis seems unwarranted, a good case can be made for dietary and pharmacologic intervention if patients with ESRD have underlying lipid disorders and evidence of atherosclerosis (Wilkens et al., 2012:824). It is recommended that both patients on CAPD and MHD adhere to the therapeutic lifestyle changes (TLC) diet (Nelms & Lacey, 2016:541). The TLC guidelines for CKD entails limiting saturated fat to less than 7 % of total energy intake, polyunsaturated fat intake to 10 % of total energy intake, monounsaturated fat intake to up to 20 % of total energy intake, total fat intake to 25 – 35

% of total energy intake, carbohydrate intake to 50 – 60 % of total energy intake, protein intake to approximately 15 % of total energy intake, cholesterol intake to under 200 mg/day; fiber intake to 20 – 30 g/day with 5 – 10 g as soluble fiber, and total energy intake to amounts that prevent body weight gain and promote the reach of desirable body weight (NKF KDOQI, 2003:S43).

A holistic approach would entail a combination of dietary and lifestyle intervention which usually involves controlling sodium intake, modifying types of fat eaten, smoking cessation, planned moderate physical activity, and attainment or maintenance of a BMI of 25 – 28 kg/m^2, especially in Stage 1 – 4 of CKD (Raymond & Couch, 2012:755; NKF-KDOQI, 2003:S43).

2.7.6.1 Cardiovascular risk factors

Even though MHD patients have a higher risk (10 – 20 fold) for CVD events (Wilkens et al., 2012:824; Nelms & Lacey, 2016:541; Burmeister et al., 2014:473), there are controversy surrounding the traditional risk factors (obesity, hypertension, and hypercholesterolemia) which are possibly associated as being protective with better survival in MHD patients; referred to as reverse epidemiology (Kalantar-Zadeh et al., 2003:793). However, in the elderly traditional risk factors still seem relevant to predict cardiovascular events (Burmeister et al., 2014:473).

The TLC dietary approach is still recommended until further solid evidence emerges to implement other strategies for reverse epidemiology for CVD in dialysis (Nelms & Lacey, 2016:547).

2.7.7 Iron

Erythropoietin, a hormone that is produced by renal tubular cells, is insufficient in patients with CKD due to function loss of the kidneys. Less endogenous erythropoietin leads to decreased red blood cell production in the bone marrow, causing circulating red blood cell numbers and overall blood hemoglobin content to drop, without affecting the size and hemoglobin content of the individual red blood cells. The anemia is therefore classified as normochromic (normal red blood cell colour) and normocytic (normal red blood cell size) (Nelms & Lacey, 2016:548; Stopler & Weiner, 2012:725-726; Wilkens et al., 2012:825).

Anemia of chronic kidney disease is also further aggravated by a secondary increase in red blood cell destruction caused by circulating uremic waste products, as well as by blood loss through the dialysis process or through frequent blood sampling (Wilkens et al., 2012:825). Recombinant human erythropoietin (rHuEPO) is used to treat anemia in ESRD; it is administered intravenously or via the dialysis lines for patients on MHD and subcutaneously for patients on CAPD (Nelms & Lacey, 2016:548). With replacement of erythropoietin, red blood cell production and thus the demand for iron are increased (Nelms & Lacey, 2016:548).

2.7.8 Vitamins

Water-soluble vitamins (ascorbic acid and most B vitamins [B_6, B_{12} and folic acid]) are lost through dialysis, but mostly at the same rate as it would normally be lost in urine. Folate, however, is lost more through dialysis and therefore supplementation of 1 mg/day is advised (Wilkens et al., 2012:825; Escott-Stump, 2012:877). Water-soluble vitamins are also poorly consumed by patients with CKD due to general anorexia and dietary restrictions of potassium-rich fruit and vegetables, whole grains and dairy products (Nelms & Lacey, 2016:546). Replacement of fat soluble vitamins is usually not required in renal disease and excess of vitamin A should be avoided (Wilkens et al., 2012:825; Escott-Stump, 2012:877).

2.8 Evaluation of biochemical markers

The assessment of biochemical markers in patients on MHD as part of the nutrition care process, can be challenging. The most relevant markers include the following:

2.8.1 Serum albumin

Hypoalbuminemia is associated with poor survival in ESRD. Serum albumin levels are routinely used to evaluate the nutritional, or specifically the protein status, of ESRD patients as it may reflect poor nutrition in the absence of inflammation. Albumin is, however, also decreased during the acute phase inflammatory response, thus limiting its usefulness in the presence of acute or chronic inflammation, often related to co-morbid diseases (Wilkens et al., 2012:817).

Normal serum albumin levels for the CKD population are the same as for the rest of the population, namely 35 – 52 g/L. When albumin levels fall <29 g/L, edema occurs due to

decreased oncotic pressure in the circulation; this forces fluid into the interstitial spaces from where it is more difficult to remove with dialysis, and where it can cause complications. Thus, low serum albumin levels are closely associated with increased risk of death in patients on dialysis (Wilkens et al., 2012:820).

2.8.2 Serum urea

Serum urea, also referred to as blood urea nitrogen (BUN), is a waste product of protein breakdown, which, unlike creatinine, is affected by the amount of protein in the diet. Dialysis removes urea nitrogen. High blood urea nitrogen levels in dialysed patients are therefore most often due to inadequate dialysis. However, if dialysis is adequate, over consumption of dietary protein should be considered, as well as hyper-catabolism, congestive heart failure, gastrointestinal bleeding, or dehydration (Wilkens et al., 2012:819, Nelms & Lacey, 2016:534). Low levels of BUN may indicate poor dietary intake, over-hydration, or a decrease in muscle mass (Wilkens et al., 2012:819; Nelms & Lacey, 2016:534).

2.8.3 Serum creatinine

Serum creatinine levels reflect muscle mass, somatic protein stores, and dietary protein intake. Therefore, it can be a useful marker of lean muscle mass and predict outcome in patients with CKD. Creatinine levels are, however, also affected by the presence and severity of inflammation, as well as by age, gender, race, residual kidney function, variation in creatinine metabolism, and dose and adequacy of dialysis (NKF-K/DOQI, 2005:S105; Wilkens et al., 2012:819).

Higher “normal” reference values for serum creatinine levels are used for dialysed patients, because they are not being dialysed 24 hours per day, 7 days per week in the way blood would be filtered through the normal kidney. Thus, normal values for patients on dialysis are 64 – 104 µmol/L for men and 49 – 90 µmol/L for women (Rossouw et al., 2010:15). For patients with CKD, values are influenced by the frequency, dose and adequacy of dialysis and higher target values are accepted as normal. For a large patient on dialysis, creatinine values of 1 328 – 1 770 µmol/L are considered normal; whilst for a small person on dialysis,

creatinine levels of 708 – 1 062 µmol/L are considered normal (NKF-K/DOQI, 2005:S105; Rossouw et al., 2010:15).

2.8.4 C-reactive protein

C-reactive protein (CRP) is a positive acute-phase protein, synthesised in the liver in response to inflammation, and serves as a general indicator and measure of systemic inflammation. Thus, in an individual without infection or inflammation, CRP levels are very low (<6 mg/L) (Raymond & Couch, 2012:750). During a viral infection, CRP levels are usually 20 – 75 mg/L, and during bacterial infections, levels usually rise to >100 mg/L (Rossouw et al., 2010:26).

In the absence of a pathogenic infection, elevated CRP levels indicate the activation of the inflammatory response due to metabolic stress. In patients with CKD on dialysis, most studies with high applicability found that elevated CRP levels predicted all-cause mortality (NKF-K/DOQI, 2005:S84). Currently, there is no consensus in the literature with regard to the optimal "cut-off" value for CRP levels to mark the presence of inflammation in CKD patients (NKF-K/DOQI, 2005:S84). However, according to the NKF, CRP levels should be within normal limits of standard reference ranges, which is < 8 mg/L (Nelms & Lacey, 2016:534).

2.8.5 Serum electrolytes (phosphate, potassium and sodium)

Maintaining water-electrolyte balance is one of the key functions of the kidneys, as discussed before, thus, the blood levels of these electrolytes need to be monitored.

High serum phosphate levels are usually related to high dietary intake and non-compliance to phosphate binder therapy. Adequate homeostasis of serum phosphorous levels is needed to prevent renal osteodystrophy (Wilkens et al., 2012:823).

High potassium levels could indicate high dietary intake, but may also be related to gastrointestinal bleeding, trauma, hyperglycemia, medications (e.g. diuretics, aldosterone antagonistic overuse), inadequate dialysis, or inappropriate dialysate potassium content. If all other causes are eliminated, potassium content in diet should be re-evaluated and restricted to recommendations (Wilkens et al., 2012:819).

High serum sodium levels may occur due to dehydration, but is often masked by water retention or diabetes insipidus, whereas low levels are caused by over-hydration, diuretic

use, inappropriate antidiuretic hormone levels, burns, adrenal insufficiency, nephritis, hyperglycemia, diabetic acidosis, hyperproteinemia, and starvation (Nelms & Lacey, 2016:536).

Serum sodium should be evaluated in context of fluid status. High sodium levels with high fluid gains could indicate high salty food intake. Conversely, low fluid gains could indicate dehydration, which is rare. Low sodium levels with high fluid gains may also occur due to high dietary salt intake, which causes thirst and leads to high fluid consumption that has a dilution effect. Too much sodium and water raises blood pressure and can cause fluid overload, pulmonary edema, and congestive heart failure (Wilkens et al., 2012:819).

2.8.6 Kinetic modelling

Kinetic modelling is a method for evaluating the efficacy of dialysis as it measures the removal of urea from the patient's blood over a given time period. The formula used, is Kt/V (where K is the urea clearance of the dialyser, t is the length of time of dialysis, and V is the patient's total body water volume) and this should produce a value >1.4 per hemodialysis session (Wilkens et al., 2012:816). Inadequate dialysis sessions will lead to more nitrogenous waste in the body, which has a negative impact on nutritional status.

2.8.7 Serum cholesterol

As explained before, the patient with ESRD typically has an elevated triglyceride level, with or without increased cholesterol levels (Wilkens et al., 2012:825). Elevated blood lipid parameters can be a marker for atherosclerotic CVD risk in patients on MHD (Fouque et al., 2007:51; Wilkens et al., 2012:825).

Conversely, low (<1.7 mmol/L) or declining serum cholesterol concentrations are also predictive of increased mortality risk. Hypocholesterolaemia is associated with chronic PEM due to poor oral intake and/or the presence of comorbid conditions, including inflammation. Individuals with low, low–normal (1.7 – 2 mmol/L), or declining serum cholesterol levels should be investigated for possible nutritional deficits, as well as for other comorbid conditions. Use of lipid-lowering drugs should be considered and should possibly be reduced when patients are malnourished or underweight (Fouque et al., 2007:51; Wilkens et al., 2012:825).

2.8.8 Hemoglobin A1c

Diabetes is, as discussed before, a leading cause of CKD and blood glucose levels, therefore, needs to be monitored as hyperglycemia can influence potassium levels. Circulating glucose binds to hemoglobin in red blood cells in a non-enzymatic, dose-dependent and irreversible manner, so that hemoglobin A1c (HbA1c) may be used to assesses blood glucose control over the life-span in the red blood cell (90-120 days) (Nelms & Lacey, 2016:535).

Due to shortened life-span of red blood cells in patients on MHD, the reliability of HbA1c in this population has been questioned (Peacock et al., 2008:1065). Nevertheless, chronic hyperglycemia, indicated by higher than normal HbA1c levels may indicate poorly controlled diabetes mellitus, but may also be associated with splenectomy, pregnancy, or non-diabetic hyperglycemia. Conversely, low levels of HbA1c can occur due to haemolytic anemia secondary to uremia, chronic blood loss, or early CKD (Nelms & Lacey, 2016:535).

2.8.9 Hemoglobin, ferritin, transferrin saturation and white blood cells

As discussed above, CKD is associated with deficiency of erythropoietin, which leads to anemia. To evaluate responsiveness to erythropoietin replacement therapy, monthly check-ups should be performed. The monthly hemoglobin target for effective treatment with erythropoietin and iron, is 11 – 12 g/dL (Nelms & Lacey, 2016:548).

The production of red blood cells that is stimulated by erythropoietin replacement therapy, requires iron. To assess iron status, transferrin and ferritin levels, as well as transferrin saturation, are assessed. Transferrin is the beta-1-globulin protein that transports iron in the body, from absorption sites in the intestines to iron storage sites where it is stored as ferritin, and, in turn, to tissues where iron is utilized, including the bone marrow for hemoglobin synthesis. Transferrin saturation measures the amount of iron bound to transferrin and should increase with higher iron needs, given adequate stores in the body. Transferrin levels may decrease due to metabolic stress, as it is a negative acute-phase protein. During iron shortages, however, transferrin levels rise as an adaptation to increase iron absorption (Hammond & Litchford, 2012:163-164). Ferritin is a protein that binds iron for storage and may be used as an accurate marker for iron status in patients with renal failure (Wilkens et al., 2012:825). However, ferritin can be increased during inflammatory

states and then an iron shortage may be missed and, therefore, it needs to be assessed together with transfuration saturation in CKD (Wish, 2006:s5).

In chronic illness, the metabolic stress triggers an inflammation response that releases eicosanoids and cytokines to mobilises nutrients required to synthesize positive acute phase proteins (e.g. CRP), as well as white blood cells as part of the protective response. These cytokines, however, also impair the production of red blood cells, thus contributing to anemia. Furthermore, red blood cell production, besides iron, also needs protein, vitamin B_{12}, and folic acid; so that inadequate intakes will further contribute to anemia (Stopler & Weiner, 2012:726). Thus, even with erythropoietin and iron therapy, anemia may not be entirely preventable especially if the diet is also inadequate (Hammond & Litchford, 2012:163-164).

Other causes of erythropoietin non-responsiveness, are infections (that also trigger the metabolic stress response), secondary hyperthyroidism, chronic blood loss, acquired immune deficiency syndrome, pancytopenia/aplastic anemia, haemolytic anemia, cancer, chemotherapy, or radiotherapy (Nelms & Lacey, 2016:548; NKF-K/DOQI, 2006:S83).

2.9 Nutrition intervention: Practical aspects

Nutrition intervention for a chronic condition like ESRD treated with MHD, is challenging for both the patient and the dietitian. Compliance, barriers to following the diet, and solutions for adherence, need to be considered within all the relevant contexts.

2.9.1 Compliance to the “renal diet”

The dietary adaptations that patients on chronic dialysis need to implement, are life-long. The challenge for the dietitian include to educate the patient with ESRD on a great number of recommendations, to monitor and evaluate if the interventions and nutrition education are effective, and if not, to find ways of helping the patient overcome these barriers. No single educational or clinical strategy has been shown to be consistently effective across CKD populations (Beto et al, 2016:22).

The best adherence has been observed when both the diet and the education efforts are individualised to each patient and adapted over time to changing lifestyle and CKD variables (Beto et al, 2016:22). This requires the dietitian to develop a long-standing rapport with the

patient and family and to serve as a continuous supporter to help them make the best nutrition choices as circumstances change. Understanding the burden of a complex, challenging, ever-changing diet hinges on communicating information in a workable, flexible and easily understood manner (Wilkens et al., 2012:824); even more so in South Africa with its many different cultures and language communities, and vast socio-demographic variations amongst patients with ESRD.

Compliance to the renal eating pattern hinges on good KAP and sufficient adherence to the required daily practices. Understanding and identifying possible hurdles in KAP may improve compliance to the nutrition interventions. According to the Food and Agricultural Organization of the United Nations' recently developed, Guideline for Assessing Nutritional related KAP (Macías & Glasauer, 2014:54), gaps in people's KAP may be identified by studies that utilise appropriately developed KAP questionnaires.

After administering the KAP questionnaire in the selected population, gaps in knowledge related to specific nutritional issues are identified by comparing the percentage of people who gave the correct answer(s) to a specific question, to the percentage of people who did not know the answer(s). Similarly, gaps in attitudes are determined by comparing the percentage of people who gave the desired or positive response, to the percentage who gave a negative or noncommittal response. Gaps in practices are identified by comparing the percentage of people employing an optimal or desired practice, to that of people who do not (Macías & Glasauer, 2014:54).

The suggested threshold level that would recommend the need for urgent intervention to address identified gaps in KAP, according to Macías & Glasauer (2014:54), are a value below or equal to 70 % of "correct answers", "optimal practices" or "desired/positive attitudes" in the survey population.

2.9.2 Barriers for following the diet

Most dietary intervention studies are based on the assumption that lack of knowledge or motivation is the key contributor to dietary non-adherence, which may not be the case (Macías & Glasauer, 2014:55; St-Jules et al., 2016:122). The progression from knowledge to changed attitudes and improved practices, according to Macías & Glasauer (2014:55), not

only depends on the assimilation of information and accumulation of knowledge, but also on other factors, including: the physical environment: food availability, built environment; sociocultural environment (family and social networks, including intra-household interactions and decision-making), cultural practices, social structures and public policies; the economic environment (resources, prices and time); and the informational environment (advertising and mass media). Even though knowledge is not the only factor, knowledge seems to be integral and barriers in acquiring knowledge e.g. poor basic literacy skills can influence health outcomes (Steyn et al., 2000; Kruger et al., 2002 & Shisana et al., 2013; Zimmerman & Woolf, 2014:1).

Information on these factors will help provide a broader picture of the nutrition situation and important influences on it. These can then be taken into account in the design of the nutrition intervention by, for instance, identifying other strategies to be pursued, such as influencing nutrition policies or changing the food environment (Macías & Glasauer, 2014:55).

In the Balance-Wise study conducted in Pennsylvania, United States, sociodemographic and clinical characteristics of participants were associated with dietary intakes in more than half of the 140 participants receiving MHD (St-Jules et al., 2016:122). Whilst, technical difficulties (e.g., tracking nutrients, the nearest grocery store being too far away, and difficulty to select the correct foods when shopping), and physical form (e.g., low appetite, being too tired to cook) were found to influence dietary intake in this study, reported dietary intakes were most affected by issues of time and food preparation and behavioural factors (e.g., feeling deprived, not having the time to cook). Of particular interest was the fact that longer dialysis history was associated with lower protein intakes, suggesting that PEM may be of greater concern the longer patients remain on MHD (St-Jules et al., 2016:122). Thus, the authors concluded that registered dietitians should consider issues of time management and food preparation (grocery shopping and skills for meal preparation), and behavioural factors in their nutrition assessment of patients on MHD and should continually monitor them for changes in protein intake that may occur over time (St-Jules et al., 2016:118).

2.9.3 Solutions to improve adherence

Practical and effective strategies for increasing adherence to nutritional advice are limited. Focusing on a single goal rather than multiple goals seem to provide better results. Recognising that the typical food pattern may be snacking rather than formal meals and adapting interventions accordingly may be advances to better compliance (Beto et al., 2016:21).

Creating active learning and coping strategies may be an innovative way for dietitians to improve renal care for dialysis patients. To overcome the problem of being too tired to cook, for example, food can be made ahead and kept in the freezer to be taken out when needed for an immediate meal. The preparation, storage and reheating of simple, time-saving and nutritiously appropriate meals and snack can be demonstrated in the dialysis unit and patients can be asked to create their own recipes (Beto et al., 2016:29).

Active learning can also involve adapting traditional recipes to more renal-friendly versions and combining these into illustrated recipe books in the patients' home language. Patients can be invited to share their favourite recipes and personalised stories can be added with each recipe (Beto et al., 2016:30).

Herb gardens outside units are an example of practical hands-on learning. Fresh herbs are usually too expensive for patients to purchase in stores and the concept to grow them can be foreign for some. Herbs are full of flavour and provide ideal low-sodium alternatives for adding flavour to meals. Plastic bags, scissors and recipes can be provided near the pots for the patients to help themselves. Herb tasting can be another activity in the waiting room, using a mixture of unsalted butter and olive oil combined with chopped herbs on unsalted crackers. The scope of this simple concept is endless and exemplifies the true sense of interactive "show and tell" nutrition advice, which can include the entire health care team (Beto et al., 2016:30).

Patients can be taught to use their cell phones for taking pictures of meals, snacks and fluids that they consume; as the date and time is already recorded on the photo, this can provide insight on individual patterns and unique situations. Food labels of products can be photographed and showed to the dietitian to create relevant, useful learning interactions.

Reminders can be programmed to take medication, including phosphate binders. Videos can be made of nutrition education and be shared with family members. Cell phone applications can be downloaded that are specifically customary for CKD and more CKD applications can be researched and developed (Beto et al., 2016:28).

According to the Food and Agricultural Organization of the United Nations' Guideline for Assessing Nutritional-related KAP (Macías & Glasauer; 2014:54), when it is found that a patient's KAP are not ideal, improving nutrition education should always be a goal of the treating dietitian. Providing passive information is usually not enough to ensure lasting change in eating patterns. The content of the educational strategy should be memorable and therefore the usage of visual and audio support techniques are advised, as well as slides, films, personal histories, dialogues, etc. Employing participatory methods, such as group discussions, role plays, games or other group activities, should also be incorporated as much as possible. Also use other culturally appropriate methods, such as story-telling, songs and humour. Macías & Glasauer (2014:175-177) proposed specific strategies to address gaps in KAP (Table 2.2).

Table 2.2: Nutrition education strategies for low indicators for knowledge, attitudes and practices (Macías & Glasauer, 2014:175-177)

Low indicators for:	Possible nutrition education strategies	Examples for hemodialysis (MHD) patients
Knowledge		
Knowledge	Build on the current knowledge and increase comprehension of participants through discussions, lectures, slides, presentations	Educational objective: Increase knowledge about foods containing high phosphates Content and activities of educational sessions: • Present signs of high serum phosphate levels in MHD, causes, health consequences, local statistics of prevalence and ways to prevent and treat it • Conduct a group activity to identify phosphate-rich food sources

Low indicators for:	Possible nutrition education strategies	Examples for hemodialysis (MHD) patients
Attitudes		
Perceived susceptibility	Provide facilitated discussions of risk factors or threats leading to the problem	Educational objective: Increase food preparer's perception of MHD patient's vulnerability to undernutrition/PEM Content and activities of educational sessions: • Present and discuss with the group factors leading to undernutrition/PEM: uraemia induced anorexia, inflammation, loss of aminoacids through dialysis, altered taste, etc. and causing inadequate dietary intake and higher need
Perceived severity	• Present health consequences of the problem through films, images, statistics and personal stories	Educational objective: Increase awareness of the health risks of fluid overload Content and activities of educational sessions: • Present health consequences of fluid overload
Perceived benefits	Present scientific arguments in favour of the practice • Generate group discussion to evaluate pros and cons • Provide information about personal health benefits and benefits for the family or community	Educational objective: Increase the perception of benefits of eating low sodium foods Content and activities of educational sessions: • Present and discuss reasons for eating low sodium foods and highlight health benefits Change favourite home recipes to lower sodium options
Perceived barriers	Hold sessions for brainstorming and group discussion of barriers and ways to overcome them	Educational objective: Decrease the perceived barriers to preparing moderate to low potassium containing vegetables Content and activities of educational sessions: • Guide a group discussion on the barriers to preparing moderate to low potassium containing vegetables • Encourage participants to identify ways to overcome the barriers • Hold a participatory cooking demonstration, guiding preparations of moderate to low potassium containing vegetables

Low indicators for:	Possible nutrition education strategies	Examples for hemodialysis (MHD) patients
Attitudes		
Self-confidence	• Guide hands-on food-related activities: participatory cooking demonstrations, recipe preparation • Hold sessions for brainstorming and group discussion of the perception of barriers and ways to overcome them	Educational objective: Increase people's skill in cooking higher energy foods without increasing the fluid content in order to increase confidence in preparing and consuming them Content and activities of educational sessions: • Hold a participatory cooking demonstration: guided practice of making meringues (high in energy and protein but low in phosphates)
Perceived importance of following nutrition recommendations	• Hold sessions for brainstorming and group discussion of the importance of following a specific nutrition recommendation • Presentation and discussion of scientific arguments in favour of the recommended practice	Educational objective: Increase the perceived importance of the renal diet Content and activities of educational sessions: • Encourage participants to present the renal diet and make specific recommendations • Have a brainstorming session and generate a group discussion: "Which recommendations seem important to you? Which ones do not? Why?" • Present arguments in favour of following specific recommendations
Food preferences	• Provide information about personal health benefits and benefits to the family or community of eating/ feeding a food or including it in meal preparation • Facilitate participatory cooking demonstrations and food-tasting activities in order to increase acceptability of a specific food	Educational objective: Increase acceptability of herbs as a flavouring to include in the preparation of meals Content and activities of educational sessions: • Present the health benefits for MHD when consuming green herbs instead of salt (i.e. less thirst). • Guide cooking demonstrations of mince including herbs and facilitate food tasting
Food taboos	• Provide facilitated discussions on specific food taboos (only if present) • Present evidence for optimal dietary practices through films, images, statistics and personal stories	Educational objective: Modify the food taboo (only if present) to include the specific food; if it is permitted on the renal diet Content and activities of educational sessions: • Facilitate a group discussion about a food taboo: "Who agrees? Who disagrees? Why?" • Present arguments in favour of eating the condemned food

Low indicators for:	Possible nutrition education strategies	Examples for hemodialysis (MHD) patients
Practices		
Practices	Address knowledge and attitudes to increase participants' ability to modify dietary or feeding practices and/or adopt new ones • Guide hands-on food- related activities: participatory cooking demonstrations, recipe preparation	Educational objective: Increase participants' skills in food label reading Content and activities of educational sessions: • Present the optimal way of reading a food label • Hold a participatory session of reading food labels: Encourage participants to partake and make them feel safe to learn and that mistakes are permissible and a learning opportunity

Visual tools, as advised by Macías & Glasauer (2014:175-177), are very useful and relevant to the South African dialysis population. One such nutrition education tool currently available in South Africa, is the Five Illustrated Steps to Improve Renal Diet Compliance Manual (Verseput, 2012:A82). This tool is fully illustrated with colour images and addresses five topics, namely: (i) what the patient currently eats; (ii) how the kidney works; (iii) what to eat; (iv) what not to eat; and (v) how much to eat. The scope of efficacy of this education tool has, however not been validated yet.

Educational videos are another visual tool that can be utilised. A study on 77 patients on MHD in the United States, showed the role of a 45-minute educational video to successfully improve serum phosphate levels. Overall, 28 % of the participants with elevated average phosphate levels during the previous three months, showed significantly improved phosphorous levels in the month after viewing the video. Video intervention also has the advantage of being simple, low-cost, and easy to implement (Baldwin, 2013:437), and in the home language of the patient.

Dietitians possibly tend to focus more on nutrition education and not so much on nutrition counselling. Whereas nutrition education involves an instructive, formal process to impart knowledge to a patient to modify food choices and eating behaviour, nutrition counselling is a supportive process that involves setting priorities, creating individualised action plans and establishing goals (ADA, 2011:279). According to Beto et al. (2016:27), talking control is a cognitive behaviour technique that could be incorporated into nutrition counselling. This technique can be described as creating a "befriending" relationship in which all the information that is shared is controlled by both the patient and the provider. A study in a

CKD population used the following components of talking control, namely: (i) focusing on a general conversation without the specific intent of education, (ii) listening more than talking, and (iii) limiting the "talk" to 5–10 minutes. At the end of the 12 week intervention, 82 % of the patients had met or exceeded mean target laboratory goals (albumin and phosphorus), compared with 66 % before the intervention. The unit's patient satisfaction survey response also reported improved results in the questions "feeling of belonging" and "staff involvement in care" (Beto et al., 2016:27).

Beto et al. (2016:27) states that the talking control technique works best if all staff are invited to be involved, including support staff (cleaners, reception staff, etc.) as they are part of who the patient "sees" as contributing to their care. This method with its most important feature of restricted visit time in a single visit, appears to drive increased expectations of contact by the patient rather than promote boredom of repeated information (Beto et al., 2016:27).

2.9.4 The South African situation

A recent article by Gerntholtz et al. (2015:4-5) makes specific recommendations for management and treatment strategies for the South African CKD population with or without ESRD, including lifestyle changes. The article suggests that the following aspects of lifestyle and diet should be focussed on:

- Smoking cessation is important to avoid the progression of CKD (Yacoub et al., 2010:online) and the development of cardiovascular disease;
- Ideally, energy intake should be restricted to 30 – 35 kcal/kg/day, an in the case of overweight, reduce to 25 kcal/kg/day;
- In earlier stages (3 - 5) of CKD, protein restriction of 0.8 g/kg/day may be beneficial to avoid progression of CKD. Protein restriction is not advisable for dialysis patients, who should consume protein 1 – 2 g/kg/day.
- If not on dialysis, fluid intake should exceed urine output by around 500 mL/day, or patients can be advised to weigh themselves daily to titrate intake/diuretic doses/fluid restriction against their established dry weight. Patients with cardiac failure may need more aggressive fluid restriction. Patients should be cautioned to

reduce diuretic doses when fluid losses are high, e.g. sweating in hot environments, gastroenteritis;

- It is unhealthy to consume more than 14 units of alcohol per week for men, or 7 units per week for women.
- Salt restriction helps to control thirst and maintain dry weight (and blood pressure). Ideally, patients should add no salt when cooking food, or to any food. Salt intake should be restricted to 1 – 2 g/day.
- It is advisable to keep potassium intake at 2 – 3 g/day. Foods to be avoided are potatoes (soaking overnight in water will remove potassium), dried fruits, tomatoes, bananas, nuts and sweets. It is best to refer patients to a dietitian to discuss their diets.
- In terms of calcium and phosphate, patients should be advised to limit the intake of high calcium foods (dairy products), and avoid vascular and other ectopic calcification, especially when using calcium-containing phosphate binders. Once the GFR falls <30 mL/min, it is important that patients are advised to limit phosphate in the diet (e.g. bran, brown rice, dried beans, lentils, offal, salmon, chocolate, cola drinks and milk products).
- In both type 1 and 2 diabetes, evidence exists that good control (HBA1c <7 %) of glucose has a beneficial effect on progression and prevention of CKD, particularly of other microvascular complications.

These lifestyle factors focus mostly on delaying progression of CKD and this is especially important in South Africa as eligibility for RRT is a somewhat uniquely South African issue. Severe obesity (BMI >35 kg/m^2), smoking and abuse of substances such as alcohol, may prohibit patients from state dialysis and transplantation programmes (Gerntholtz et al., 2015:4).

Unfortunately, a large group of South African patients in the public sector are referred to renal units for the first time when they present with ESRD and therefore possibly only have late access to lifestyle care by means of dietitian intervention. This may be the result of insufficient access to adequate healthcare facilities and no regular follow-up visits,

especially when abnormalities are detected in the earlier stages of CKD (Van Rensburg & Meyers, 2015:3).

A study by Herselman et al. (2005:61) showed that South African dietitians working in government, consulted government patients more frequently ($p < 0.05$) (mostly on a weekly or monthly basis) than privately practising dietitians (who consulted patients more commonly on a monthly to yearly basis). Results of this study also showed that dietitians were mostly involved with the dietary management of pre-dialysis patients (n= 39), followed by patients on MHD (n= 27) and patients on CAPD (n= 20) (Herselman et al., 2005:61). No more recent data on the frequency of consultations, as well as the type of CKD patients being consulted in SA, is available.

The study further identified barriers to nutrition counselling, as experienced by South African dietitians, as mainly socioeconomic and educational factors, which were related to high rates of poverty and illiteracy amongst patients. Herselman et al. (2005:65) proposed that the poor nutritional status of many South African renal patients may be due to insufficient protein and energy intake as a result of poor household food security.

Further skill improvement for dietitians beyond obtaining continuous professional development points by reading articles and attending infrequent lectures on CKD are not currently available in South Africa. In the United States, dietetic skills are evaluated and classified as general, advanced and specialised, and skill upgrade opportunities in the form as speciality board certificates are available (Brommage et al., 2009:1618). Similar skill evaluation and development of dietitians needs to be explored in South Africa.

2.9.5 Promising new nutrition interventions

A recent study (Tang et al., 2014:448) on the role of increased plasma levels of trimethylamine N-oxide (TMAO) in CKD, which is also associated with coronary artery disease pathogenesis, found that a gut microbial-dependent metabolite of dietary choline, lecithin (phosphatidylcholine) and L-carnitine occur early in patients with CKD. These serum levels increase with the severity of CKD. TMAO was found to cause more rapid renal functional deterioration, vascular endothelial damage, renal fibrosis, atheroma and CVD.

These dietary amino acids are especially high in all red meats (including pork), but not in poultry or most fish. Consequently, it might in future become advisable to place CKD patients in the earlier stages of CKD (3a or 3b) on a fish/poultry/egg diet and omit red meat completely to delay progression to ESRD (Tang et al., 2014:448; Van Rensburg & Meyers, 2015:3).

2.10 Conclusion

Renal failure, requiring dialysis and specifically MHD are challenging for health professionals to ensure better morbidity and mortality. Dietitians further need to be innovative to prompt adherence to the multiple dietary modifications necessary, whilst, the patient is responsible to acquire, prepare and consume their own diet. There is no one-size-fits-all approach for medical nutrition intervention in the diverse CKD population and therefore several more studies are required for each unique situation, especially in South Africa, where resources are limited and information is scarce on this topic. Monitoring and evaluation of the efficacy of nutrition interventions are probably the most important but overlooked component.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter describes the methodology followed in order to meet the aim and objectives stipulated in chapter 1. Description follows in terms of ethical approval, study design, study population and sample selection, variables, techniques, validity, reliability and procedures. The pilot study, statistical analysis, ethical considerations and challenges/limitations experienced during the execution of this study, are also described. All data were collected by the researcher, a registered dietitian (RDSA) who was trained at the University of the Free State (UFS) and has been working as a clinical dietitian in renal units in Bloemfontein for eight years.

3.2 Approval for the study

Approval to conduct the study was obtained from the Health Sciences Research Ethics Committee of the Faculty of Health Sciences (HSREC) at the UFS (HSREC142-2016), as well as from the Provincial Health Research Committee of the Free State Department of Health (Appendix J). Permission to conduct the study at the various renal units were obtained from the unit managers of Pelonomi and Universitas tertiary hospitals, BBraun Avitum, National Renal Care (NRC) unit and Bloemfontein Kidney and Dialysis Centre: Fresenius, as well as from Rosepark Life Hospital (Appendix C).

3.3 Study Design

A descriptive, cross-sectional study was conducted.

3.4 Study population

According to information obtained from the six hemodialysis centres in Bloemfontein, 177 patients were receiving MHD in Bloemfontein during June 2016 when the study was planned: 54 at Tertiary Government Hospitals (26 at Universitas Hospital and 28 at Pelonomi Hospital); and 123 at private institutions (21 at BBraun Avitum Dialysis Unit, 42 at the

National Renal Care Unit, 24 at the Bloemfontein Kidney and Dialysis Centre: Fresenius and 36 at Rosepark Life Hospital). These patients formed the study population.

3.5 Sampling, inclusion and exclusion criteria

Patients attend the dialysis centres three times a week, thus, data collection was planned to be scheduled during these visits. Data were collected by the researcher and it was estimated that this would require a maximum of three hours per participant, spread over two separate appointments on different days. A convenience sample of 100 participants, proportionally comprising 30 participants from tertiary government institutions and 70 participants from private institutions, was deemed practical, whilst still yielding appropriate statistical power. It was originally estimated that data collection would require three months, but, due to logistical problems, data was collected over a seven month period. The final sample comprised 77 participants - 30 (39 %) from tertiary government institutions and 47 (61 %) from private institutions – who complied with the inclusion and exclusion criteria.

The following inclusion and exclusion criteria (Gibson, 2005:10) were set:

3.5.1 Inclusion criteria:

Participants were included if they:

- Had ESRD (stage 5 of CKD);
- Were 18 years and older;
- Had been receiving MHD treatment for at least three months, at any of the six hemodialysis units in Bloemfontein (listed above) during the time of data collection (January 2017 to July 2017), and;
- Had signed informed consent.

3.5.2 Exclusion criteria:

Any person who had been hospitalised in the three months before commencement of study, or who were not able to stand unassisted for accurate anthropometrical measurement, were excluded.

3.6 Measurements

To meet the objectives of the study, the following variables were measured according to the techniques discussed below, with consideration of factors to improve validity and reliability of the measurements and minimise measurement errors. Validity refers to the extent to which a measurement instrument actually measures what it is supposed to measure (Katzenellenbogen & Joubert, 2007:117). Reliability or precision refers to the degree of similarity of the results obtained when the measurement is repeated on the same participants or the same group (Katzenellenbogen & Joubert, 2007:117).

3.7 Socio-demographic and medical information

For the purpose of this study, socio-demographic variables included: age, gender, education and relationship status, housing and utilities, number of children and adults living in the home, transport to and from the dialysis unit, household finances (monthly income per household, number of people contributing to the monthly household income, income per person per month and money spent on food in the household), linguistic information (home language, second language, language in which verbal/written nutrition education had been received), and information regarding who mostly prepared the participants' meals.

Household density ratio (HDR) was calculated, as overcrowding may indicate poor household conditions and poverty (Songpol et al., 2005:221). Each person older than ten years living in the same household was counted as one equivalent person (EP) and persons younger than ten years was counted as half an EP (Coetzee, et al., 1988:354). Table 3.1, indicates the number of sleeping rooms required for the number of EPs in the same household (Coetzee, et al., 1988:354).

Table 3.1: Sleeping rooms required for equivalent persons (EPs) in the same household (Coetzee et al., 1988:354)

Equivalent Persons (EPs)	Number of sleeping rooms required
≤ 2.5	1
≤3.5	2
≤5.0	2

One additional sleeping room is required for each additional 2.5 EP

HDR was calculated with the following equation:

$$\frac{\text{Number (no) of EPs in dwelling}}{\text{Ideal no of EPs for no of sleeping rooms}} \times 100$$

A value of over 100% was considered as overcrowding (Coetzee et al., 1988:354).

At the time of the study, the minimum wage for a household comprising five people was suggested to be R8 000 per month (R1 600 per person), with 40 % (R3 115.26) of that to be spent on a minimum nutritional food basket (Peyper, 2016:online). As the disability grant, at the time of the study, was up to R1 500 per person, ≤R1 500 per person per month was used as the minimum income bracket.

Medical variables that were measured or recorded for each participant, included the time on MHD treatment (in years), cause of kidney disease, co-morbidities, current medications, and tobacco use. Appetite loss was assessed as a symptom associated with ESRD, by asking the participants about their appetite and food intakes on dialysis and non-dialysis days (Appendix D).

3.7.1 Techniques used to measure socio-demographic and medical variables

Socio-demographic information was obtained by means of a questionnaire (Appendix D), designed for the study, which was administered during a semi-structured interview. The interview took about 20 minutes and was done at the dialysis units whilst the patients were receiving MHD. Medical variables (e.g. years on dialysis, etiology of ESRD, etc.) were recorded from the patients' medical files, although initiation of MHD was not always in the file, therefore, participants were asked to provide the date of commencement of MHD.

3.7.2 Validity and reliability of socio-demographic and medical questionnaires

Validity and reliability were addressed as follows:

3.7.2.1 Validity

To promote content validity, the questionnaire was based on an in-depth literature review, to ensure that all questions were directly relevant to the aims and objectives of the study. Care was taken to ensure that all questions were unambiguous and easy to understand. The researcher administrated the questionnaires during semi-structured interviews. This has an

advantage over self-completed questionnaires, of overcoming illiteracy, and preventing responder fatigue, whilst, the researcher has the advantage of being able to explain questions and ensuring that they are understood as intended. The clinical experience of the researcher as a registered dietitian involved in treating patients with CKD for eight years, also contributed in this regard. Questionnaires were available in English, Afrikaans, and Sesotho. The researcher is fluent in English and Afrikaans, and where necessary, a registered nurse was used as an interpreter during the interviews to interpret between English and Sesotho, making use of the Sesotho questionnaires provided. Before the interviews commenced, participants were given the option of making use of the interpreter or not.

3.7.2.2 Reliability

All interviews were conducted by a single researcher, who is a registered dietitian and trained and experienced in semi-structured interviews (particularly in the population receiving RRT). The researcher ensured that interviews were conducted within the set time frame of around 20 minutes to promote alertness and responsive answers. The first dialysis day of the week was not used for data collection, because participants are usually more tired due to the longer time lapse since the previous dialysis session, which occurred before the weekend. The longer inter-dialysis period, causes more waste products to accumulate, leading to fatigue and malaise. If a participant indicated that he/she was not feeling well on the day that the interview was scheduled, the interview was rescheduled for another day.

The researcher completed the questionnaires (data collection forms) (Appendix D) during each interview. The data was then transferred to two separate Microsoft Excel® 2010 data sheets, on two separate occasions, thus, generating two independent Excel data sheets. These were submitted to the biostatistician who verified the data.

3.8 Nutritional status

For the purpose of this study, nutritional status was based on anthropometry, biochemical information and dietary patterns, in the context of CKD.

3.8.1 Anthropometry

For the purpose of this study, anthropometrical variables that were measured, included body composition based on post dialysis BMI, muscle mass (measured as AMA), fat percentage, the dry weight three months prior to the study (recorded from patients medical file). Risk for CVD was assessed based on WC and WHtR. These variables were interpreted as follows:

3.8.1.1 Body mass index (BMI)

BMI is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. BMI is defined as weight in kg divided by the square of the height in meter (kg/m^2), and is categorised according to international cut-off points summarised in Table 3.2. For people with diabetes and CKD, the target BMI is within the normal range (18.5 to 24.9 kg/m^2) (NKF-K/DOQI, 2007:S18). As water retention between dialysis sessions influences weight, BMI was calculated using the participant's weight immediately post dialysis (referred to as edema-free weight).

Table 3.2: International classification BMI (Bethesda, 1998:xiv; WHO 1995:364; WHO 2000:9)

Classification	Principal cut-off points BMI* (kg/m²)	Associated risk of comorbidities
Underweight Grade III CED#	<16.0	Severe risk
Underweight Grade II CED	16.0 – <17.0	Increased risk
Underweight Grade I CED	17.0 – <18.5	Low risk
Normal range (target BMI for CKD$)	18.5 – <25.0	Average risk
Overweight	≥25.0 – <30.0	Increased risk
Obese class I	30.0 – <35.0	Moderate risk
Obese class II	35.0 – <40.0	Severe risk
Obese class III	≥40.0	Very severe risk

* – body mass index
# – chronic energy deficiency
$ – chronic kidney disease

3.8.1.2 Arm muscle area

AMA, which is related to the total body muscle mass, was calculated based on the participant's measured mid upper arm circumference (MUAC) and triceps skinfold in cm (TSF), using the following formula (Frisancho, 2011:19):

$$\text{AMA } (cm^2) = \frac{(\text{MUAC} - \pi\ \text{TSF})^2}{4\pi}$$

The participants were classified into five categories according to AMA, as indicated in Table 3.3 (Lee & Nieman, 2013:467-468; Frisancho, 2011:157, 314).

Table 3.3: Classification of AMA (Lee & Nieman, 2013:467-468 Frisancho, 2011:157, 314):

AMA percentiles for age and gender	Classification of AMA
$\leq 5^{th}$ percentile	Wasted
$>5^{th} - \leq 15^{th}$ percentile	Below average muscle mass
$>15^{th} - <85^{th}$ percentile	Normal muscle mass
$\geq 85^{th} - \leq 95^{th}$ percentile	Above average muscle mass
$>95^{th}$ percentile	High muscle mass

3.8.1.3 Fat percentage

Determining fat percentage can be a challenge in the MHD population due to edema. According to Gibson (2005:285), single skinfold measurement should not be used to determine body fat in a population with possible edema. Therefore the four site skinfold thickness method, recommended by Fouque et al. (2007:50), was used in this study. This provides a more accurate measure of body fatness, is easy to perform and cost-effective. The participants were classified into five categories according to fat percentage, as indicated in Table 3.4 (Frisancho, 2011:164, 316).

Table 3.4: Classification of fat percentage (Frisancho, 2011:164, 316)

Fat percentage percentiles for age and gender	Classification
$\leq 5^{th}$ percentile	Low fat percentage
$>5^{th} - \leq 15^{th}$ percentile	Below average fat percentage
$>15^{th} - <85^{th}$ percentile	Normal fat percentage
$\geq 85^{th} - \leq 95^{th}$ percentile	Above average fat
$>95^{th}$ percentile	Excessive fat percentage

3.8.1.4 Waist circumference (WC)

Studies have identified WC as a good indicator of intra-abdominal fat mass in adults. The amount of intra-abdominal fat is a better predictor of risk for CVD, diabetes, hypertension and other endocrine abnormalities, than BMI (SASSO, 2003:6). WC was categorised according to the ethnic-specific cut-off values recommended by the International Diabetes Federation for Sub-Saharan Africa (Alberti et al., 2009:1642) to indicate increased risk for metabolic complications. The World Health Organisation cut-off values (SASSO, 2003:5) were used to indicate substantial risk, as indicated in Table 3.5.

Table 3.5: Classification of WC associated with increased risk for metabolic complications (Alberti et al, 2009:1642 & SASSO, 2003:5)

Gender	Ideal	Increased Risk	Substantial Risk
Women	<80 cm	80.0 – 8 7.9 cm	≥88 cm
Men	<94 cm	94.0 – 101.9 cm	≥102 cm

3.8.1.5 Waist-to-height ratio (WHtR)

WHtR is determined by dividing WC (cm) by height (cm). A WHtR of >0.5 is associated with increased risk for metabolic comorbidities such as hypertension, diabetes and CVD, and may be more accurate in this regard than BMI and WC, as evidenced by studies (Ashwell et al., 2012:284).

3.8.2 Techniques used to measure anthropometry

All anthropometric measurements were performed by the researcher, directly after a dialysis session, using standardised anthropometry techniques. Measurements were recorded on a data form (Appendix F). To ensure privacy, measurements were taken in a private room at the dialysis unit. To calculate BMI, dry weight/edema-free weight (aBWef) (Nelms & Lacey, 2016:541) and height were recorded (Lee & Nieman, 2013:13). To calculate AMA, MUAC and TSF were recorded. To calculate fat percentage, TSF, sub-scapular, supra-iliac, and biceps skinfolds were recorded. WHtR was calculated from WC and height. The researcher clearly explained procedures and instructed the patient on what to do while taking measurements according to standardised techniques.

3.8.2.1 Height

Height was measured using a stadiometer. A participant stood barefoot with heels together against the stadiometer, arms to the side, legs straight, shoulders relaxed and the head in the horizontal Frankfort plane. Heels, buttocks, scapulae (shoulder blades) and the back of the head were positioned against the vertical surface of the stadiometer and the measurement was recorded to the nearest 0.1 cm at the end of a maximum inhalation (Frisancho, 2011:4).

3.8.2.2 Weight

Weight was measured directly after a dialysis session to obtain dry weight. Participants stood unsupported on a SOEHNLE Professional scale (Mediscale Bluetooth, Model 7841; manufactured in Germany; Digital, max 220 kg with 100 g increments) with arms to the side and relaxed, without shoes and with minimal, lightweight clothing. Weight was recorded to the nearest 0.1 kg (Lee & Nieman, 2013:170).

3.8.2.3 Mid upper arm circumference

The participants' MUAC were recorded on the arm that was not used for dialysis access by measuring and drawing an anatomical landmark (with a black, erasable Revlon eye make-up pencil) along the circumference of the upper arm at the midpoint between the lateral projection of the acromion process of the scapula and the inferior margin of the olecranon process of the ulna. A non-stretchable, flexible SECA tape measure was used (Mitch & Ikizler, 2010:197 & Fouque et al., 2007:85). The researcher ensured that the tape was in a horizontal plane and wrapped gently, but firmly, around the arm (not too tight that the tissue was compressed). The measurement was taken twice and recorded to the nearest 0.1 cm (Appendix F).

3.8.2.4 Triceps skin fold

All skinfolds were measured with a high quality skinfold calliper (Slimguide Baseline Calliper manufactured in Plymouth, Michigan [USA]). The participant's TSF was measured on the arm that was not used for dialysis access (Fouque et al., 2007:85). An anatomical landmark was marked with a black, erasable Revlon eye make-up pencil, on the posterior aspect of

the upper arm, over the body of the triceps muscle, and at the midpoint of the upper arm, at the same point where MUAC was measured (Lee & Nieman, 2013:190). This was performed with the participant standing with arms relaxed to the sides. The skinfold was grasped on the anatomical landmark, with the left thumb and index finger and with the dorsum of the hand facing the researcher. The calliper was inserted at a depth of ± 2 cm at a 90^{o} angle, and the measurement was recorded after 2 seconds of applying pressure and then releasing the skin. A complete set of skinfold was obtained, one at a time, before the whole set of measurements was repeated. Three measurements were measured to the closest 1 mm for each skinfold, and the mean was used for calculations.

3.8.2.5 Biceps skinfold

The biceps skinfold was measured as the thickness of a vertical fold on the front of the upper arm, directly above the centre of the cubital fossa, at the same level and on the same arm as where the triceps skinfold was measured (Gibson, 2005:275). An anatomical landmark was drawn with a black, erasable Revlon eye make-up pencil, on the anterior part of the arm, over the body of the biceps muscle and at the midpoint of the arm (at the same point where MUAC was measured). This was performed with the participant standing with arms relaxed to the sides. The skinfold was grasped on the anatomical landmark, with the left thumb and index finger, and with the dorsum of the hand facing the researcher. The skinfold calliper (Slimguide Baseline Calliper manufactured in Plymouth, Michigan [USA]) was inserted at a depth of ±2 cm at a 90^{o} angle, and the measurement was recorded after 2 seconds of applying pressure and then releasing the skinfold. Three measurements were taken to the nearest 1 mm for each skinfold, and the mean was used for calculations.

3.8.2.6 Sub-scapular skinfold

The sub-scapular skinfold was measured 1 cm below the lowest, or inferior, angle of the scapula where the anatomical landmark (marked with a black, erasable Revlon eye make-up pencil) was drawn. The long axis of the skinfold was at a 45^{o} angle directed downward and to the right side. This was performed with the participant standing with arms relaxed to the sides. The skin was grasped 1 cm above and medial to the site along the axis on the anatomical landmark, between the left thumb and index finger, and the back of the hand

facing the researcher. The skinfold calliper (Slimguide Baseline Calliper manufactured in Plymouth, Michigan [USA]) was inserted at a depth of ±2 cm, at a 90^{o} angle, and the measurement was recorded after 2 seconds of applying pressure and then releasing the skinfold. A complete set of skinfold was obtained, one at a time, before the whole set of measurements was repeated. Three measurements were taken to the nearest 1 mm for each skinfold, and the mean was used for calculations.

3.8.2.7 Supra-iliac skinfold

The supra-iliac skinfold was measured just above the ileac crest at the mid-axillary line where the anatomical landmark (marked with a black, erasable Revlon eye make-up pencil) was drawn. The long axis diagonally followed the natural cleavage lines of the skin. The subject stood erect with feet together and arms hanging at the sides. The skinfold was grasped between the left thumb and index finger of the researcher with the back of the hand facing the researcher, 1 cm posterior to the mid-axillary line and the measured at the mid-axillary line. The skinfold calliper (Slimguide Baseline Calliper manufactured in Plymouth, Michigan [USA]) was inserted at a depth of ±2 cm, at a 90^{o} angle, and the measurement was recorded after 2 seconds of applying pressure and then releasing the skinfold. Three measurements were taken to the nearest 1 mm for each skinfold, and the mean was used for calculations.

A complete set of skinfold was obtained, one at a time, before the set of measurements was repeated to obtain the second and third measurements of each skinfold.

3.8.2.8 Wrist circumference

Wrist circumference was measured on the right arm or the non-fistula arm, with the arm flexed at the elbow, with the palm facing upward and the hand muscles relaxed. A non-stretchable, flexible SECA measuring tape was placed around the wrist crease just distal to the styloid process of the radius and ulna, in the depressions between the hand bones. The tape was placed at a 90^{o} angle to the length of the forearm. The tape touched the skin, but did not compress the soft tissues. This measurement was taken twice to the nearest 0.1 cm (Lee & Nieman, 2013:180).

3.8.2.9 Waist circumference

WC was measured midway between the top of the superior iliac crest and the lowest rib in the mid-axillary line in a horizontal plane, with the individual standing in the upright position with feet together, at the end of normal expiration with arms hanging relaxed to the sides. Heavy outer clothing and binding garments were removed in order to achieve an accurate measurement. The non-stretchable, flexible SECA tape measure was kept firm against the skin without cutting into the skin (SASSO, 2003:5). This measurement was taken twice to the nearest 0.1 cm.

3.8.3 Validity and reliability of anthropometric measurements

Validity and reliability were addressed as follows:

3.8.3.1 Validity

Anthropometric variables which have been validated in the literature, to best reflect the nutritional status of patients with ESRD receiving RRT, were chosen based an in-depth literature review.

3.8.3.2 Reliability

All anthropometric measurements were performed by a single researcher who is a trained and registered dietitian with eight years of clinical experience, according to standardised techniques. For skinfolds, the mean of three measurements were used in the data analysis, as this is standard practice. All other anthropometry measurements were repeated twice to avoid possible methodological errors. The same measuring instruments were used for every participant and were calibrated to reduce instrument variation. The scale was calibrated each morning before data collection with the same five kilogram weight (Katzenellenbogen and Joubert, 2007:119).

3.8.4 Biochemistry

For the purpose of the study, biomarkers that are routinely tested on all patients receiving MHD, were recorded from the participant's treatment files. Serum urea and electrolytes are routinely performed pre-dialysis and post-dialysis. The standard protocol at the NRC unit is to perform hemoglobin testing monthly, iron studies three monthly, CRP when an infection

is suspected, and white cell counts occasionally. The most recent biochemistry results, the date when the measurements were performed, and whether it was done pre or post-dialysis, were recorded from the patients' treatment files.

3.8.5 Biochemical variables

The biochemical variables of interest in this study, included serum levels of albumin, CRP, urea, creatinine, phosphate, potassium, sodium, HbA1c and total cholesterol, adequacy of dialysis as Kt/V, and biomarkers of anemia. The cut-off values recommended by the NKF in 2009 (Nelms & Lacey, 2016:534-536), were used to categorise the biomarkers as indicated in Table 3.6.

The pilot study (discussed later) found that in some dialysis units, CRP is not routinely measured. A question to assess how often CRP is tested, was therefore included in the questionnaire in order to describe the current practice in units across Bloemfontein.

White blood cell (WBC) count was assessed as an additional indicator of acute infection/inflammation, trauma, and metabolic stress that may cause erythropoietin non-responsiveness. Low WBC counts also occur due to dietary deficiencies, overwhelming infections, autoimmune diseases, radiation, chemotherapy and bone marrow failure (Rossouw et al., 2010:89).

Hemoglobin, ferritin and transferrin saturation (TSAT) were evaluated to assess the presence of anemia due to malnutrition despite erythropoietin and iron therapy (Nelms & Lacey, 2016:548).

Table 3.6: NKF (2009) recommended categorisation of biochemical markers for patients with CKD (Nelms & Lacey, 2016:534-536)

Marker	Below normal	Normal	Above normal
Serum albumin (g /L)	<35	35 – 52	>52
Serum urea (mmol/L)	<21	21 – 29	>29
Serum creatinine (µmol/L)	< 177	177 – 1326	>1326
CRP (mg/L)	<6	6 – 8	>8
Serum cholesterol (mmol/L)	<3.8	3.8 – 5	>5
Kt/V	<1.4	1.4	>1.4
Serum phosphate (mmol/L)	<1.8	0.8 – 1.8	>1.8

Marker	Below normal	Normal	Above normal
Serum potassium (mmol/L)	<3.5	3.5 – 5.3	>5.3
Serum sodium (mmol/L)	<136	136 – 145	>145
HbA1C (%; mmol/mol)	<4; <20	4 – 7; 20 – 53	>7; >53
Hemoglobin (g/dL)	<10	10 – 13	>13
Ferritin (ng/ml)	<200	200 – 500	>500
TSAT (%)	<20	20 – 50	>50
WBC (10^9/L)	<4	4 – 11	>11

3.8.6 Techniques for obtaining biochemistry

For the purpose of this study, the most recent routine biochemical data and related information, as discussed above, were obtained from the participants' treatment files and captured on a data form (Appendix G); results older than six months were not considered. The researcher, also asked each unit manager, when CRP was measured and this was also recorded on the data form (Appendix G).

3.8.7 Validity and reliability of biochemical information

The following actions were taken to ensure validity and reliability:

3.8.7.1 Validity

Biomarkers that have been validated in the literature to best reflect the nutritional status of patients with ESRD receiving RRT, were chosen for this study, based on an in-depth literature review (Fouque, et al., 2007 & Nelms and Lacey, 2016).

3.8.7.2 Reliability

All available biochemical variables were obtained from the patients' treatment files, and after data collection, the researcher verified that it was indeed the most recent, by phoning the laboratory that reported on the biochemical results. It was recorded whether biomarkers were taken pre or post-dialysis in order to ensure reliability (Appendix G). It may be a possible limitation of the study that retrospective biochemical results were used, because the assumption had to be made that standardised, routine procedures were followed in the collection, transportation, storage and testing of the blood samples.

3.8.8 Dietary patterns

To assess the overall dietary patterns of participants on MHD, the frequencies with which specific foods, including those that specifically impact on the blood levels of protein waste products, phosphate, potassium and sodium, were consumed (daily, weekly, monthly or never), were recorded. In addition, for each food type, participants also indicated whether they usually ate a small, medium or large portion. The three predetermined portion size options, from which they chose for each food type, were based on the South African renal exchange lists (Herselman & Esau, 2005:51-57). This data gives an overall indication of the frequency of consumption of restricted and unrestricted foods.

In addition, to support the food frequency information and allow quantification of dietary intake of energy and macronutrients, participants were asked to describe everything that they consumed on a typical non-dialysis day. From this data, meal frequency on a typical non-dialysis day was assessed, and Food Finder® III Software (version 1.1.3) (Appendix I), which utilises the South African Food Composition Tables, were used to quantify the daily intakes of energy, protein (both total and HBV), carbohydrates, and fats. The estimated intakes of these were then compared to the NKF-K/DOQI (2000, 2006) recommendations for patients receiving MHD, and were categorised as inadequate, adequate and above adequate, according to the cut-off values indicated in Table 3.7.

Table 3.7: Recommended macronutrient dietary intakes for patients with ESRD on MHD (NKF-K/DOQI, 2000, 2006)

Macronutrient	Inadequate Intake	Adequate Intake	Above Adequate Intake
Energy (kcal/kg)[#]	<30	30 – 35	>35
Total Protein (g/kg)[#]	<1.2	1.2 – 1.3	>1.3
HBV protein (% of TP[¥])	<50	50 – 75	>75
Carbohydrate (% of TE[§])	<50	50 – 60	>60
Fat (% of TE)	<25	25 – 35	>35

– kg - dry weight or adjusted edema free body weight
¥ –TP - total protein;
§ – TE - total energy

Intakes of high biological value protein (protein from animal origin), were also quantified with the Food Finder® III Software (version 1.1.3) and expressed as a percentage of total protein intakes.

As recommended by the NKF, the macronutrient intakes were evaluated based on edema free body weight (BWef), which refers to the dry weight measured immediately post-dialysis. If BWef was <95 % or >115 % of standard body weight (SBW), the adjusted edema free body weight (aBWef) was used, which was calculated with the following formula (Nelms & Lacey, 2016:541, Fouque et al., 2007:79):

aBWef = BWef + [(SBW - BWef) x 0.25]

Using aBWef may prevent recommendations for too large intakes that may induce overproduction of waste products, and increase uremic symptoms (Fouque et al., 2007:79). SBW is derived from the National Health Nutrition Evaluation Survey (NHANES) II data (Fouque et al., 2007:81) and is defined for three frame sizes, gender, age and height and categorised according to Figure 3.1 (Fouque et al., 2007:81). Frame size was calculated by dividing body height (cm) by right wrist circumference (cm), and was categorised according to Table 3.8 (Lee & Nieman, 2013:179-180).

Fiftieth (50th) Percentile of Standard Body Weight for Men

Age	25–54 years			55–74 years		
	Weight (kg)					
Height (cm)	Small frame	Medium frame	Large frame	Small frame	Medium frame	Large frame
157	64	68	82	61	68	77
160	61	71	83	62	70	80
163	66	71	84	63	71	77
165	66	74	79	70	72	79
168	67	75	84	68	74	80
170	71	77	84	69	78	85
173	71	78	86	70	78	83
175	74	78	89	75	77	84
178	75	81	87	76	80	87
180	76	81	91	69	84	84
183	74	84	91	76[a]	81	90
185	79	85	93	78[a]	88	88
188	80	88	92	77[a]	95	89

Fifthieth (50th) Percentile of Standard Body Weight for Women

Age	25–54 years			55–74 years		
	Weight (kg)					
Height (cm)	Small frame	Medium frame	Large frame	Small frame	Medium frame	Large frame
147	52	63	86[a]	54	57	92
150	53	66	78	55	62	78
152	53	60	87	54	65	78
155	54	61	81	56	64	79
157	55	61	81	58	64	82
160	55	62	83	58	65	80
163	57	62	79	60	66	77
165	60	63	81	60	67	80
168	58	63	75	68	66	82
170	59	65	80	61[a]	72	80
173	62	67	76	61[a]	70	79
175	63[a]	68	79	62[a]	72[a]	85[a]
178	64[a]	70	76	63[a]	73[a]	85[a]

[a]Value estimated through linear regression equation.

(NHANES I and II); reproduced with permission from Frisancho *et al. The American Journal of Clinical Nutrition* [1].

Figure 3.1: Standard body weight (Fouque et al., 2007:81)

Table 3.8: Determining frame size from the ratio of height to the circumference of the right wrist (Lee & Nieman, 2013:179-180)

Frame Size	Women	Men
Small	>10.9	>10.4
Medium	10.9 – 9.9	10.4 – 9.6
Large	<9.9	<9.6

3.8.9 Techniques to measure dietary patterns

The researcher determined dietary patterns using a short, semi-quantified food frequency questionnaire (FFQ) (Appendix E), based on the South African renal exchange lists (Herselman & Esau, 2005:51-57); and the 'Five Illustrated Steps to Improve Renal Diet Compliance' Manual (Verseput, 2012:A82). A version of this FFQ is routinely used by dietitians in renal units in South Africa. Usual daily food intake on a typical non-dialysis day was recorded with an adapted 24h-recall (Appendix I).

The researcher administered these questionnaires during a structured interview with each participant, with the help of a Sesotho interpreter where necessary, while the patient was receiving MHD at one of the renal units in Bloemfontein. Administering the FFQ took around 30 minutes and the adapted 24h-recall, around 20 minutes. In order not to fatigue the participants or interfere with medical procedures, these interviews were conducted on a different day than the structured interview during, which, the socio-demographic and KAP questionnaires were administered. Care was taken to ensure privacy as discussed under ethical issues.

When administering the adapted 24h-recall, standardised food models, as well as photographs, were used to illustrate portion sizes, as recommended by Lillegaard et al. (2005). Participants could also demonstrate how much of a given food they normally dished up, using raw oats, serving utensils and crockery supplied by the researcher for this purpose. The researcher then measured the dished-up amounts and quantified it to household measures, which were recorded on the questionnaires.

3.8.10 Validity and reliability of dietary information

The following actions were taken to ensure validity and reliability:

3.8.10.1 Validity

A semi-quantified FFQ that has been adapted for the South African renal population, based on the South African Renal Exchange Lists (Herselman & Esau, 2005:51-570) and the 'Five Illustrated Steps to Improve Renal Diet Compliance' Manual (Verseput, 2012:A82), was used to collect dietary data. These exchange lists and the manual were developed specifically for the South African renal population, and are routinely used for training at South African universities, as well as by South African renal dietitians.

Questionnaires were available in English, Afrikaans, and Sesotho. The questionnaires were translated from English to Sesotho by a registered dietitian-lecturer who is fluent in English and Sesotho and who, at the time of the study had 17 years of experience in compiling nutrition research questionnaires. The researcher translated the questionnaire from English to Afrikaans. Meticulous care was taken to ensure that translation remained true in all aspects. Administering these questionnaires during structured interviews had the advantage over self-completed questionnaires of overcoming illiteracy, and preventing fatigue and avoiding misunderstanding of questions. The clinical experience of the researcher in renal nutrition, also aided in this regard. The researcher is bilingual in English and Afrikaans. When necessary, a registered nurse employed at the relevant renal unit we used during the interviews to interpret from English to Sesotho, using the Sesotho questionnaires provided.

3.8.10.2 Reliability

A single researcher, who is a registered dietitian and trained and experienced in conducting structured interviews (particularly in the population receiving RRT), conducted all interviews and was present during all interviews where an interpreter were utilised. The researcher ensured that interviews were conducted within the planned time frames to promote alertness and responsive answers. The first dialysis day of the week was not to be used for data collection, because participants are typically more tired due to the longer inter-dialysis time over the weekend, which causes more waste products to build up, leading to fatigue and malaise. If participants indicated on the date arranged for the interview that they were

not feeling well, before or during the interview, the interview was rescheduled. Scheduling the data collection during and/or directly after dialysis sessions (which lasts 3 – 4 hours, up to three times a week) had the benefit by not infringing on the participants' time away from dialysis or incurring additional travel costs.

Ideally, as discussed by Fouque et al. (2007:52), three 24h-recalls (one of a dialysis day, one of a non-dialysis day and one of a weekend day) are needed to reliably measure nutrient intakes. In the current study, this was not logistically possible due to a number of reasons. Firstly, the different units had different hemodialysis schedules; thus, some participants received dialysis on Mondays, Wednesdays and Fridays, and others on Tuesdays, Thursdays and Saturdays. For the group who were dialysed on Tuesdays, no 24h-recall of a weekend day would have been possible if the interviews were conducted during dialysis. For the group who were dialysed on Mondays, a 24h-recall of a weekend day would also not have been viable, due to the typical post weekend fatigue and malaise, as discussed above. Telephonic recalls were considered as a possibility, but it was foreseen that some participants would be difficult to reach on non-dialysis days (to attain a 24h-recall of a dialysis day), as they would have been at home or at work. Language barriers, as well as the fact that no visual aids such as food models, can be used in telephonic recalls, were amongst other difficulties that were foreseen with telephonic interviews. Thus, instead of three 24h-recalls (recalling what was eaten the day before the interview), one adapted 24h-recall, designed to depict typical intake on a non-dialysis, was used to give a rough estimate of typical intakes. In addition, dietary intake was assessed via a semi-quantified FFQ, which records overall dietary habits rather than specific intakes. The idea was that, in addition to, the typical dietary intake on a non-dialysis day, this would provide a more accurate and complete picture of the participants' dietary habits.

Standardised food models, as well as food photographs were used to increase the reliability of estimating portion sizes, as recommended by Lillegaard et al. (2005). Participants were also asked, when appropriate, to dish up raw oats in order to show the researcher the amounts of food that they normally eat. The researcher then measured the volumes and related those to portion sizes. This was deemed more accurate than participants estimating intakes based on their own perception of household measures.

If a participant mentioned in the FFQ that a specific food type was eaten daily, but failed to mention it in the adapted 24h-recall, the researcher also prompted the participant about such foods to confirm the daily intake thereof.

The researcher captured the dietary data from the FFQ, as well as the analysed energy and nutrient intake data from the adapted 24h-recall, onto two separate Microsoft Excel® 2010 data sheets (Appendix E & I), on two separate occasions. Thus, two independent Microsoft Excel® data sheets were submitted to the biostatistician, who verified the data to ensure reliability.

3.9 Variables to measure KAP regarding dietary modifications and restrictions required for patients with ESRD on MHD, as well as involvement of a dietitian

For the purposes of this study, the KAP of participants regarding the dietary restrictions recommended for patients with ESRD on MHD, as well as the involvement of a dietitian in their treatment, were assessed with a questionnaire (Appendix H). This was administered by the researcher during a structured interview that lasted around 20 minutes, on the same day as the anthropometry measurements were done and the socio-demographic questionnaire was administered (Appendix F & D).

3.9.1 Knowledge

Before patients can adhere to dietary restrictions, they must have knowledge of these restrictions (Macías & Glasauer, 2014:8). Knowledge of dietary restrictions for ESRD on MHD was assessed by showing participants pictures of twelve different food types, and asking them to indicate whether or not the food may be eaten in larger amounts (less restrictively) or needs to be restricted in the diet. An additional option, ‘do not know’, was included to minimise guessing (Devraj & Wallace, 2013:635). The participant’s response to each question was recorded on the questionnaire (Appendix H) (Lopez et al., 2007:139).

For the purposes of this study, a score of >75 % (ten or more correct answers) were defined as good knowledge, a score of 50 – 75 % (six to nine correct answers) as average knowledge, and a score of <50 % (five or fewer correct answers) as poor knowledge of dietary restrictions required for patients with ESRD on MHD (Lopez et al., 2007:142).

In addition, participants were also asked another twelve questions to assess their knowledge regarding phosphate, potassium and sodium [salt] content of twelve food types shown to them. The participants were also asked to indicate if, to their knowledge, they were allowed to eat certain food types in larger amounts (more freely), or whether they were supposed to limit the amounts of these foods in their diets to control electrolyte levels between dialysis sessions (Appendix H) (Lopez et al., 2007:139). For the purposes of this study, a score of >75 % (ten or more correct answers), was considered as good knowledge, a score of 50 – 75 % (six to nine correct answers) as average knowledge, and a score of <50 % (five or fewer correct answers), as poor knowledge of foods that must be restricted in the diet to control electrolyte levels (Lopez et al., 2007:142). The twelve food pictures were chosen according to the South African Renal Exchange Lists (Herselman & Esau, 2005:51-57). Three foods high in phosphate (PO4) (>110 mg PO4 per portion) were selected, namely milk, organ meat (liver) and cola drinks. One food low in phosphate (<100 mg PO4), namely cooked chicken breast, was added as control. Three foods high in potassium (K) (>240 mg K per portion) were selected, namely baked potato in skin, orange, and butternut pumpkin. One food low in potassium (<120 mg K), namely apple, was added as control. Three foods high in sodium (Na) (>400 mg Na per portion) were selected to form part of the questionnaire, namely vienna, instant soup powder and corn flakes. One food low in sodium (<100 mg Na), namely chilli pepper powder, was added as control.

To avoid ambiguity, the phrase “If you have diabetes mellitus, only consider the following food in terms of minerals (phosphate, potassium and salt) that need to be restricted/limited in ESRD on hemodialysis and not according to carbohydrate or sugar amount”, was included at the beginning of the questionnaire (Appendix H).

Knowledge of phosphate binders and how these are supposed to be used, was assessed by two open-ended questions. Participants were asked to identify the phosphate binder that they were prescribed and to describe their compliance in taking these. Phosphate binders like, calcium carbonate, calcium acetate, sevelamer carbonate and lanthanum carbonate, have to be taken with each meal or snack to effectively limit phosphate absorption from the diet (Wilkens et al., 2012:823).

3.9.2 Attitude

Adherence to dietary restrictions not only entails having a good knowledge of foods allowed or restricted, but requires a positive attitude to follow these restrictions consistently (Macías & Glasauer, 2014:10). Participants' attitudes towards dietary restrictions for patients with ESRD on MHD, were assessed with one question: "How would you describe your feelings (attitude) towards the prescribed eating pattern for persons with kidney failure on hemodialysis?". If the participant answered "positive" to this specific question, it was scored one (indicating a positive attitude); if the participant answered "negative" or "neutral" it was scored zero (thus indicating a negative attitude) (Macías & Glasauer, 2014:17; Lopez et al., 2007:142). In the next question on the questionnaire, the participant was asked to explain this attitude statement (Appendix H). In addition, two open-ended questions were asked: "Describe your feelings towards the cost of the eating pattern for persons with kidney failure on hemodialysis.", and "Describe your feelings towards the food that you can eat with the prescribed eating pattern for persons with kidney failure on hemodialysis." (Appendix H) (Lopez et al., 2007:142). The answers to the open ended questions were grouped according to similar themes.

3.9.3 Practices

Adherence to dietary restrictions requires consistent practices (Macías & Glasauer, 2014:18). Adherence to the dietary restrictions for patients with ESRD on MHD, as a practice, was assessed with five questions (Appendix H) (Lopez et al., 2007:144). The first three questions were: "Are you able to eat the correct amount of restricted food?"; "Does your family support you to follow the correct diet?"; and "Do you measure your food using scales, different size spoons and cups?". The options were: "yes"; "no"; "sometimes". For the purposes of this study, two affirmative ("yes") answers to these first three questions, were considered as agreeable practices regarding renal dietary restrictions.

The other two questions were open-ended. For the purposes of this study, for the first: "How many times do you eat take-a-ways per week?", ≤3x/week was considered good practice; whilst for the second: "For how many days last week did you follow the prescribed eating pattern for persons with kidney failure on hemodialysis?", ≥3x/week, was considered good practice (Appendix H) (Lopez et al., 2007:142).

3.9.4 Involvement of a dietitian

Frequent nutrition counselling results in compliance with dietary intervention and improved outcomes (NKF-K/DOQI, 2000:S46). According to NKF-K/DOQI recommendations, patients on MHD should consult a dietitian every three to four months (NKF-K/DOQI 2000:S46). Fouque et al. (2007:52) recommends consultation every six to twelve months, or every three months if the patient is older than 50 years or have been on dialysis for longer than 5 years.

The dietitian's involvement in the treatment of participants was assessed with five questions. The first question assessed who was involved in educating the participant regarding the "renal diet", and was posed as an open-ended question: "Who taught you about the kidney eating pattern?", to include all possibilities.

To the second question: "Have you ever seen/consulted a dietitian and talked about what foods you should eat more of, or less of, since being on hemodialysis?", the participant could answer "yes", "no" or "do not know". If the participant answered "yes", the following question was asked: "How often did you see/consult the dietitian since you were on dialysis where you specifically talked about what foods you should eat more or less of?". The number of years recorded, was then divided by the number of years on dialysis to record "number of visits per year on MHD", and categorised as indicated in Table 3.9.

Table 3.9: Categorisation of a dietitian's involvement in the treatment

Involvement of a dietitian	Poor	Average	Good
Number of visits per dialysis year	0 – 1	2 – 3	>3

To the fourth question: "Did you understand what the dietitian taught you about the kidney eating pattern?", the participant could choose, "yes", "no" or "some of it, but not everything". If the participant answered "no" or "some of it, but not everything", the fifth question, also open-ended, was asked: "What were the barriers that made it difficult for you to understand?".

3.10 Validity and reliability regarding measures of adherence to dietary modifications and restrictions for end stage renal disease on maintenance hemodialysis

The following precautions were taken to ensure validity and reliability:

3.10.1 Validity

The questionnaires were compiled based on an in-depth literature review to ensure that all questions were directly relevant to the aims and objectives of the study, thus improving content validity. Care was taken to ensure that the questions were not ambiguous and was easy to understand exactly as intended. Subsequently, the questionnaires were evaluated by Cecile Verseput, a dietitian in renal care with 15 years of experience in renal nutrition and also the developer of the "Five illustrated steps to renal diet compliance Manuel" which was presented at the Bi-annual International Congress of Nephrology in Cape Town [April, 2010] and at the sixteenth International Congress on Nutrition and Metabolism in Renal Disease, held in Honolulu, Hawaii [June, 2012]. Her inputs, based on her vast experience, were used to make some adaptations to the questionnaire to improve the content validity.

Questionnaires were available in English, Afrikaans, and Sesotho. The questionnaires were translated from English to Sesotho by a registered dietitian-lecturer who is fluent in English and Sesotho and who, at the time of the study had 17 years of experience in compiling nutrition research questionnaires. Meticulous care was taken to ensure that translation remained true in all aspects. The researcher translated the questionnaires from English to Afrikaans. Administering these questionnaires during structured interviews had the advantage over self-completed questionnaires, of overcoming illiteracy, and preventing fatigue and misunderstanding of questions. The clinical experience of the researcher in renal nutrition, also aided in this regard. The researcher is bilingual in English and Afrikaans. When necessary a registered nurse employed at the relevant renal unit was used during the interviews to interpret from English to Sesotho using the Sesotho questionnaires provided.

3.10.2 Reliability

A single researcher, who is a registered dietitian and trained and experienced in conducting structured interviews (particularly in the population receiving RRT), conducted all interviews and was present during all interviews where an interpreter was used. The researcher

ensured that interviews were conducted within the planned time frame to promote alertness and responsive answers. The first dialysis day of the week was not to be used for data collection, because participants are typically more tired due to the longer inter-dialysis time over the weekend, which causes more waste products to build up, leading to fatigue and malaise. If participants indicated that they were not feeling well, on the date arranged for the interview, before or during the interview, the interview was rescheduled. Scheduling the data collection during and/or directly after dialysis sessions (which lasts 3 – 4 hours up, to three times a week) had the benefit by not infringing on the participants' time away from dialysis or incurring additional travel costs.

Measurements (answers) were captured on data collection forms (Appendix H). The researcher then captured the data of the questionnaires onto two separate Microsoft Excel® 2010 data sheets, on two separate occasions. Thus, two independent Excel data sheets were submitted to a biostatistician who verified the data.

3.11 Procedures

The study was executed in the following steps:

Step 1: Obtaining permission to perform the study

Approval and permissions to perform the study was obtained as described in section 3.2.

Step 2: Performing the pilot study

A pilot study was performed by the researcher following the exact procedures of the main study (Step 4), as described in section 3.12.

Step 3: Obtaining informed consent

Sampling was done as described in section 3.5 and informed consent was obtained as described in section 3.14.

Step 4: Collecting the data

The researcher was responsible for all actions regarding data collection. Data collection took place over the course of two days per participant, while the participant was at the dialysis

centre for treatment. All ethical considerations towards the participant were maintained as outlined in 3.14, and techniques outlined in section 3.10 were meticulously followed.

During the first appointment with a participant, the researcher administered the sociodemographic questionnaire (Appendix D), the questionnaire regarding KAP and the dietitian's involvement in the treatment of the participant (Appendix H) (which took around 40 minutes each), while the participants' were receiving dialysis. The anthropometry measurements (Appendix F) (which took around 20 minutes) were completed directly after the dialysis session.

During the second appointment with a participant, the FFQ (which took around 30 minutes) as well as the usual daily intake of a non-dialysis day (which took around 20 minutes), were completed via structured interviews (Appendix E & I). Biochemical values (Appendix G) were obtained from the participant's treatment file and the question regarding the scheduling of CRP measurements were posed to the unit manager (Appendix G).

The researcher then captured the data as described in section 3.10.

Step 6: Analysing the data

The completed questionnaires and data sheets captured from the questionnaires were electronically transferred to the Department of Biostatistics of the University of the Free State for analysis.

3.12 Pilot study

Macías & Glasauer (2014:42-45) recommends quality control pre-testing of questionnaires which involves validity, ease of administration and participant burden.

A pilot study was performed on one conveniently selected participant from each unit (n= 5) who signed informed consent (one unit was not included as obtaining permission was still in progress at the time). Language was taken into account; thus, the sample comprised two English, one Sesotho and two Afrikaans speaking participants to assess possible language barriers with the questionnaires.

During the pilot study, no problems were detected with ease of administration and participant burden. However, the following amendments were made afterwards, to improve

validity. In the socio-demographic questionnaire (Appendix D), the order of questions were changed to ask how many people contribute to the monthly income before asking what is the total monthly income, since it was noted that participants did not consider other sources of income. The question on how long it takes to travel to and from dialysis was changed to "How much time do you spend on travelling to the dialysis unit from your home (in minutes and/or hours)?", as it was noted that the previous question was subject to multiple interpretations. In the KAP questionnaire (Appendix H), participants struggled to word their attitude to the two following open-ended questions and needed prompting thus options to choose from were included for these questions: "Describe your feelings towards the cost of the eating pattern for persons with kidney failure on hemodialysis" and "Describe your feelings towards the food that you can eat with the prescribed eating pattern for persons with kidney failure on hemodialysis". These changes were resend to the HSREC and were approved before the full scale study was conducted. The amendments made were minor, thus, these five participants' data was also included in the study, except the data for the KAP questions on attitude (Appendix H) and the travel time to dialysis (Appendix D) as described above.

3.13 Statistical analysis

Descriptive statistics were calculated and expressed as frequencies and percentages for categorical data, and medians and percentiles for continuous data. Associations were calculated by means of 95 % confidence intervals for the percentage or Fisher's exact test for categorical data comparisons. The 95 % confidence interval for median difference, or Kruskal-Wallis's test was calculated when the sample was small for numerical data comparisons. The Bhapkar test was performed for paired data. The analysis was performed by the Department of Biostatistics at the University of the Free State. The data analysis for this study was generated using SAS software (version 9.4). Copyright, SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.

3.14 Ethical considerations

Information documents describing the aims, objectives and procedures of the study, as well as the rights of participants, were handed to potential participants, in the language of their choice (English, Afrikaans, and Sesotho). The researcher also explained everything verbally and gave opportunity for questions. Those that wanted to be included in the study, subsequently gave written consent (Appendix A & B).

Participants were reassured that all their information would remain confidential, as no names of participants were disclosed. Al participants received a responder number which was used in data analysis. Results were only reported for groups. During data collection, privacy was maintained by drawing curtains around the chair and by taking anthropometric measurements in a private room at the relevant dialysis unit. Participants were also assured that participation was voluntary and that they were free to withdraw from the study at any time without any consequence to them.

Completed questionnaires and a compact disc with the Microsoft Excel® data sheets are being stored securely at the Department of Nutrition and Dietetics (UFS). Only the researcher, biostatistician and Head of Department have access to them. These documents do not contain any information that may identify individual participants - only respondent numbers are noted.

After data collection was completed, the researcher gave each participant, information on the prescribed eating patterns for persons with kidney failure on MHD (Wilkens et al., 2012:817-826). A final report on the findings will be made available to the Free State Department of Health and the unit managers of the private dialysis units.

3.15 Challenges encountered during the execution of the study

The problems encountered during the research process included time restraints, accessibility of the participants and incomplete biochemical markers.

3.15.1 Time restraints

The researcher originally planned to complete the pilot study during November, but obtaining approval from the HSREC was hampered by student strikes in 2016. Obtaining

permission from the Provincial Health Research Committee of the Free State Department of Health also took longer than expected. After the pilot study, amendments to the questionnaires (as described in section 3.12) needed to be re-approved by the HSREC. One renal dialysis unit took five months to grant final permission.

Data collection could not occur on Mondays and Tuesdays, and, for each participant, had to be spread out over two days, during dialysis sessions (as described in sections 3.5, 3.10 and 3.11). Subsequently, data could only be collected from three to four participants per dialysis session (and this would then only be half of the data as described above). To ease this problem, Saturdays were included to collect data.

The FFQ included food eaten in the previous six months. The data collection period, however, inevitably stretched over seasons, this may have impacted on the consumption of seasonal fruits and vegetables, which needed to be considered in the interpretation of the data.

3.15.2 Accessibility of participants

All MHD patients in the respective dialysis units were invited to participate, many chose not to, whilst, some that were willing, had to be excluded due to the exclusion criteria. Although nobody was asked to provide reasons for not volunteering, it may be noteworthy that one participant indicated that he/she was old and therefore did not think the research would benefit him/her individually.

Thus, the final sample was smaller than originally planned. In addition, one participant opted not to continue with day two of the data collection, whilst another was hospitalised after the first day of data collection and therefore their incomplete, collected data, could not be included.

3.15.3 Incomplete sets of biochemical markers

Not all the biochemical markers needed for the study are routinely done by all of the dialysis units (for example, CRP, serum cholesterol, pre and post-dialysis BUN, WBCs), thus causing missing values in the data set.

CHAPTER 4: RESULTS

4.1 Introduction

A total of 77 patients participated in the study. Two of these participants were subsequently excluded from the study, as discussed in section 3.15.2. The final sample comprised 75 participants; thus, 42 % of the study population.

This chapter describes the socio-demographic and medical information of the sample, their nutritional status, which included anthropometry, biochemical information and dietary patterns, as well as their KAP with regard to dietary modifications and restrictions that are recommended for persons with ESRD who are receiving MHD. In addition, the results regarding the involvement of dietitians in the treatment of these participants are presented.

4.2 Socio-demographic results

Socio-demographic results, summarised in Table 4.1 to Table 4.6, include data on education and relationship status, housing, transport to and from the dialysis unit, household finances, linguistic information, and information on the person that mostly prepared the meals in the household.

4.2.1 Basic socio-demography

As summarised in Table 4.1, almost three quarters (70.7 %, n= 53) were men. The median age of the participants was 50.5 years, ranging from 25 to 78.9 years; but with a lower quartile of 41 years and an upper quartile of 59.6 years, indicating that most participants were middle aged and older. Education levels ranged from Grade 4 to post-graduate level, with the median being Grade 12. About a third (28 %, n= 21) had some level of tertiary education, whilst almost two thirds (65.3 %, n= 49) had partially or fully completed secondary school (of the latter, 13 had completed secondary school up to grade 10 only [info not in table]). Half of the participants (56 %, n= 42) were married and two (2.7 %) lived with a partner. The other 40.1 % (n= 31) were single, divorced, or widowed.

The majority (81.4 %, n= 61) lived in formal brick houses, with three or more rooms. Two participants (2.7 %) indicated that they lived in shacks (informal housing). The majority (89.3

%, n= 67) had running tap water inside the home and almost all had electricity in the home (98.7 %, n= 74). According to the calculated HDR, however, most participants (64 %, n= 48) lived in overcrowded conditions (Coetzee, et al., 1988:354).

Almost half (46.7 %, n= 35) used their own car to drive to and from the dialysis units. The rest mostly used taxi services (25.3 %, n= 19) and the government hospitals' ambulance/commuting services (18.7 %, n= 14). The median one-way travel time to the dialysis unit was 30 minutes (ranging from five minutes to three hours).

Table 4.1: Socio-demographic information (n= 75)

Variables	Number of participants (n)	Percentage (%)
Gender		
Men	53	70.7
Women	22	29.3
Education level		
Primary school (grade 4 – 7)	5	6.7
Secondary school (grade 8 – 12)	49	65.3
Tertiary education (diploma, degree and post-graduate degree)	21	28.0
Relationship Status		
Single	21	28.0
Married	42	56.0
Divorced	8	10.6
Widower/Widow	2	2.7
Lives with partner	2	2.7
Type of housing		
Shack (informal)	2	2.7
Brick house (one to two rooms)	4	5.3
Brick house (three or more rooms)	61	81.4
Flat	4	5.3
Townhouse	4	5.3
Household density ratio (HDR)		
Ideal	27	36.0
Overcrowded	48	64.0
Utilities		
Running tap water available in home	67	89.3

Variables	Number of participants (n)	Percentage (%)
No running tap water available in home	8	10.7
Electricity available in home	74	98.7
No electricity available in home	1	1.3
Means of travel to and from dialysis unit		
Own car	35	46.7
A friend/family member's car	1	1.3
Per taxi	19	25.3
Per bus	5	6.7
Walks	1	1.3
Hospital ambulance/commuting service	14	18.7

4.2.2 Household finances

As summarised in Table 4.2, 38.7 % (n= 29) received a social grant. Overall, 32 % (n= 24) had some form of employment, whilst 22.7 % (n= 17) were retired and receiving a pension from their former employers.

The monthly household income was mostly contributed by one (44 %, n= 33), or two (42.7 %, n= 32) people. The median for household income was R9 000 per month, whilst the median, per person income, was R2 375 per month. The distribution is summarised in

Table 4.3. In addition, the proportion of participants with a household income in the minimum bracket defined for this study (≤R1 500), was calculated to be 41.7 % (n= 30).

According to Peyper (2016:online), 40 % of per person monthly income should be spent on food. The majority of participants (78.9 %, n= 56 calculated from n= 71) reported spending less than 40 % on food. As summarised in Table 4.3, the median percentage of income available for food per person, per month was only 27.3 %.

Table 4.2: Household finances (n = 75)

Variables	Number of participants (n)	Percentage (%)
Employment Status		
Unemployed	4	5.3
Employed: Full time	18	24.0

Variables	Number of participants (n)	Percentage (%)
Employed: Part time/ Piece jobs	4	5.3
Receives pension (from previous employment)	17	22.7
Receives a social grant	29	38.7
Self-employed	2	2.7
Student	1	1.3
Number of people contributing to the household income		
1 person	33	44.0
2 people	32	42.7
3 – 5 people	10	13.3

Table 4.3: Income data

Variables	Minimum	25th percentile	Median	75th percentile	Maximum
Total monthly income per household (n= 72)	R1 500	R3 100	R9 000	R20 000	R80 000
Total monthly income per person (n= 72)	R208	R817	R2 375	R5 375	R50 000
Percentage of income spent on food per person, per month (n= 71)	3.8	15.0	27.3	37.5	80.0

4.2.2.1 Association between per person income and household density ratio

Participants living in over-crowded conditions (63.9 %, n= 46), had statistically significantly lower median per person monthly income (R1 690.48), than those who did not (R4 750) (95 % CI [R500 ; R4 500]) (Table 4.4).

Table 4.4: Per person income per household density ratio (n= 72)

Group	Minimum	25th percentile	Median*	75th percentile	Maximum
Participants living in overcrowded conditions (63.9 %, n= 46)	R208.33	R733.33	R1 690.48	R4 000.00	R8 333.33
Participants not living in overcrowded conditions (36.1 %, n= 26)	R375.00	R1 500.00	R4 750.00	R10 000.00	R50 000.00

*95 % CI for the median difference [R500 ; R4 500] and statistically, significant

4.2.3 Linguistic data

As summarised in Table 4.5, almost half (46.7 %, n= 35) of the group were Sesotho speaking and a fifth were Afrikaans speaking (24 %, n= 18). Most of the group indicated that their second language was English (61.4 %, n= 46), whilst 18.7 % (n= 14) indicated Sesotho as their second language. The language in which written nutrition information had been received, was mostly English (73.4 %, n= 55). Similarly, English (60 %, n= 45) was also the language in which most verbal nutrition information had been received.

Table 4.5: Linguistic Information (n= 75)

Language	Home Language		Second Language		Language of written nutrition information received		Language of verbal nutrition information received	
	n	%	n	%	n	%	n	%
English	1	1.3	46	61.4	55	73.4	45	60.0
Afrikaans	18	24.0	7	9.3	14	18.7	23	30.7
Sesotho	35	46.7	14	18.7	4	5.3	6	8.0
Setswana	11	14.7	4	5.3	1	1.3	0	0
isiXhosa	9	12.0	3	4.0	0	0	1	1.3
isiZulu	1	1.3	0	0	0	0	0	0
Setswana and isiZulu	0	0	1	1.3	0	0	0	0
No written nutrition material received					1	1.3		

Only 21.3 % (n= 16) of participants received written nutrition education, and only 32 % (n= 24) received verbal nutrition education in their home language. Moreover, 24 % (n= 18) did not receive either written or verbal nutrition education in their home and/or second language.

4.2.4 Person preparing the meals in the home

As summarised in Table 4.6, almost a third (29.3 %, n= 22) of participants were solely responsible for preparing their own meals at home. An additional 18 participants (24.0 %), shared meal preparation responsibilities with others in the home, and for almost half of the group (46.7 %) meal preparation was the responsibility of female family members. Of the 40 participants who were involved in the preparation of their own meals, most reported that,

when they had to prepare their own meals, they were sometimes tired (62.5 %, n= 25), whilst 12.5 % (n= 5) reported that they were always tired.

For 20 (26.7 %) of the men, their meals were primarily prepared by their wives. For the rest of the participants, female family members (e.g. mothers and daughters) were also involved in meal preparation.

Table 4.6: People primarily responsible for preparing the participants' meals (n= 75)

Variables	Number of participants (n)	Percentage (%)
Persons that prepare meals at home (n= 75) (open question)		
Self	22	29.3
Wife	20	26.7
Ex-wife	1	1.3
Wife and self	11	14.7
Daughter	2	2.7
Maid	2	2.7
Daughter and self	3	4.0
Wife, daughter and self	1	1.3
Mother	5	6.7
Wife and daughters	1	1.3
Mother and self	3	4.0
Grandmother	1	1.3
Girlfriend	2	2.7
Wife and sister	1	1.3
Tiredness level of participants that always or sometimes prepared their own meals (n= 40)		
Always tired	5	12.5
Sometimes tired	25	62.5
Never tired	10	25.0

4.3 Medical information

Medical information for the purpose of this study, as summarised in Table 4.7 to Table 4.11, referred to participants' history of dialysis, cause(s) of their kidney disease and co-morbidities, as well as data on prescribed medications, self-reported appetite and food intake, the dry weight of three months prior to the study, and tobacco use.

4.3.1 History of kidney failure and comorbidities present

As summarised in Table 4.7, 37 % (n= 27) of participants had received peritoneal dialysis before being switched to MHD. Overall, 36 % (n= 27) had been receiving MHD for less than two years. Another quarter (24 %, n= 18) of the group had been on dialysis between two and five years. Furthermore, 25.3 % (n= 19) had been on MHD between six and ten years, and eleven participants (14.7 %) had been on MHD for longer than 10 years (Table 4.7).

Hypertension was indicated in the patient files as a single etiology of kidney failure for 37.3 % (n= 28) and diabetes mellitus for 6.7 % (n= 5). Both hypertension and diabetes mellitus were indicated for 10.7 % (n= 8). Polycystic kidneys were indicated for 4.0 % (n= 3). For 28 % (n= 21) the etiology for kidney failure was missing in the files.

The most frequent co-morbidities reported in the patient files, were hypertension (54.7 %, n= 41), diabetes mellitus (18.7 %, n= 14) and anemia (21.3 %, n= 16). For 32 % (n= 24) of participants, no co-morbidities were recorded in the file. Overall, 13.3 % (n= 10) of participants had three or more co-morbidities.

Table 4.7: Dialysis history, etiology of kidney disease and co-morbidities (n= 75)

Variables	Number of participants (n)	Percentage (%)
Dialysis history		
Received CAPD before being switched to MHD (n= 73)	27	37.0
Number of years on MHD		
<1 year	12	16.0
≥1 year – <2 years	15	20.0
≥2 years – <3 years	8	10.7
≥3 years – <4 years	5	6.7
≥4 years – <5 years	5	6.7
≥5 years – <6 years	6	8.0
≥6 years – <7 years	3	4.0
≥7 years – <8 years	6	8.0
≥8 years – <10 years	4	5.3
≥10 years – <11 years	3	4.0
≥11 years – <13 years	4	5.3
≥13 years – <16 years	3	4.0
>21 years	1	1.3

Variables	Number of participants (n)	Percentage (%)
Etiology of kidney disease		
Hypertension	36	48.0
Diabetes Mellitus	13	17.3
Glomerular nephritis	2	2.7
TB	1	1.3
SLE	0	0
HIV	2	2.7
Vesicoureteral reflux	1	1.3
Polycystic kidneys	3	4.0
Goodpasture syndrome	1	1.3
Indicated as unknown in file	4	5.3
Etiology not indicted in file	21	28.0
More than one etiology		
Hypertension and Diabetes Mellitus	8	10.7
Goodpasture syndrome and glomerular nephritis	1	1.3
Co-morbidities present		
Hypertension	41	54.7
Diabetes Mellitus	14	18.7
Cardiovascular disease	4	5.3
TB	0	0
Anemia	16	21.3
Renal osteodystrophy	10	13.3
Gout	0	0
Pulmonary edema	3	4.0
SLE	0	0
Short bowel after bariatric surgery	1	1.3
Hypothyroidism and hyperlipidaemia	1	1.3
Retinopathy grade 1	1	1.3
No co-morbidities present	1	1.3
Co-morbidities not indicated in file	24	32
Number of co-morbidities present		
No co-morbidities recorded in file	22	29.3
1 co-morbidity	28	37.3
2 co-morbidities	15	20.0
3 co-morbidities	8	10.7
4 co-morbidities	1	1.3

Variables	Number of participants (n)	Percentage (%)
6 co-morbidities	1	1.3

CAPD – continuous ambulatory peritoneal dialysis
TB – tuberculosis
SLE – systemic lupus erythematosus
HIV – human immunodeficiency virus

4.3.2 Prescribed medications

Overall, 113 different types of medications were prescribed for participants, the most frequently prescribed are listed in Table 4.8. Most of the participants 82.9 % (n= 58) used phosphate binders, most frequently calcium carbonate (58.6 %), followed by calcium acetate (36.2 %) and calcium citrate (5.2 %) (not in table). Vitamin D analogues (alfacalcidol and ergocalciferol), were prescribed for 81 % (n= 57) of participants, erythropoietin-stimulating agents (Eprex, Aranesp and Mircera) for 78.6 % (n= 55), and intravenous iron for 58.6 % (n= 41). Five participants (6.7 %) did not have scripts in their files.

Table 4.8: Most frequently prescribed medications (n= 70) (SAMF, 2008)

Medication	Indication	Number of participants (n)	Percentage (%)
Lasix, Puresis, Austell-Furosemide (Furosemide)	High-ceiling diuretic for edema, ascites and acute pulmonary edema, mild to moderate hypertension, oliguria due to intrinsic renal disease and hypercalcaemia.	44	62.9
One Alpha (Alfacalcidol)	Vitamin D analogue, to control hyperparathyroidism and aids in calcium metabolism.	43	61.4
Venofer, Rautevene (Iron Sucrose)	Anti-anemic preparation; Ferric sugar complex. Haematinics (required for red blood cell formation in bone marrow). Severe adult iron (Fe) deficiency in patients not tolerating/responding to oral Fe when confirmed by appropriate investigation; injected intravenously.	41	58.6
Cardura XL/ Carzin XL/ Cardugen (Doxazosin)	Alpha- receptor blocker for mild to moderate hypertension and urine outflow obstruction & symptoms associated with benign prostatic hypertrophy	36	51.4

Medication	Indication	Number of participants (n)	Percentage (%)
Titrilac, Eno Tums, Calcium Hexal, Caltrate, Ca-Sandoz	Calcium carbonate for treating hyperphosphatemia in chronic kidney disease (phosphate binder) and for relief of heartburn and acid indigestion.	34	48.6
Amlodipine / Amloc / Keysal / Ciplavasc	Calcium channel blocker (Dihydropridine derivatives) with mainly vascular effect for mild to moderate hypertension and angina pectoris.	33	47.1
Aspirin Cardio / Disprin (Aspirin)	Salicylic acid and derivatives (salicylates) for mild to moderate pain and fever (analgesics and antipyretics) and platelet aggregation inhibitor.	31	44.3
Eprex, Recormon (Epoetin alfa and beta, [recombinant human erythropoietin – r-HuEPO])	Short-acting erythropoietin-stimulating agent, haematinics (required for red blood cell formation in bone marrow); injected for anemia in chronic renal failure in patients on hemodialysis and peritoneal dialysis	30	42.9
Enalapril / Pharmapress	Angiotensin-converting Enzyme (ACE) inhibitor for hypertension and congestive heart failure in combination with diuretics, and for symptomatic left ventricular dysfunction.	27	38.6
Atenolol	Beta-receptor blocking agent, 2nd and 3rd degree heart block, cardiac failure, hypertension, angina and arrhythmias.	24	34.3
Phosphosorb	Calcium acetate for treating hyperphosphatemia in chronic kidney disease (phosphate binder).	21	30.0
Lanzor/ Lansoloc (Lansoprazole)	Proton pump inhibitors, suppressor of gastric acid, short-term treatment duodenum gastric ulcer and gastro-oesophageal reflux (mild dyspepsia).	17	24.3
Minoxidil, Loniten	Pyrimidine derivatives, direct acting powerful vasodilator for hypertension which has failed to respond to extensive multiple therapies.	15	21.4
Nifedipine / Adalat XL / Fedaloc	Calcium channel blocker (dihydropridine derivatives), mild to moderate hypertension and angina pectoris.	14	20.0

Medication	Indication	Number of participants (n)	Percentage (%)
Aranesp (Darbepoetin Alfa)	Long-acting erythropoietin-stimulating agents, haematinics (required for red blood cell formation in bone marrow). Injected for anemia in chronic renal failure in patients on hemodialysis and peritoneal dialysis	14	20.0
Calciferol (Ergocalciferol)	Vitamin D analogue, to control hyperparathyroidism and aids in calcium metabolism.	14	20.0
Adco-simvastatin/Zocor	HMG-CoA reductase inhibitors (statins), reduction of elevated total cholesterol and LDL-cholesterol.	13	18.6
Mircera (methoxy polyethylene glycol-epoetin beta)	Long-acting erythropoietin-stimulating agents, haematinics (required for red blood cell formation in bone marrow). Injected for anemia in chronic renal failure in patients on hemodialysis and peritoneal dialysis.	11	15.7
Carvadilol Unicorn / Carloc / Carvatrend	Alpha-and beta receptor blockers for mild to moderate hypertension and congestive heart failure.	11	15.7
Puricos (Allopurinol)	Anti-gout preparation (inhibiting uric acid production).	9	12.9
Omeprazole/ Losec	Proton pump inhibitors, suppressor of gastric acid, short-term treatment duodenum gastric ulcer and gastro-oesophageal reflux (mild dyspepsia).	8	11.4
Bilocor/Betacor (Bisoprolol)	Beta-receptor blockers for congestive heart failure and mild to moderate hypertension and angina.	6	8.6
Vitamin B Complex	Vitamin combination of thiamine (B1), riboflavin (B2), pyridoxine (B6), nicotinamide (B3) and cyanocobalamin (B12) to replenish water-soluble vitamin losses in dialysate.	6	8.6
Folic Acid	Vitamin needed for blood cell formation (haematopoiesis).	6	8.6
Eltroxin (Levothyroxine sodium/ thyroxine)	Hypothyroidism	6	8.6
Cozaar (Losartan)	Angiotensin II antagonists, for hypertension, left ventricular hypertrophy and type 2 diabetes nephropathy.	6	8.6
Lamivudine (3TC)	HIV infection (combination) (Nucleoside reverse transcriptase inhibitor)	5	7.1

Medication	Indication	Number of participants (n)	Percentage (%)
No script in file (n= 75)		5	6.7

4.3.3 Appetite

As summarised in Table 4.9, most participants reported that they had good to very good general appetite regardless if it is a dialysis day or not. Most also reported good food intake on both dialysis and non-dialysis days. Only around 10 % reported poor, to very poor, appetite and food intake.

Table 4.9: Appetite and food intake on dialysis and non-dialysis days (n= 75)

Variables	Dialysis days		Non-dialysis days	
	Number of participants (n)	Percentage (%)	Number of participants (n)	Percentage (%)
Appetite				
Very poor to poor	9	12.0	8	10.7
Reasonable	20	26.7	17	22.7
Good to very good	46	61.3	50	66.6
Food intake				
Very poor to poor	8	10.7	4	5.3
Reasonable	19	25.3	15	20.0
Good to very good	48	64.0	56	74.7

Data regarding duration of their general appetite and food intake as reported above, are summarised in Table 4.10. Although only three of the participants reported very poor appetite on dialysis days, it is disconcerting that it lasted a median of 60 months (5 years), ranging from 17 months (1.4 years) to 120 months (10 years). In addition, eight participants reported poor food intake on dialysis days with the median duration of 24 months (2 years) (ranging from 7 – 120 months [10 years]).

Similar concerns occur for the extended duration of reported appetite as, very poor, on non-dialysis days with the median duration of 12 months (1 year) with a minimum of 7 months and a maximum of 96 months (8 years). Only one participant reported very poor food intake on non-dialysis days with a very long median duration of 96 months (8 years).

Table 4.10: Duration of appetite and food intake on dialysis and non-dialysis days (n= 75)

Variables	Minimum	25th percentile	Median	75th percentile	Maximum
Duration of appetite on dialysis days (months)					
Very poor (n= 3)	17	17	60	120	120
Poor (n= 6)	3	10	48	84	96
Reasonable (n= 20)	1	9.5	21	36	144
Good (n= 32)	2	6	24	60	144
Very good (n= 14)	0.9	6	27	84	252
Duration of food intake on dialysis days (months)					
Poor (n= 8)	7	14.5	24	90	120
Reasonable (n= 19)	2	10	24	36	144
Good (n= 34)	1	6	27	60	252
Very good (n= 14)	1	6	21.5	120	144
Duration of appetite on non-dialysis days (months)					
Very poor (n= 3)	7	7	12	96	96
Poor (n= 5)	10	24	30	240	252
Reasonable (n= 17)	1	8	36	60	144
Good (n= 37)	1	6	24	48	144
Very good (n= 13)	2	7	30	84	120
Duration of food intake on non-dialysis days (months)					
Very poor (n= 1)	96	96	96	96	96
Poor (n= 3)	1	1	10	30	30
Reasonable (n= 15)	1	4	36	60	120
Good (n= 41)	1	6	24	48	252
Very good (n= 15)	6	12	36	120	144

4.3.3.1 Comparison of appetite and food intake between dialysis and non-dialysis days

Overall, 28 % (n= 21) reported improved appetite on non-dialysis days, whilst 22.7 % (n= 17) reported better appetite on dialysis days. The rest of the group (49.3 %, n= 37) reported equivalent appetite on dialysis and non-dialysis days. No statistically, significant difference was found between the reported appetite of participants on dialysis and non-dialysis days (Bhapkar test for paired data: p= 0.93).

Overall, 32 % (n= 24) of participants reported improved food intake on non-dialysis days and 16 % (n= 12) reported better food intake on dialysis days. The rest of the group (52 %, n= 39)

reported equivalent food intake on dialysis and non-dialysis days. No statistical significant difference was found between reported food intake of participants on dialysis and non-dialysis days (Bhapkar test for paired data: p= 0.49).

4.3.4 Use of tobacco

As summarised in Table 4.11, most participants (58.7 %, n= 44) reported never having used tobacco, whilst 26.6 % (n= 20) were ex-users. Overall, 14.7 % (n= 11) were using tobacco at the time of the study: three (4 %) were snuffing tobacco and eight (10.7 %) were smoking cigarettes. About half of the tobacco users (54.6 %, n= 6), used two to eight times per day, whilst the other half (45.4 %, n= 5) used 10 to 20 times per day. Those using tobacco at the time of the study, had been using for a median of six years, ranging from six months to fifty years (lower quartile 3 years; upper quartile 17.5 years). Of the eleven tobacco users, four had not change their habits with regard to the frequency of tobacco usage, whilst the others reported that they were smoking less than in the past.

The ex-users reported that they had used tobacco for a median duration of 15 years, ranging from four years to fifty-five years (lower quartile 7 years; upper quartile 20 years).

Table 4.11: Tobacco usage (n= 75)

Current tobacco use			Previous tobacco use		
Variable	**Number of participants** (n)	**Percentage (%)**	**Variable**	**Number of participants (n)**	**Percentage (%)**
Smoke (cigarettes, pipe, cigars)	8	10.7	**Smoked (cigarettes, pipe, cigars) before and 20 of these quitted**	26	34.7
Snuff tobacco	3	4	**Snuffed tobacco before**	1	1.3
Do not use tobacco now	64	85.3	**Never used tobacco**	44	58.7
			Current frequency and type of tobacco usage unchanged from previous use	4	5.3
Frequency of current tobacco usage (n= 11)			**Frequency of previous tobacco usage (n= 31)**		
2 – 8 x / day	6	54.6	**2 – 8 x / day**	10	32.3
10 – 20 x / day	5	45.4	**10 – 20 x / day**	19	61.3
>20 x / day	0	0	**>20 x / day**	2	6.4
Summary of tobacco usage					
Ex-tobacco user	20	26.6			
Current tobacco user	11	14.7			
Non-tobacco user	44	58.7			

4.4 Anthropometric data

Anthropometric data collected in this study are summarised in Table 4.12 to Table 4.16.

4.4.1 Body mass index (calculated using edema-free body weight)

BMI calculated from edema-free body weight (in other words, post-dialysis weight) are summarised in Table 4.12. One participant's edema free body weight was not included in the results, because this participant had ascites and the results were not deemed reliable.

The median BMI was 26.4 kg/m^2, ranging from 17.3 to 47.7 kg/m^2 (lower quartile 22.2 kg/m^2; upper quartile 32 kg/m^2). More than half of the participants (56.8 %, n= 42) had above normal BMIs, including 33.8 % (n= 25) that were obese (BMI >30 kg/m^2). Only four participants were underweight (Grade 1 CED) (BMI <18.5 kg/m^2 – >17 kg/m^2) (Bethesda, 1998:xiv; WHO, 1995:364; WHO, 2000:9).

Table 4.12: Classification of body composition according to BMI (n= 74) (Bethesda, 1998:xiv; WHO, 1995:364; WHO, 2000:9)

BMI category (BMI calculated from *BW_{ef})	**Number of participants (n)**	**Percentage (%)**
Underweight – Grade I CED (BMI: ≥17.0 – <18.5 kg/m^2)	4	5.4
Normal (target BMI for CKD) (BMI: ≥18.5 – <25.0 kg/m^2)	28	37.8
Overweight (BMI: ≥25.0 – <30.0 kg/m^2)	17	23.0
Obese class I (BMI: ≥30.0 – <35.0 kg/m^2)	14	18.9
Obese class II (BMI: ≥35.0 – <40.0 kg/m^2)	6	8.1
Obese class III (BMI: ≥40.0 kg/m^2)	5	6.8

*BW_{ef} – Body Weight Edema Free (Post- dialysis Weight)

4.4.2 Arm muscle area

AMA is summarised in Table 4.13. More than half (56.0 %, n= 42) had an AMA ≤15th percentile, indicating low muscle mass. The rest of the participants had normal and above normal AMA.

In addition, of those (56 %, n= 42) who had an AMA below the 15th percentile (indicating muscle wasting), 31 % (n= 13) had a BMI ≥25 kg/m^2 indicating being overweight, and 57 % (n= 24) had a normal BMI (>18.5 kg/m^2 – <24.9 kg/m^2) (info not in table).

Table 4.13: Classification of muscle mass according to AMA (n= 75) (Lee & Nieman, 2013:467-468 & Frisancho, 2011:157, 314)

Arm muscle area (AMA) percentiles for age and gender	**Number of participants (n)**	**Percentage (%)**
Wasted (≤5th percentile)	30	40.0
Below average muscle mass (>5th – ≤15th percentile)	12	16.0
Normal muscle mass (>15th – <85th percentile)	21	28.0
Above average muscle mass (≥85th – ≤95th percentile)	11	14.7
High muscle mass (>95th percentile)	1	1.3

4.4.3 Body fat percentage

Body fat percentages, calculated from the sum of four skinfolds (biceps, triceps, subscapular, and supra-ileac skinfolds), are summarised in Table 4.14. Almost a third of the group (29.3 %, n= 22) had very low fat percentages (<5th percentile), whilst 25.4 % (n= 19) had above normal body fat percentages (>85th percentile), including 14.7 % (n= 11) with excessive body fat (>95th percentile).

Table 4.14: Classification of fat percentage based on sum of 4 skinfolds (n= 75) (Frisancho, 2011: 164, 316)

Fat percentage percentiles for age and gender	Number of participants (n)	Percentage (%)
Low fat (≤5th percentile)	22	29.3
Below average fat (5th – ≤15th percentile)	7	9.3
Normal fat (>15th – <85th percentile)	27	36.0
Above average fat (≥85th – ≤95th percentile)	8	10.7
Excessive fat (>95th percentile).	11	14.7

4.4.4 Waist circumference

One participant's WC was not included in the results, because this participant had ascites and the results were not deemed reliable. WC, summarised in Table 4.15, indicated that 81.8 % (n= 18) of women and 48 % (n= 25) of men were at risk for developing metabolic complications.

Table 4.15: Classification of metabolic risk according to WC (n= 74) (Alberti et al., 2009:1642)

WC associated with increased risk for metabolic complications	Number of participants (n)	Percentage (%)
Women		
Ideal (<80 cm)	4	18.2
Increased risk (80.0 – 87.9 cm)	4	18.2
Substantial risk (≥ 88 cm)	14	63.6
Men		
Ideal (<91 cm)	27	51.9
Increased risk (94.0 – 101.9 cm)	6	11.5
Substantial risk (≥102 cm)	19	36.5

4.4.5 Waist-to-height ratio

Based on WHtR (Table 4.16), most participants (66.2 %, n= 49) were at increased risk for metabolic comorbidities, such as hypertension, diabetes and CVD (Ashwell et al., 2012:284).

Table 4.16: Classification of metabolic complications according to WHtR (n= 74) (Ashwell et al., 2012:284)

Waist-to-Height ratio (WHtR) according to risk for comorbidities (hypertension, diabetes and CVD[#])	**Number of participants (n)**	**Percentage (%)**
Increased risk for metabolic comorbidities >0.5	49	66.2
Ideal ≤0.5	25	33.8

[#] CVD – Cardio vascular disease

4.4.6 Dry weight three months prior to the study

The median weight change in the three months preceding the study, was +0.55 kg (-7.5 kg to +8.6 kg; lower quartile -0.8 kg; upper quartile +1.7 kg). More than half (56.8 %, n= 42) had gained dry weight.

4.5 Biochemistry

The biochemical markers recommended for the monitoring of chronic kidney disease, categorised according to cut points suggested by the NKF (2009) also referenced in Nelms & Lacey (2016:534-536), are summarised in Table 4.17 to Table 4.19. Some of the biochemical markers were missing from the patient files.

Table 4.17: Biochemical markers categorised according recommendations for patients with CKD (NKF, 2009)

Variable	**Number of participants (n)**	**Percentages (%)**
Serum albumin (g /L) (n= 75)		
Below normal <35	37	49.3
Normal 35 – 52	38	50.7
Above normal >52	0	0
Serum urea (mmol/L), pre-dialysis (n= 61)		
Below normal <21	32	52.5
Normal 21 – 29	24	39.3
Above normal >29	5	8.2
Serum urea (mmol/L), post-dialysis (n= 47)		
Below normal <21	46	97.9
Normal 21 – 29	1	2.1
Above normal >29	0	0

Variable	Number of participants (n)	Percentages (%)
Serum creatinine (µmol/L) (n= 75)		
Below normal <177	2	2.7
Normal 177 – 1 326	68	90.7
Above normal >1 326	5	6.7
CRP[◊] (mg/L)		
No results in file; not tested regularly	No results	No results
Serum cholesterol (mmol/L) (n= 15)		
Below normal <3.8	8	53.3
Normal 3.8 – 5.0	4	26.7
Above normal >5	3	20.0
Kt/V (n= 75)		
Below normal <1.4	41	54.7
Normal 1.4	4	5.3
Above normal >1.4	30	40.0
Serum phosphate (mmol/L) (n= 75)		
Below normal <0.8	6	8.0
Normal 0.8 – 1.8	50	66.7
Above normal >1.8	19	25.3
Serum potassium (mmol/L) (n= 75)		
Below normal <3.5	1	1.3
Normal 3.5 – 5.3	53	70.7
Above normal >5.3	21	28.0
Serum sodium (mmol/L) (n= 74)		
Below normal <136	10	13.5
Normal 136 – 145	56	75.7
Above normal >145	8	10.8
HbA1C (%) (n= 4)		
Below normal <4	0	0
Normal 4 – 7	4	100.0
Above normal >7	0	0
Hemoglobin (g/dL) (n= 75)		
Below normal <10	21	28.0
Normal 10 – 13	45	60.0
Above normal >13	9	12.0

Variable	Number of participants (n)	Percentages (%)
Ferritin (ng/ml) (n= 73)		
Below normal <200	16	21.9
Normal 200 – 500	19	26.0
Above normal >500	38	52.0
TSAT* (%) (n= 74)		
Below normal <20	14	18.9
Normal 20 – 50	55	74.3
Above normal >50	5	6.8
WBC$^{\delta}$ (10^9/L) (n= 53)		
Below normal <4	14	26.4
Normal 4 – 11	39	73.6
Above normal >11	0	0

$^{\delta}$ CRP – C-reactive protein
* TSAT – Transferrin saturation
$^{\delta}$ WBC – White blood cells

Table 4.18: Distribution of biochemical parameters

Variable	Minimum	25th percentile	Median	75th percentile	Maximum
Serum albumin (n= 75)	24	32	35	37	42
Serum urea (pre-dialysis) (n= 61)	10.2	16.7	20.8	24.2	36.1
Serum urea (post-dialysis) (n= 47)	0.49	4.6	5.6	8.0	25.3
Serum creatinine (n= 75)	81	541	731	953	1505
Serum cholesterol (n= 15)	2.0	3.27	3.7	4.9	5.6
Kt/V (n= 75)	0.7	1.2	1.32	1.5	2.5
Serum phosphate (n= 75)	0.43	1.1	1.42	1.83	3.55
Serum potassium (n= 75)	3.2	4.2	4.8	5.4	7.6
Serum sodium (n= 74)	131	137	140	142	151
HbA1c (%) (n= 4)	5.3	5.7	6.3	6.7	6.8
Hemoglobin (n= 75)	7.6	9.7	10.8	12.1	17.0
Ferritin (n= 73)	7.61	227.0	508.73	833.0	72 000.0
TSAT* (n= 74)	4.8	21.7	24.35	31.0	103.0
WBC$^{\delta}$ (n= 53)	2.03	3.96	5.22	6.09	9.44

* TSAT – Transferrin saturation
$^{\delta}$ WBC – White blood cells

Almost half of the participants (49.3 %, n= 37) had below normal serum albumin levels. WBCs were normal in most participants (73.6 %, n= 39), and no participants had elevated WBCs. No CRP testing to confirm inflammation was done in any of the participants in the six months prior to the study. According to the unit managers, CRP is only infrequently tested, by special request, when an infection is suspected (Table 4.19).

Table 4.19: Frequency of CRP testing in the six Bloemfontein renal units according to the unit managers

Frequency of CRP testing according to renal unit managers	Number of participants from unit (n)	Percentage of participants from unit (%)
"When there is a problem e.g. redness at fistula, malaise and low blood pressure that indicate an infection."	12	16
"It is not routinely done in the renal unit; it will only be measured when patient is admitted in hospital and infection is suspected."	9	12
"Only when it is necessary; when the patient has a fever and infection is suspected."	11	14.7
"Infection suspected – high temperature, chilliness, general malaise and headaches - then only will it be tested."	15	20
"If it is requested by medical doctor – if there is a suspicion of infection, but it is not done regularly."	15	20
"When the patient is ill and shows signs of infection, then CRP will be tested and especially for patients with catheters, it happens often."	13	17.3

As categorisation of serum urea according to NKF (2009) recommendations for patients with CKD does not indicate if serum urea values are for pre or post-dialysis, both values were categorised under the same cut-off values. About half of the participants (52.5 %, n= 32) had below normal pre-dialysis serum urea. Almost all of the participants (90.7 %, n= 68) had normal serum creatinine values.

More than half of the group (54.7 %, n= 41) had Kt/V values below normal, but at the same time, 40 % (n= 30) had above normal Kt/V values. Overall, around one in four participants had elevated levels of serum phosphate (>1.8 mmol/L) (25.3 %, n= 19), and/or elevated levels of serum potassium (28 %, n= 21). When the cut off point for serum phosphate is lowered to >1.42 mmol/L, almost half (49.3 %, n= 37) of the participants had elevated phosphate levels. Serum sodium levels were elevated in only 10.8 % (n= 8) of the participants.

HbA1c levels were only available for four participants, and 100 % of them were within normal values. Serum cholesterol levels were only reported for 15 participants and of them, 53.3 % (n= 8) had below normal values.

Slightly more than a quarter (28 %, n= 21) of the group had below normal hemoglobin values. More than half of the participants (52 %, n= 38) had elevated ferritin levels which could be indicative of high ferritin stores or of an acute phase response (thus, acting as a marker of inflammation). Most (74.3 %, n= 55) had normal TSAT values, whilst almost a fifth had below normal (18.9 %, n= 14) TSAT values.

4.5.1 Comparison between serum albumin values and arm muscle area

Overall, 49.3 % (n= 37) had serum albumin levels <35 g/L with 48.7 % (n = 18) of those which had an AMA of $\leq 5^{th}$ percentile (wasted). However, in the group with >35g/L serum albumin levels there was also 31.6 % (n= 12) which had an AMA of $\leq 5^{th}$ percentile (wasted). No statistically significant difference was found between the two serum albumin level groups regarding AMA (Chi-Square: p= 0.42).

4.6 Dietary intake data

The dietary intake data, collected with an adapted 24h-recall of usual dietary intake, on a typical non-dialysis day, in addition to overall dietary patterns collected by semi-quantitative FFQ, are summarised below.

4.6.1 Usual intake on a typical non-dialysis day

The usual intake of participants on a typical non-dialysis day results are summarised in Table 4.20. Almost half (44.6 %, n= 33) had an energy intake below 30 kcal/kg dry weight or adjusted edema free body weight. Conversely, 44.6 % (n= 33) had an energy intake >35 kcal/kg. The median intake for energy (kcal/kg) was 32.2 kcal/kg, ranging from 12.9 kcal/kg to as high as 85.3 kcal/kg (lower quartile 23.6 kcal/kg; upper quartile 47.6 kcal/kg). One participant's weight was not reliable thus kcal/kg and protein (g/kg) could not be calculated (see 4.4.1).

Similarly, almost half of the group (48.6 %, n= 36) had a daily total protein intake <1.2 g/kg dry weight or adjusted edema free body weight, whereas 43.3 % (n= 32) consumed >1.3

g/kg protein. The median intake for total protein (g/kg) was 1.2 g/kg, ranging from 0.3 g/kg to 2.8 g/kg (lower quartile 0.9 g/kg; upper quartile 1.6 g/kg). Overall, 40 % of the participants (n= 30) had inadequate HBV protein intakes (NKF-K/DOQI, 2000, 2006).

Half of the group (50.7 %, n= 38) had above adequate intake of carbohydrates, expressed as a percentage of total energy intake. Conversely, total fat intake, expressed as a percentage of total energy, was below adequate in 45.4 % (n= 34) of the participants, whilst 13.3 % (n= 10) had above adequate fat intake (NKF-K/DOQI, 2000, 2006).

Table 4.20: Energy and macronutrient intakes on a typical non-dialysis day (NKF-K/DOQI, 2000, 2006)

Variable	Number of participants (n)	Percentage (%)
Energy (kcal*/kg)# (n= 74)		
Inadequate intake <30	33	44.6
Adequate intake 30 – 35	7	9.4
Above adequate intake >35	34	46.0
Total protein (g/kg)# (n= 74)		
Inadequate intake <1.2	36	48.6
Adequate intake 1.2 – 1.3	6	8.1
Above adequate intake >1.3	32	43.3
HBV◊ protein (% of total protein intake¥) (n= 75)		
Inadequate intake <50	30	40.0
Adequate intake 50 – 75	36	48.0
Above adequate intake >75	9	12.0
Carbohydrate (% of TE§) (n= 75)		
Inadequate intake <50	13	17.3
Adequate intake 50 – 60	24	32.0
Above adequate intake >60	38	50.7
Fat (% of TE) (n= 75)		
Inadequate intake <25	34	45.4
Adequate intake 25 – 35	31	41.3
Above adequate intake >35	10	13.3

* kcal – kilocalorie
# kg – dry weight or adjusted edema free body weight
¥ TP – total protein
§ TE – total energy
◊ HBV – high biological value

The median phosphate intake (analysed with Food Finder® III; Version 1.1.3) was 1 313 mg PO4, ranging from 339 mg to 2 958 mg (lower quartile 985 mg, upper quartile 1 791 mg).

The recommended phosphate intake relative to total dietary protein intake, is 10 – 12 mg PO4 per 1 gram of protein consumed (NKF-K/DOQI, 2000, 2006). Overall, 23 % (n= 17) of participants managed to consume <10 mg PO4/g protein, yet 35.3 % (n= 6) of this subgroup sill had a median serum PO4 level >1.8 mmol/L (NKF, 2009). Only 16.2 % (n= 12) of participants had consumptions within the range of 10 – 12 mg PO4/g protein, of which 25 % (n= 3) had serum PO4 level >1.8 mmol/L. Conversely, most participants (60.8 %, n= 45) consumed >12 mg PO4/g protein; of them, 22.2 % (n= 10) had a serum PO4 level >1.8 mmol/L.

4.6.1.1 High biological value protein intake in relation to arm muscle area

Of the 40 % (n= 30) of the participants that were wasted (AMA <5th percentile), 43.3 % (n= 13) had inadequate intake of HBV protein (<50 % of total protein), half (50 %, n= 15) had adequate intake of HBV protein (50 – 75 % of total protein) and only a small percentage, 6.7 % (n= 2) had above adequate intake of HBV protein (>75 % of total protein) (NKF-K/DOQI, 2000, 2006; Lee & Nieman, 2013:467-468; Frisancho, 2011:157, 314) (see Table 4.13 & Table 4.20). No statistical significant differences were found between the groups.

4.6.1.2 Association between serum phosphate levels and phosphate dietary intake

When serum phosphate levels were stratified according to mg PO4/g protein intake, no statistically significant differences were found between the groups (Table 4.21).

Table 4.21 Median serum phosphate levels stratified according to mg PO4/g protein intake(NKF-K/DOQI, 2000, 2006, 2009; Nelms & Lacey, 2016:534-536) (n= 74)

Variable	Serum phosphate levels (mmol/L)				
	Minimum	25th percentile	Median	75th percentile	Maximum
Group 1 <10 mg PO4/g protein (23 %, n= 17)	0.77	1.10	1.31	2.18	3.55
Group 2 10 – 12 mg PO4/g protein (16.2 %. n= 12)	0.72	1.09	1.46	1.84	2.08
Group 3 >12 mg PO4/g protein (60.8 %, n= 45)	0.43	1.11	1.41	1.68	2.78

95 % CI for the median difference between group 1 and 2 [-0.37 ; 0.64]
95 % CI for the median difference between group 2 and 3 [-0.26 ; 0.38]
95 % CI for the median difference between group 1 and 3 [-0.24 ; 0.55]

4.6.1.3 Association between years on dialysis and protein intake

When typical protein intake on a non-dialysis day, calculated from one adapted 24h-recall, was stratified according to duration of dialysis, no significant statistical differences were found between the groups (Table 4.22).

Table 4.22: Median protein intake stratified according to duration of dialysis

Duration of dialysis	Number (n)	Percentage (%)	Total protein intake per day (g)				
			Minimum	25th percentile	Median	75th percentile	Maximum
Short ≤2 yrs.	27	36.0	29.9 g	71 g	102.1 g	118.4 g	162.8 g
Medium >2 – ≤5 yrs.	18	24.0	44.1 g	69.4 g	77.9 g	117.4 g	183.3 g
Long >5 yrs.	30	40.0	19.1 g	69.3 g	89.7 g	107.9 g	177.9 g

95 % CI for the median difference between short and medium duration [-12.5 g ; 34.0 g]
95 % CI for the median difference between medium and long duration [-23.8 g ; 19.9 g]
95 % CI for the median difference between short and long duration [-8.8 g ; 29.2 g]

4.6.1.4 Association between high biological value protein intake and household finances

When HBV protein intake on a non-dialysis day, calculated from one adapted 24h-recall, was stratified according to income per person, there was a statistically significant difference between the inadequate HBV protein intake (<50 % of total protein) group which shows less

income per person compared to the above adequate intake of HBV protein (>75 % of total protein) group, 95 % CI [R4 416.70 ; R19 000.00] (see Table 4.23). Furthermore, there was also a significant, statistical difference between the inadequate HBV protein intake (<50 % of total protein) group which shows a lower food cost per person compared to the above adequate intake of HBV protein (>75 % of total protein) group, 95 % CI [R216.70 ; R1 309.50] (see Table 4.24). The same is true for percentage income available for food per person which showed a statistically significant difference between the inadequate HBV protein intake (<50 % of total protein) group compared to the adequate intake of HBV protein (>75 % of total protein) group, 95 % CI [7.58 % ; 27.0 %] (see Table 4.25).

Table 4.23: High biological value protein intake and income per person (n= 72)

HBV[◊] protein intake	Number (n)	Percentage (%)	Income per person (in the household) in SA Rand				
			Minimum	25th percentile	Median	75th percentile	Maximum
Inadequate HBV[◊] protein intake (<50 % of TP[¥])	28	38.9	R208.30	R672.90	R1 416.70	R2 833.30	R27 000.00
Adequate HBV intake (50 – 75 % of TP)	35	48.6	R320.00	R875.00	R3 750.00	R5 500.00	R13 333.30
Above adequate HBV intake (>75 % of TP)	9	12.5	R500.00	R6 000.00	R7 333.30	R20 000.00	R50 000.00

95 % Confidence interval (CI) for the median difference of income per person between inadequate HBV protein intake and adequate [R1.33 ; R3 000.00]*

95 % CI for the median difference of income per person between adequate HBV protein intake and above adequate [R2 000.00 ; R16 250.00]*

95 % CI for the median difference of income per person between inadequate HBV protein intake and above adequate [R4 416.70 ; R19 000.00]*

* Statistically, significant difference

[◊] HBV – High Biological Value

[¥] TP – Total protein

Table 4.24: High biological value protein intake and food cost per person (n= 74)

HBV[◊] protein intake	Number (n)	Percentage (%)	Food cost per person (in the household) in SA Rand				
			Minimum	25th percentile	Median	75th percentile	Maximum
Inadequate HBV[◊] protein intake (<50 % of TP[¥])	29	39.2	R83.30	R250.00	R300.00	R833.30	R4 000.00
Adequate HBV intake (50 – 75 % of TP)	36	48.6	R111.10	R300	R562.50	R1 000.00	R2 000.00
Above adequate HBV intake (>75 % of TP)	9	12.2	R300.00	R1 000.00	R1 000.00	R2 000.00	R2 000.00

95 % Confidence interval (CI) for the median difference of food cost per person between inadequate HBV protein intake and adequate [R25.00 ; -R350.00]
95 % CI for the median difference of food cost per person between adequate HBV protein intake and above adequate [R100.00 ; R1 166.70]*
95 % CI for the median difference of food cost per person between inadequate HBV protein intake and above adequate [R216.70 ; R1 309.50]*
* Statistically, significant difference
[◊] HBV – High Biological Value
[¥] TP – Total protein

Table 4.25: High biological value protein intake and percentage income available for food per person, per month (n= 71)

HBV[◊] protein intake	Number (n)	Percentage (%)	Percentage income available for food per person (in the household), per month				
			Minimum	25th percentile	Median	75th percentile	Maximum
Inadequate HBV[◊] protein intake (<50 % of TP[¥])	27	38.0	7.5	25.0	31.3	40.0	72.7
Adequate HBV intake (50 – 75 % of TP)	35	49.3	3.8	15.0	26.7	37.5	80.0
Above adequate HBV intake (>75 % of TP)	9	12.7	4.0	9.1	11.4	22.2	60.0

95 % Confidence interval (CI) for the median difference of percentage income available for food per person, per month between inadequate HBV protein intake and adequate [-0.5 % ; 13.75 %]
95 % CI for the median difference of percentage income available for food per person, per month between adequate HBV protein intake and above adequate [0.91 % ; 20.13 %]*
95 % CI for the median difference of percentage income available for food per person, per month between inadequate HBV protein intake and above adequate [7.58 % ; 27.0 %]*
* Statistically, significant difference
[◊] HBV – High Biological Value
[¥] TP – Total protein

4.6.2 Dietary patterns

The FFQ results are summarised in Table 4.26 to Table 4.36, according to food groups: dairy, meat, meat alternatives, bread and grains, snack products, vegetable, fruit, fat, condiments, miscellaneous foods, alcohol and take-away consumption. The number of the participants that consumed a specific food, the frequencies of consumption expressed in terms of the number of times per month that the food item was consumed and the percentage of participants that consumed a certain portion size (small, medium or large) of the food is summarised.

4.6.2.1 Frequencies and size of dairy consumption

The consumption of dairy products, a food group with a high phosphate content (110 mg PO4/portion) (Herselman & Esau, 2005:51-57), are summarised in Table 4.26. Full cream and low fat milk was consumed by 65.3 % (n= 49,) and 28 % (n= 21) of participants on a median of 28 days / month (every day), mostly in small portion sizes (63 ml) by 77.6 %, and 62 %, respectively.

Fermented dairy products, custard, condensed milk, and ice cream were consumed at a median of one to four times per month only, mostly in medium sized portions.

Table 4.26: Frequency of dairy consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Fresh milk								**63ml**	**125 ml**	**250 ml**
Milk (fresh/ long life), full cream (3.3 – 4.5 % fat)	49	65.3	4	16	28	28	28	77.6	18.4	4.0
Milk (fresh/ long life), medium fat (1.5 – 3.3 % fat)	0	-	-	-	-	-	-	-	-	-
Milk (fresh/ long life), low fat (>0.5 – 1.5 % fat)	21	28.0	4	12	28	28	28	62.0	28.6	9.4

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Milk (fresh/ long life), skimmed (≤0.5 % fat)	2	2.7	28	28	28	28	28	100.0	0.0	0.0
Milk powder								**5g**	**15g**	**30g**
Milk powder, full cream	3	4.0	6	6	8	28	28	33.3	66.7	0.0
Milk powder, fat free	0	-	-	-	-	-	-	-	-	-
Condensed milk								**5 g**	**50 g**	**100 g**
Condensed milk	2	2.7	1	1	1	1	1	50.0	0.0	50.0
Fermented milk and custard								**63 ml**	**125 ml**	**250 ml**
Yoghurt	53	70.7	1	2	4	8	28	45.3	49.0	5.7
Custard (home-made or commercial)	50	66.7	1	1	2	4	16	12.0	66.0	22.0
Inkomazi	36	48.0	1	2	4	8	16	33.3	58.4	8.3
Ice cream								**30 ml**	**125 ml**	**250 ml**
Ice cream	36	48.0	1	1	2.5	4	16	11.1	58.4	30.5

4.6.2.2 Frequencies and size of meat consumption

Meat consumption is summarised in Table 4.27. Almost all (90.7 %, n= 68) consumed boerewors which is considered high in sodium (>430 mg Na/60 g) (Herselman & Esau, 2005:51-57), with a median intake of four times per month and most (72 %) ate a medium portion size (15 cm).

Processed meats that are high in sodium (>430 mg Na/portion) (Herselman & Esau, 2005:51-57), namely polony (70.7 %, n= 53), viennas (49.3 %, n= 37) and russians (53.3 %, n= 40) respectively, were consumed at a median of four to eight times per month, in mostly small to medium portions. These processed meats seemed to be eaten by slightly more participants and more frequently per month than beef (49.3 %, n= 37), and mutton/lamb (61.3 %, n= 46) that is lower in sodium.

Chicken was not mentioned in the FFQ (limitation of the study) and only two (2.7 %) pointed chicken out, when the question was asked if any other meat is consumed.

Home-cooked fish were eaten at a median of three times per month by four fifths (81.3 %, n= 61) with 70.5 % (not mentioned in table) that fried it in egg-and-flour batter; with the majority (63.9 %) that ate a medium (90 g) portion size.

Tinned pilchards, a high PO4 meat (>100 mg PO4/portion) (Herselman & Esau, 2005:51-57), were eaten by three fifths (65 %, n= 45) at a median of twice per month, whilst tinned tuna a low PO4 meat (<100 mg PO4/portion) (Herselman & Esau, 2005:51-57), was only consumed by one third (32 %, n= 24). Tinned pilchards were mostly (66.7 %) eaten in a medium size (90 g) whilst tuna was mostly (62.5 %) eaten in a small size.

Table 4.27: Frequency of meat consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Processed Meats								**1**	**2**	**4**
Polony	53	70.7	1	2	5	12	28	30.2	60.4	9.4
Vienna	37	49.3	1	1	8	12	16	51.4	45.9	2.7
Russians	40	53.3	1	1	4	8	28	67.5	30.0	2.5
Sausage								**5 cm**	**15 cm**	**30 cm**
Boerewors	68	90.7	1	3	4	8	16	11.8	72.0	16.2
Dry sausage (wors)	20	26.7	1	1	2	3	4	30.0	35.0	35.0
Bacon								**1**	**3**	**5**
Bacon	36	48.0	1	2	4	8	28	30.6	63.9	5.5
Biltong								**½ hand**	**handful**	**2 hands**
Biltong	20	26.7	1	1	1.5	3	16	55.0	45.0	0
Meats								**30 g**	**90 g**	**150 g**
Organ meats, liver	50	66.7	1	1	2	4	16	58.0	38.0	4.0
Chicken heads/feet's	17	22.7	1	1	2	4	28	35.3	52.9	11.8
Organ meats, offal/ tripe	24	32.0	1	1	1	2.5	10	54.2	37.5	8.3

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Beef	37	49.3	1	4	4	8	28	40.5	51.4	8.1
Mutton/lamb	46	61.3	1	2	4	8	20	30.4	58.7	10.9
Stew								**¼ cup**	**1 cup**	**2 cups**
Beef, stew with vegetables	36	48.0	1	4	4	8	16	28.6	68.5	2.9
Mutton/lamb, stew with vegetables	30	40.0	1	2	4	8	16	16.7	70.0	13.3
Meats								**30 g**	**90 g**	**150 g**
Pork	49	65.3	1	1	3	4	28	22.5	63.3	14.2
Fish (fresh/ frozen, homemade)	61	81.3	1	2	3	4	16	24.6	63.9	11.5
Tinned fish, pilchards	45	60.0	1	1	2	4	12	33.3	66.7	0
Tinned fish, tuna	24	32.0	1	1	1.5	3.5	8	62.5	33.3	4.2
Tinned fish, sardines	9	12.0	1	1	2	8	8	66.7	22.2	11.1
Tinned beef	28	37.3	1	1	1	3.5	12	39.3	50.0	10.7
Other: mince (beef)	7	9.3	1	2	4	8	12	28.6	28.5	42.9
Other: turkey	2	2.7	1	1	4.5	8	8	0	100.0	0
Other: chicken	2	2.7	16	16	22	28	28	0	0	100.0

4.6.2.3 Frequencies and size of meat alternative consumption

Meat alternatives consumption is summarised in Table 4.28. Almost all (94.7 %, n= 71) consumed eggs which is considered high in phosphate (>100 mg PO4) (Herselman & Esau, 2005:51-57) with a median intake of 12 times per month and half (56.6 %) ate a medium portion size (2 eggs), which is already above the daily recommendation of only one high PO4 meat/meat alternative portion per day (Renalsmart, 2008:online; Herselman & Esau, 2005:51-57).

Peanut butter, another high PO4 meat alternative (>100 mg PO4) (Herselman & Esau, 2005:51-57), was eaten by half (53.3 %, n= 40) with a median monthly consumption of 4.5

times per month. The portion size was almost equally distributed amongst small (2 teaspoons) (47.5 %) and medium (2 level dessertspoons) (45 %).

Cottage cheese, a low PO4 meat alternative (<100 mg PO4/portion) (Herselman & Esau, 2005:51-57), was only eaten by few (4 %, n= 3).

Dried beans, that could be re-classified as containing <12 mg PO4/g protein aDA (NKF/KDOQI, 2009:S87; D'Alessandro et al., 2015:5), were only consumed by three out of ten participants (30.7 %, n= 23), with a median of twice per month. Three fifths (60.9 %) ate a medium portion size (90 g/ ¾ cup) of cooked dried beans. However, it should be noted that some participants mentioned it would be eaten more frequently in winter and the first half of the FFQ's data measuring were done at the end of summer (end of April) which did not include the winter season in the prior six months.

Canned sugar beans, were eaten more frequently (78.7 %, n= 59) than cooked dried beans with a median intake of four times per month. Slightly more than half (57.6 %) ate a small (45 g/ 2 heaped tablespoons) portion size of canned sugar beans.

Table 4.28: Frequency of meat alternatives consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Cottage Cheese								**10 g**	**60 g**	**120 g**
Cottage Cheese	3	4.0	1	1	1	1	1	0	0	100.0
Cheese								**15 g**	**30 g**	**60 g**
Cheese	59	78.7	1	2	8	12	28	47.5	40.7	11.8
Other: feta cheese	1	1.3	1	1	1	1	1	0	100	0
Egg								**1**	**2**	**3**
Egg	71	94.7	1	4	12	16	28	32.1	56.6	11.3
Nuts								**15 g**	**30 g**	**60 g**
Tree nuts, salted	5	6.7	1	1	2	2	3	40.0	60.0	0.0
Tree nuts, unsalted	4	5.3	1	1	1	4.5	8	25.0	25.0	50.0

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Ground nuts (peanuts), salted	26	34.7	1	1	2	3	28	53.9	26.9	19.2
Ground nuts (peanuts), unsalted	11	14.7	1	1	1	4	8	72.7	18.2	9.1
Soya								**24 ml**	**188 ml**	**375 ml**
Soya Products (Toppers/ Imana)	16	21.3	1	2.5	4	6.5	16	18.8	62.4	18.8
Legumes								**30 g**	**90 g**	**180 g**
Legumes, dried beans	23	30.7	1	1	2	8	12	34.8	60.9	4.3
Legumes, dried split peas/ lentils	2	2.7	1	1	4.5	8	8	50.0	50.0	0
Legumes, lentils, whole	5	6.7	1	4	8	8	8	40.0	60.0	0
Legumes, chickpeas	0									
Baked Beans								**45 g**	**90 g**	**180 g**
Baked beans (sugar beans), tinned	59	78.7	1	2	4	8	16	57.6	40.7	1.7
Peanut butter								**10 g**	**30 g**	**60 g**
Peanut butter	40	53.3	1	3	4.5	12	28	47.5	45.0	7.5
Other								**¼ cup**	**½ cup**	**1½ cup**
Other: beans and samp	1	1.3	1	1	1	1	1	0	100.0	0

4.6.2.4 Frequencies and size of bread and grains consumption

Bread and grains consumption are summarised in Table 4.29. Everybody (100 %, n= 75) consumed bread on a median of 28 days / month (every day) and almost two thirds (65.3 %) ate a medium portion size (2 slices).

Stiff maize porridge, was also eaten by a majority (96 %, n= 72), with a median intake of 12 times per month. Three quarters (75 %) ate a medium portion size (½ cup).

Corn flakes, a high sodium cereal (484 g Na/ 40 g) (Herselman & Esau, 2005:51-57), were eaten by almost half (49.3 %, n= 37) with a median intake of eight times per month.

Rice as well as samp was not mentioned in the FFQ and only five participants (6.7 %) mentioned rice and samp when the question was asked if any other grains are consumed.

Table 4.29: Frequency of bread and grains consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Bread								½ slice	2 slices	4 slices
Bread	75	100.0	3	24	28	28	28	0	65.3	34.7
Cheese								¼ cup	½ cup	1½ cup
Cereals, corn flakes	37	49.3	1	4	8	12	28	8.1	81.1	10.8
Cereals, wheat pressed blocks	29	38.7	1	4	8	8	28	6.9	72.4	20.7
Cereals, all-bran & puffed rice	9	12.0	1	4	8	12	16	0	100.0	0
Maize porridge, stiff	72	96.0	1	6	12	28	28	13.9	75.0	11.1
Maize porridge, soft	27	36.0	1	4	8	12	28	7.4	85.2	7.4
Motoho (fermented sorghum porridge)	7	9.3	1	2	4	12	12	14.3	85.7	0
Other cooked porridge, oats	40	53.3	1	4	8	12	28	20.0	75.0	5.0
Other cooked porridge, mabele/maltabella (sorghum porridge, not fermented)	16	21.3	1	3	6	10	28	6.3	74.9	18.8
Other: crumbly maize porridge, buns, instant maize/sorghum porridge	6	8.0	2	2	8	12	12	0	66.7	33.3
Other: samp	5	6.7	1	1	2	2	4	20.0	20.0	60.0
Other: pasta	3	4.0	3	3	4	4	4	0	66.7	33.3
Other: rice	5	6.7	4	8	8	15	28	0	80.0	20.0
Mageu								63 ml	125 ml	250 ml
Mageu (fermented porridge drink)	16	21.3	1	1	2	4.5	12	18.7	37.5	43.8

4.6.2.5 Frequencies and size of snack products consumption

Snack products consumption are summarised in Table 4.30. Biscuits were eaten by three quarters (78.7 %, n= 59) with a median intake of four times per month and more than half (57.6 %) ate a large portion size (4 biscuits).

Potato/maize chips, a high potassium, energy and fat starch (>100 mg K/ 50 g) (Herselman & Esau, 2005:51-57) were eaten by almost two thirds (64 %, n= 48), with a median intake of three times per month. The majority (81.2 %) ate a medium portion size (a small packet).

Chocolate, is high in protein, potassium, phosphate and sodium (Herselman & Esau, 2005:51-57) and were eaten by 44 % (n= 33), with a median intake of twice per month. Most (66.7 %) ate a small portion size (¼ slab).

Table 4.30: Frequency of snack products consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Cake								**25 g**	**50 g**	**100 g**
Cake	37	49.3	1	1	1	1	8	13.5	75.7	10.8
Tart	22	29.3	1	1	1	2	28	9.1	72.7	18.2
Puddings								**23 ml**	**90 ml**	**180 ml**
Puddings	33	44.0	1	1	1	4	5	18.2	66.6	15.2
Jelly								**63 ml**	**125 ml**	**250 ml**
Jelly	43	57.3	1	1	2	4	28	20.9	65.1	14.0
Sugar Treats								**15 g**	**30 g**	**60 g**
Biscuits	59	78.7	1	2	4	8	28	1.7	40.7	57.6
Sweets, jelly or hard boiled	35	46.7	1	4	4	24	28	8.6	40.0	51.4
Toffees	21	28.0	1	4	8	20	28	14.3	23.8	61.9
Liquorice	18	24.0	1	1	2	8	28	0	22.2	77.8
Chocolates								**25 g**	**50 g**	**100 g**
Chocolates	33	44.0	1	1	2	5	28	66.7	24.2	9.1

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Savoury								1 hand full	small packet	large packet
Chips (potato/maize crisps)	48	64.0	1	1	3	4	28	12.5	81.2	6.3
Other: popcorn	18	24.0	1	1	4	12	28	16.7	57.5	25.8

4.6.2.6 Frequencies and size of vegetable consumption

Vegetable consumption is summarised in Table 4.31. Almost all (97.3 %, n= 73), consumed potato, a high potassium starch (>100 mg K/100 g) (Herselman & Esau, 2005:51-57), with a median intake of eight times per month, and more than half (54.8 %) ate a medium portion size (100 g/ 1 medium) and three out of ten (31.5 %) ate two medium potatoes (large portion), which is considered double the recommendation (Herselman & Esau, 2005:51-57; Renalsmart, 2012a:online). Even though potato is a starchy vegetable, it is listed under vegetables as it was the researcher's assumption that most people consider it mistakenly as a vegetable.

Almost all (92 %, n= 69) consumed onion, a low potassium vegetable (<120 mg K/ 30 g) (Herselman & Esau, 2005:51-57) with a median intake of 12 times per month and two thirds (66.7 %) ate a small portion size (30 ml/ 1 large spoon).

More people ate spinach with potato (65.3 %, n= 49), which would be higher in potassium than spinach without potato (33.3 %, n= 25) (Herselman & Esau, 2005:51-57). The median monthly consumption of spinach with potato was four times and almost three quarters (73.5 %) ate a medium portion size (½ cup). In the FFQ there was not a differentiation between cooked Swiss chard, bigger leave spinach (moderate potassium, 120 – 200 mg K) and small leave spinach (high potassium, >200 mg K) (Herselman & Esau, 2005:51-57). Furthermore, some of the participants (5.3 %, n= 4) indicated that they did not eat "morogo", which included spinach as well as cabbage ("morogo", is a collective term in

Sesotho for green leafy vegetables). The reason for this avoidance is because they were advised to avoid “morogo”; this could indicate a possible language barrier because cabbage is allowed (<120 mg K/ portion) (Herselman & Esau, 2005:51-57).

Almost all (89.3 %, n= 67) ate cabbage with a median intake of eight times per month; interestingly, almost a third (31.3 %, n= 21) of those prepared cabbage with potato and one participant cooked green beans with potato. This could increase the potassium content of these otherwise classified as low and moderate potassium vegetables (Herselman & Esau, 2005:51-57).

Four out of five (82.7 %, n= 62) participants ate tomatoes and furthermore ate two fifths (42 %), of those, tomato and onion gravy (not shown in table), which is considered high in potassium (>200 mg K / 75 g) (Herselman & Esau, 2005:51-57).

Butternut were eaten by 76 % (n= 57), which is a high potassium vegetable (>200 mg K / ½ cup) (Herselman & Esau, 2005:51-57), and the median intake was four times per month. Almost two thirds (64.9 %), ate a medium portion size (½ cup).

Table 4.31: Frequency of vegetable consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Vegetable								**30 ml**	**125 ml**	**375 ml**
Spinach, with potato and onion	49	65.3	1	3	4	8	28	26.5	73.5	0
Spinach, without potato and onion	25	33.3	1	3	4	8	20	28.0	64.0	8.0
Morogo*, with potato and onion	9	12.0	1	1	3	4	8	22.2	77.8	0
Morogo*, without potato and onion	7	9.3	2	3	4	12	24	0	100.0	0
Butternut	57	76.0	1	2	4	4	16	31.6	64.9	3.5
Gem squash	27	36.0	1	1	2	4	12	22.2	63.0	14.8

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Tomatoes	62	82.7	1	4	8	12	28	45.2	53.2	1.6
Onion	69	92.0	1	4	12	28	28	66.7	29.0	4.3
Cabbage	67	89.3	1	3	8	8	28	26.9	65.6	7.5
Potato								**50 g**	**100 g**	**200 g**
Potato	73	97.3	1	4	8	12	28	13.7	54.8	31.5
Other								**30 ml**	**125 ml**	**375 ml**
Other: green beans	4	5.3	1	2.5	4	6	8	25.0	75.0	0
Other: carrots	4	5.3	4	6	10	12	12	25.0	75.0	0

*Morogo – wild, dark green leaves; e.g. beetroot leaves

4.6.2.7 Frequencies and size of fruit consumption

Fruit consumption is summarised in Table 4.32. Almost all (93.3 %, n= 70) consumed apples, a low potassium fruit (<120 mg K / 100 g) (Herselman & Esau, 2005:51-57), with a median intake of 12 times per month and most (85.7 %) ate a medium portion size (100 g/1 small).

Pear, another low potassium fruit (<120 mg K / 50 g) (Herselman & Esau, 2005:51-57), were eaten by 72 % (n= 54) but less frequent than apples with a median intake of eight times per month. Almost all (96.3 %) ate a medium portion size (1 small).

Almost two thirds (65.3 %, n= 49) drank 100 % fruit juice, with a median intake of 4 times per month, whilst (28.6 %) consumed a large portion (250 ml). Interestingly, 19 out of 49 (38.8 %) consumed orange juice and may possibly be overconsuming on potassium. In the FFQ it wasn't specified if it was commercial orange juice (ceres/ liquifruit), which is classified as low in potassium or fresh orange juice which is classified as high in potassium (>200 mg K / portion) (Herselman & Esau, 2005:51-57).

Even though watermelon, a moderate potassium fruit (120 – 200 mg K / 100 g) (Herselman & Esau, 2005:51-57). were only eaten by one third (36 %, n= 27) with a median intake of twice per month; almost half (48.2 %) ate a large portion size (200 g).

Table 4.32: Frequency of fruit consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Fruit								**½**	**1 small**	**2 small**
Banana	21	15.8	1	2	4	8	16	14.3	80.9	4.8
Orange	31	41.3	1	2	4	8	28	12.9	74.2	12.9
Peach	46	61.3	1	1	4	8	28	8.7	69.6	21.7
Apple	70	93.3	1	8	12	28	28	4.3	85.7	10.0
Pear	54	72.0	1	2	8	8	28	0	96.3	3.7
Potato								**50 g**	**100 g**	**200 g**
Grapes	45	60.0	1	1	2	4	16	28.9	53.3	17.8
Watermelon	27	36.0	1	1	2	8	28	18.5	33.3	48.2
Paw-paw	16	21.3	1	1	1	6	12	31.3	56.2	12.5
Other: melon, fresh pineapple, kiwi, naartjies, figs, mango, litchi's	7	9.3	1	1	2	12	16	42.9	42.8	14.3
Dried fruit	22	29.3	1	1	1	4	12	18.2	59.1	22.7
Fruit juice, 100 %								**63 ml**	**125 ml**	**250 ml**
Fruit juice, 100 %	49	65.3	1	2	4	12	28	30.6	40.8	28.6
Tinned fruit								**2 thin wedges**	**½ large fruit**	**1 large fruit**
Tinned peaches	47	62.7	1	1	2	2	8	10.6	36.2	53.2
Tinned guavas	12	16.0	1	1.5	2	4	8	0	41.7	58.3
Other tinned fruits: fruit cocktail, pears	3	4.0	1	1	2.5	16	28	0	33.3	66.7

4.6.2.8 Frequencies and size of fat consumption

Fat consumption is summarised in Table 4.33. Sunflower oil were consumed by three quarters (78.7 %, n= 59), with a median intake of 28 times / month (every day). The distribution were almost similar between small (1 teaspoon) (40.7 %) and medium (5

teaspoons) portion sizes (44.1 %). Canola and olive oil were used similarly by less than a fifth (17.3 %, n= 13), whilst canola oil seems to be more frequently (median of 16 times / month) consumed than olive oil (median of 12 times / month).

Mayonnaise was also consumed by 73.3 % (n= 55). The median intake of mayonnaise was four times per month.

Non-dairy, coffee/tea creamer should be restricted to 10 g per day due to high PO4, K and Na content (Herselman & Esau, 2005:51-57). One third (34.7 %, n= 26) consumed non-dairy, coffee/tea creamer with a median intake of 14 times / month. A quarter (26.9 %) of those consumed a large portion size (30 ml/ 1 large spoon), which is more than the recommendation by Herselman & Esau (2005:51-57).

Table 4.33: Frequency of fat consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Fat								**5 ml**	**25 ml**	**60 ml**
Oil, sunflower	59	78.7	1	8	28	28	28	40.7	44.1	15.2
Oil, olive	13	17.3	4	8	12	12	28	46.2	46.2	7.6
Oil, canola	13	17.3	2	12	16	28	28	69.2	23.1	7.7
Oil, coconut oil	1	1.3	28	28	28	28	28	0	100.0	0
Margarine, Light	17	22.7	4	12	28	28	28	52.9	47.1	0
Margarine, Med Fat (PUFA)	41	54.7	1	16	28	28	28	58.6	39.0	2.4
Margarine, Brick	15	20.0	1	8	12	28	28	93.3	6.6	0
Butter	8	10.7	1	5.5	22	28	28	50.0	50.0	0
Mayonnaise	55	73.3	1	2	4	8	28	40.0	54.5	5.5
Coffee/tea creamer								**2.5 ml**	**10 ml**	**30 ml**
Coffee/tea Creamer	26	34.7	1	8	14	28	28	23.1	50.0	26.9

4.6.2.9 Frequencies and size of condiments and miscellaneous foods consumption

Condiments and miscellaneous foods consumption are summarised in Table 4.33. The majority (88 %, n= 66) used salt every day (median intake of 28 times / month) and almost two thirds (65.2 %) used a small portion size (½ teaspoon). Furthermore, stock cubes were also used to flavour food by two thirds (69.3 %, n= 52) with a median intake of eight times per month, with 63.5 % that used a medium portion size (1 cube). Whilst, 14.7% (n= 11) used salt in combination with stock cubes on a daily basis (28 times / month), similarly, 10.6% (n= 8) used salt in combination with mixed, salty meat spice, daily, to flavour food (info not in table). Moreover, of those, 6.7 % (n= 5) used three to four sodium rich flavourants (e.g. salt, stock cubes, meat spice and soup powder) on a daily basis (info not in table).

Green herbs were used by 58.7 % (n= 44) to flavour food (median intake of 12 times / month). Three quarters (75 %) used a medium portion size (12 ml/ 1 level tablespoon).

One out of five (21.3 %, n= 16) consumed cola cool drinks which should be restricted due to high PO4 content (Herselman & Esau, 2005:51-57), with a median intake of four times per month. Half (50 %) consumed a medium portion size (250 ml).

Table 4.34: Frequency of condiments and miscellaneous foods consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Condiments								**2.5 ml**	**5 ml**	**15 ml**
Salt	66	88.0	4	28	28	28	28	65.2	31.8	3.0
Aromat/ Fondor	29	38.7	1	4	4	12	28	62.1	37.9	0
Steak and chops spice								**1 shake**	**4 shakes**	**7 shakes**
Steak and chops spice	38	50.7	1	4	12	28	28	36.8	60.6	2.6

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Stock cubes								**½ cube**	**1 cube**	**2 cubes**
Stock cubes	52	69.3	1	4	8	28	28	30.8	63.5	5.7
								5 ml	**12 ml**	**24 ml**
Soup powder / gravy powder	41	54.7	1	4	8	12	28	24.4	58.5	17.1
Green Herbs	44	58.7	1	8	12	28	28	22.7	75.0	2.3
Miscellaneous								**90 ml**	**180 ml**	**360 ml**
Coffee	52	69.3	1	4	12	28	28	9.6	86.5	3.9
Tea	67	89.3	1	12	28	28	28	4.5	95.5	0
Cold drinks								**125 ml**	**250 ml**	**500 ml**
Cold drinks, cola	16	21.3	1	3.5	4	12	28	37.5	50.0	12.5
Cold drinks, lemonade	33	44.0	1	3	4	12	28	48.4	36.4	15.2
Cold drinks other: fanta orange, stoney, iron brew	48	64.0	1	2	4	8	28	43.7	37.5	18.8

4.6.2.10 Frequencies and size of alcohol consumption

Alcohol consumption is summarised in Table 4.35. Alcohol seems to be consumed by only a small percentage of participants with spirits contributing the largest percentage (18.7 %, n= 14) with a median intake of once per month. Three fifths (64.3 %) used a large portion size (100 g /2 tots) of spirits.

Table 4.35: Frequency of alcohol consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Wine								**63 ml**	**125 ml**	**250 ml**
Wine	7	9.3	1	1	2	3	12	14.4	57.0	28.6
Beer								**165 ml**	**330 ml**	**660 ml**
Beer	3	4.0	1	1	1	4	4	0	100.0	0
Cider	6	8.0	1	1	1	2	4	0	50.0	50.0
Spirits								**25 g**	**50 g**	**100 g**
Spirits	14	18.7	1	1	1	4	28	21.4	14.3	64.3
Sherry								**25 g**	**50 g**	**100 g**
Sherry	1	1.3	1	1	1	1	1	100.0	0	0

4.6.2.11 Frequencies and size of take-away foods consumption

Take-away foods consumption are summarised in Table 4.36. The majority (65.3 %, n= 49) ate take-away fish, with a median intake of twice per month and 44.9 % ate a medium portion size (50 g). Pies are also eaten (65 %, n= 45) with a median of twice per month. Almost all (97.8 %) ate a medium portion size (1 pie).

Table 4.36: Frequency of take-away food consumption (expressed as times per month that the item was consumed) according to usual portion sizes (n= 75)

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Pizza								**½ slice**	**2 slices**	**4 slices**
Pizza	40	53.3	1	1	1	2	8	15.0	65.0	20.0

Variable	Number (n)	Percentage (%)	Times per month the food item was consumed					Percentage that consumed a specific portion size (usually)		
			Minimum	25th percentile	Median	75th percentile	Maximum	Small	Medium	Large
Burgers								**½**	**1**	**2**
Burgers	33	44.0	1	1	1	2	8	9.1	90.9	0
Pies								**½**	**1**	**3**
Pies	45	60.0	1	1	2	4	12	0	97.8	2.2
Boerewors roll								**½**	**1**	**2**
Boerewors roll	21	28.0	1	1	2	4	4	4.8	95.2	0
Fish								**35 g**	**50 g**	**70 g**
Fish	49	65.3	1	1	2	3	28	51.0	44.9	4.1
Other								**90 g**	**180 g**	**250 g**
Chips	41	54.7	1	1	1	3	6	0	82.9	17.1
Other: Chicken, take-away	2	2.7	2	2	3	4	4	0	0	100.0
Other: Fat Cakes	5	6.7	1	1	2	2	4	0	0	100.0

4.7 Knowledge, attitudes and practices

The KAP regarding the renal diet are summarised below.

4.7.1 Knowledge regarding restricted foods and minerals

The responses to the questions about foods and the mineral content of foods that need to be restricted, as well as knowledge regarding phosphate binder medication, are presented in Table 4.37 to Table 4.48.

4.7.1.1 Knowledge regarding phosphate content of foods

Answers to questions regarding recommendations for intake of high phosphate foods are summarised in Table 4.37. Most of the participants knew that the high phosphate foods, cola drinks (92 %, n= 69) and milk (84 %, n= 63), needs to be restricted. However, 16 % (n= 12) were not aware that they may consume milk without restriction. A third of the participants (32 %, n= 24) did not know that organ meat should be restricted or answered

incorrectly that organ meat can be eaten without restriction. Almost half (44 %, n= 33) of the participants answered incorrectly that cooked chicken breast, a low phosphate food, should be restricted.

Table 4.37: Knowledge regarding recommendations for intake of high phosphate foods (n= 75) (Herselman & Esau, 2005:51-57)

Variable	Number of participants (n)	Percentage (%)
Knowledge of high phosphate foods (PO4) (> 110 mg PO4 per portion)		
Milk		
Correct answer: I must restrict/limit the amount I eat	63	84.0
Incorrect answer: I may eat it without restriction/limit	2	2.7
Do not know	10	13.3
Organ meat (liver)		
Correct answer: I must restrict/limit the amount I eat	51	68.0
Incorrect answer: I may eat it without restriction/limit	8	10.7
Do not know	16	21.3
Cola drinks		
Correct answer: I must restrict/limit the amount I eat	69	92.0
Incorrect answer: I may eat it without restriction/limit	3	4.0
Do not know	3	4.0
Knowledge of low phosphate foods (<100 mg PO4 per portion)		
Cooked chicken breast		
Correct answer: I may eat it without restriction/limit	35	46.7
Incorrect answer: I must restrict/limit the amount I eat	33	44.0
Do not know	7	9.3

The answers to the questions testing participants' knowledge of the restricted mineral content of the selected foods in Table 4.37, are summarised in Table 4.38. Most of the participants were not aware that milk (76 %, n= 57), organ meat (82.7 %, n= 62) and cola drinks (69.3 %, n= 52) were high in phosphate. Similarly, 77.3 % (n= 58) did not know that cooked chicken breast is not high in any of the restricted minerals.

Table 4.38: Knowledge of mineral content of high phosphate foods (n= 75) (Herselman & Esau, 2005:51-57)

Variable	Number of participants (n)	Percentage (%)
Knowledge of mineral content of high phosphate foods that should be restricted		
Milk		
Correct answer: High in phosphate	18	24.0
Incorrect answer: High in potassium	9	12.0
Incorrect answer: High in sodium	1	1.3
Incorrect answer: Not high in phosphate, potassium or sodium	3	4.0
Do not know	44	58.7
Organ meat (liver)		
Correct answer: High in phosphate	13	17.3
Incorrect answer: High in potassium	13	17.3
Incorrect answer: High in sodium	2	2.7
Incorrect answer: Not high in phosphate, potassium or sodium	4	5.3
Do not know	43	57.4
Cola drinks		
Correct answer: High in phosphate	23	30.7
Incorrect answer: High in potassium	6	8.0
Incorrect answer: High in sodium	1	1.3
Incorrect answer: Not high in phosphate, potassium or sodium	2	2.7
Do not know	43	57.3
Knowledge of low mineral (phosphate) content of food that can be consumed more often and/or as an alternative		
Cooked chicken breast		
Correct answer: Not high in phosphate, potassium or sodium	17	22.7
Incorrect answer: High in phosphate	7	9.3
Incorrect answer: High in potassium	6	8.0
Incorrect answer: High in sodium	4	5.3
Do not know	41	54.7

4.7.1.1.1 Association between serum phosphate levels and knowledge of phosphate concepts

Serum phosphate levels are stratified according to levels of knowledge of phosphate-related concepts in Table 4.39. No statistically significant associations were found. Nonetheless, of

those (25.3 %, n= 19) with high serum phosphate levels (>1.8 mmol/L), most (68.4 %; n= 13) (info not in table) had poor knowledge of phosphate-concepts regarding food and phosphate binder medication combined.

Table 4.39: Serum phosphate levels stratified according to levels of knowledge of phosphate-related concepts (Nelms & Lacey, 2016:534-536) (n= 75)

Variable	Serum phosphate level (<0.8 mmol/L) (8.0 %, n= 6)	Serum phosphate level (0.8 – 1.8 mmol/L) (66.7 %, n= 50)	Serum phosphate level (>1.8 mmol/L) (25.3 %, n= 19)
Knowledge of high phosphate foods			
Poor knowledge (<50 % correct answers)	16.7 %, n= 1	10.0 %, n= 5	5.2 %, n= 1
Average knowledge (≥50 – 75 % correct answers)	33.3 %, n= 2	16.0 %, n= 8	0
Good knowledge (≥75 % correct answers)	50.0 %, n= 3	74.0 %, n= 37	94.8 %, n= 18
Knowledge of mineral content of high phosphate foods that should be restricted			
Poor knowledge (<50 % correct answers)	66.6 %, n= 4	78.0 %, n= 39	63.2 %, n= 12
Average knowledge (≥50 – 75 % correct answers)	33.3 %, n= 2	14.0 %, n= 7	10.5 %, n= 2
Good knowledge (≥75 % correct answers)	0	8.0 %, n= 4	26.3 %, n= 5
Knowledge of phosphate binder medication (name and correct way to consume)			
Poor knowledge (<50 % correct answers)	66.7 %, n= 4	66.0 %, n= 33	36.8 %, n= 7
Average knowledge (≥50 – 75 % correct answers)	0	16.0 %, n= 8	31.6 %, n= 6
Good knowledge (≥75 % correct answers)	33.3 %, n= 2	18.0 %, n= 9	31.6 %, n= 6

4.7.1.2 Knowledge regarding potassium content of foods

As summarised in Table 4.40, most participants knew that the high potassium foods, baked potato in skin (78.7 %, n= 59) and oranges (81.4 %, n= 61), should be restricted. Conversely, about half of the participants (48 %, n= 36) did not know that butternut should also be restricted, and about a third (29.3 %, n= 22) did not know that apples need not be restricted.

Table 4.40: **Knowledge regarding recommendations for intake of high potassium foods (n= 75) (Herselman & Esau, 2005:51-57)**

Variable	Number of participants (n)	Percentage (%)
Knowledge of high potassium food (K), (>240 mg K per portion)		
Baked potato in skin		
Correct answer: I must restrict/limit the amount I eat	59	78.7
Incorrect answer: I may eat it without restriction/limit	5	6.7
Do not know	11	14.7
Oranges		
Correct answer: I must restrict/limit the amount I eat	61	81.4
Incorrect answer: I may eat it without restriction/limit	7	9.3
Do not know	7	9.3
Butternut		
Correct answer: I must restrict/limit the amount I eat	39	52.0
Incorrect answer: I may eat it without restriction/limit	20	26.7
Do not know	16	21.3
Knowledge of low potassium foods (<120 mg K per portion)		
Apples		
Correct answer: I may eat it without restriction/limit	53	70.7
Incorrect answer: I must restrict/limit the amount I eat	19	25.3
Do not know	3	4.0

The answers to the questions testing participants' knowledge of the restricted mineral content of the selected foods listed in Table 4.40, are summarised in Table 4.41. Most of the participants were not aware that baked potato in skin (57.3 %, n= 46), oranges (69.3 %, n= 52) and butternut (86.7 %, n= 65) are high in potassium. Similarly, 60.0 % (n= 45) did not know that apples are not high in any of the restricted minerals.

Table 4.41: Knowledge of mineral content of high potassium foods (n= 75) (Herselman & Esau, 2005:51-57)

Variable	Number of participants (n)	Percentage (%)
Knowledge of mineral (potassium) content of food that should be restricted		
Baked potato in skin		
Correct answer: High in potassium	29	38.7

Variable	Number of participants (n)	Percentage (%)
Incorrect answer: High in phosphate	10	13.3
Incorrect answer: High in sodium	0	0
Incorrect answer: Not high in phosphate, potassium or sodium	4	5.3
Do not know	32	42.7
Oranges		
Correct answer: High in potassium	23	30.7
Incorrect answer: High in phosphate	12	16.0
Incorrect answer: High in sodium	0	0
Incorrect answer: Not high in phosphate, potassium or sodium	4	5.3
Do not know	36	48.0
Butternut		
Correct answer: High in potassium	10	13.3
Incorrect answer: High in phosphate	11	14.7
Incorrect answer: High in sodium	0	0
Incorrect answer: Not high in phosphate, potassium or sodium	6	8.0
Do not know	48	64.0
Knowledge of low mineral (potassium) content of food that can be consumed more often and/or as an alternative		
Apple		
Correct answer: Not high in phosphate, potassium or sodium	30	40.0
Incorrect answer: High in phosphate	5	6.7
Incorrect answer: High in potassium	4	5.3
Incorrect answer: High in sodium	0	0
Do not know	36	48.0

4.7.1.3 Knowledge regarding sodium content of foods

Answers to questions regarding recommendations for intake of high sodium foods are summarised in Table 4.42. Most of the participants knew that the high sodium foods, instant soup powder (82.7 %, n= 62) and viennas (73.4 %, n= 55), should be restricted. However, 26.6 % (n= 20) and (49.3 %, n= 37) were not aware that viennas and corn flakes, respectively, should be restricted. Conversely, the majority of participants (82.7 %, n= 62) were not aware that chilli pepper powder (red/cayenne pepper) could be used as a low sodium alternative.

Table 4.42: Knowledge regarding recommendations for intake of high sodium foods (n= 75) (Herselman & Esau, 2005:51-57)

Variable	Number of participants (n)	Percentage (%)
Knowledge of high sodium foods (Na), (>400 mg Na per portion)		
Vienna		
Correct answer: I must restrict/limit the amount I eat	55	73.4
Incorrect answer: I may eat it without restriction/limit	4	5.3
Do not know	16	21.3
Instant soup powder		
Correct answer: I must restrict/limit the amount I eat	62	82.7
Incorrect answer: I may eat it without restriction/limit	2	2.6
Do not know	11	14.7
Corn flakes cereal		
Correct answer: I must restrict/limit the amount I eat	38	50.7
Incorrect answer: I may eat it without restriction/limit	25	33.3
Do not know	12	16.0
Knowledge of low sodium foods(<100 mg Na per portion)		
Chilli pepper powder (red/cayenne pepper)		
Correct answer: I may eat it without restriction/limit	13	17.3
Incorrect answer: I must restrict/limit the amount I eat	36	48.0
Do not know	26	34.7

The answers to the questions testing participants' knowledge of the restricted mineral content of the selected foods listed in Table 4.42, are summarised in Table 4.43. About a third (38.7 %, n= 29) were not aware that viennas and instant soup powders (41.3 %, n= 31) were high in sodium, and almost all (96 %, n= 71) were uninformed about the high sodium content of corn flakes. Similarly, 85.3 % (n= 64) did not know that chilli powder is not high in any of the restricted minerals.

Table 4.43: Knowledge of mineral content of high sodium foods (n= 75) (Herselman & Esau, 2005:51-57)

Variable	Number of participants (n)	Percentage (%)
Knowledge of mineral (sodium) content of food that should be restricted		
Vienna		
Correct answer: High in sodium	46	61.3
Incorrect answer: High in phosphate	3	4.0
Incorrect answer: High in potassium	2	2.7
Incorrect answer: Not high in phosphate, potassium or sodium	0	0
Do not know	24	32.0
Instant soup powder		
Correct answer: High in sodium	44	58.7
Incorrect answer: High in phosphate	2	2.7
Incorrect answer: High in potassium	5	6.6
Incorrect answer: Not high in phosphate, potassium or sodium	2	2.7
Do not know	22	29.3
Corn flakes cereal		
Correct answer: High in sodium	3	4.0
Incorrect answer: High in phosphate	9	12.0
Incorrect answer: High in potassium	8	10.7
Incorrect answer: Not high in phosphate, potassium or sodium	10	13.3
Do not know	45	60.0
Knowledge of low mineral (sodium) content of food that can be consumed more often and/or as an alternative		
Chilli pepper powder (red/cayenne pepper)		
Correct answer: Not high in phosphate, potassium or sodium	11	14.7
Incorrect answer: High in phosphate	3	4.0
Incorrect answer: High in potassium	2	2.7
Incorrect answer: High in sodium	13	17.3
Do not know	46	61.3

4.7.2 Scoring of overall knowledge of restricted foods and minerals

When all the questions in the knowledge section of the questionnaire were scored as indicated in chapter 3, only about half (54.7 %, n= 41) were found to have a good knowledge

of foods that must be restricted, whilst, only 2.6 % (n= 2) had a good knowledge (≥75 % answers correct) of the actual mineral contents of the foods that they were shown (Table 4.44).

Table 4.44: Classification of overall knowledge scores regarding restricted minerals and food sources thereof (n= 75)

Classification	Number of participants (n)	Percentage (%)
Classification of knowledge of, food sources, that need to be restricted		
Poor knowledge (<50 %)	9	12.0
Average knowledge (≥50 – 75 %)	25	33.3
Good knowledge (≥75 %)	41	54.7
Classification of knowledge of, mineral content of food, that need to be restricted		
Poor knowledge (<50 %)	56	74.7
Average knowledge (≥50 – 75 %)	17	22.7
Good knowledge (≥75 %)	2	2.6

4.7.3 Knowledge regarding phosphate binders

When participants were asked in an open-ended question to identify the phosphate binder that they were prescribed (Table 4.45), if applicable, only a quarter (26.6 %, n= 20) could correctly identify the phosphate binder amongst their prescribed medications (e.g. Phosphosorb and Titrilac). The answers of most participants (54.7 %, n= 41), indicated uncertainty or ignorance.

Table 4.45: Knowledge of the name of the phosphate binder medication (n= 75)

Name your phosphate binder medication	Number of participants (n)	Percentage (%)
Correct answers		
Phosphosorb	13	17.3
Titrilac	7	9.3
Incorrect answers		
Other medication: One Alpha, Zocor, Bio-carb, Pharmapress, and Panado	5	6.7
Answers indicating ignorance or uncertainty		
“Do not know”	30	40.0
“Not sure (white or calcium pill)”	5	6.7

Name your phosphate binder medication	Number of participants (n)	Percentage (%)
"Not sure, but must take it"	2	2.7
"Forgot the name"	4	5.3
Not prescribed, according to participant		
"Not sure but not taking it anymore" and "Not sure, only taking hypertension medication"	4	5.3
"Phosphate binder is not prescribed for me"	5	6.7

Open-ended questions to test knowledge regarding correct timing and frequency of taking phosphate binder medication, yielded diverse answers that could be categorised into three groups (summarised in Table 4.46). Overall, only 37.3 % (n= 28) knew how and when to use phosphate binders correctly.

Table 4.46: Knowledge of correct way to take phosphate binder medication (n= 75)

Variable	Number of participants (n)	Percentage (%)
Timing for taking phosphate binder medication		
Correct answers		
'After meals or while eating'	3	4.0
'With meals / Two to three times per day before you eat'	14	18.7
'Chew with meals/ When I eat I must mix it with food'	4	5.3
'Thirty minutes before eating or while eating or directly afterwards"	7	9.3
Incorrect answers		
"In the morning/ Once a day"	10	13.4
"Before I go to sleep and before I go to work / two times per day"	5	6.7
"During lunch"	1	1.3
"Two to three times per day"	3	4.0
"After dialysis"	1	1.3
"Almost every day"	1	1.3
Do not know		
"Do not know"	21	28.0
"Do not know because it isn't prescribed for me"	5	6.7

When the answers to the questions testing knowledge regarding phosphate binder medication, were scored, most (58.7 %, n= 44) showed poor knowledge, 18.7 % (n= 14) had average knowledge, and only 22.7 % (n= 17) had good knowledge (see Table 4.47).

Table 4.47: Classification of knowledge scores regarding phosphate binder medication (n= 75)

Classification	Number of participants (n)	Percentage (%)
Poor knowledge (<50 %)	44	58.7
Average knowledge (≥50 – 75 %)	14	18.7
Good knowledge (≥75 %)	17	22.7

4.7.3.1 Association between knowledge of phosphate binders and phosphate intake

Amongst the group (23 %, n= 17) with a desired low phosphate intake (<10 mg PO4/ g protein), 41.2 % (n= 7) had a poor knowledge regarding phosphate binder medication (names and their use). In the group with a high phosphate intake (>12 mg PO4/ g protein) (60.8 %, n= 45) almost three quarters (71.1 %, n= 32) had a poor knowledge regarding phosphate binders (NKF-K/DOQI, 2000, 2006, 2009; Nelms & Lacey, 2016:534-536). The group with phosphate intakes in the desired range (<10 mg PO4/ g protein), had statistically significantly better knowledge of phosphate binders, compared to the group with a higher phosphate intake (>12 mg PO4/ g protein) (95 % CI for the median knowledge score [52.5 % ; 2.9 %]).

4.7.4 Combined knowledge scores

The overall knowledge scores (combining the answers to all 26 questions regarding knowledge of restricted foods, mineral content of food and phosphate binder medication) (Appendix H), revealed that half of the group (49.4 %, n= 37) had poor knowledge regarding these important concepts (Table 4.48). The rest mostly had average knowledge (45.3 %, n= 34) and only a very small percentage (5.3 %, n= 4) had good knowledge.

Table 4.48: Classification of combined knowledge scores for restricted foods, mineral content of food and phosphate binder medication (n= 75)

Classification	Number of participants (n)	Percentage (%)
Poor knowledge (<50 %)	37	49.4
Average knowledge (≥50 – 75 %)	34	45.3
Good knowledge (≥75 %)	4	5.3

4.7.5 Association between combined knowledge scores and linguistic data

Of the group (78.7 %, n= 59) that had not received any written nutrition education in their home language, almost half (49.2 %, n= 29) had poor combined knowledge scores (<50 % of correct answers), two fifths (44.1 %, n= 26) had average knowledge scores (≥50 – 75 % of correct answers) and only a small percentage (6.7 %, n= 4) had a good knowledge score (see heading 4.2.3 & Table 4.48). There were, however, no statistically significant differences between the knowledge scores of the groups that received written nutrition education in their home language and those that did not (95 % CI [-24.4 % ; 26.1 %]).

In the group (68 %, n= 51) that did not receive verbal nutrition education in their home language more than half (54.9 %, n= 28) presented with poor combined knowledge (<50 % correct answers). There were, however, no statistically significant differences between the group that did receive verbal nutrition education in their home language and those that did not (95 % CI [-38.2 % ; 6.6 %]).

Additionally, a quarter (24 %, n= 18) did not receive written and verbal nutrition education in their home language and/or second language. There was a statistically significant better knowledge score between those that did receive written and verbal nutrition education in their home language and/or second language compared to those that did not (95 % CI [49.5 % ; 3.7 %]).

4.7.6 Associations between combined knowledge scores and education level

Participants with tertiary education (diploma, degree and post-graduate degree) (28 %, n= 21), had statistically significant better combined knowledge scores compared to those (6.7 %, n= 5) with only a primary education (grade 4 – 7) (95 % CI [3.9 % ; 73.5 %]), and to those

(17.3 %, n= 13) who only partially completed secondary school (grade 8 – 10) (95 % CI [6.3 % ; 64.0 %]).

4.8 Attitude

Answers to the questions assessing participants' attitude towards the prescribed eating pattern for persons with kidney failure on MHD are summarised in Table 4.49 to Table 4.60.

4.8.1 Attitude towards adhering to the renal diet

To the question: "How do you feel towards the prescribed eating pattern (kidney diet) for persons with kidney failure on hemodialysis?" only 40 % (n= 30) of participants reported feeling positive (Table 4.49).

Table 4.49: Attitude towards prescribed eating pattern for persons with kidney failure on MHD (n= 75).

Self-reported attitude	Number of participants (n)	Percentage (%)
Positive	30	40.0
Negative	16	21.3
Neutral	29	38.7

4.8.1.1 Explanations for feeling positive about adhering to the renal diet

As summarised in Table 4.50, 30 % (n= 9) of those (40 %, n= 30) that were positive about the diet, motivated their attitude by the fact that they felt better when they adhered to the renal diet (e.g. not nauseas or swollen). In addition, 16.7 %, (n= 5) felt that adhering to the renal diet was important to improve their health. Other motivations included: having no choice due to the disease, accepting the disease, having family support, and having a lower salt threshold.

Table 4.50: Reasons given for having a positive attitude towards prescribed eating pattern for persons with kidney failure on MHD (n= 30)

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Adherence results in feeling better: "When I follow the diet my blood results are always positive." "It helps me to feel better; I don't feel nauseous if I eat the correct foods." "When I eat the correct foods. I feel okay. I picked up weight again and am not so thin anymore." "If you follow the diet you feel better you don't feel sick." "It is good to have a balanced diet, because if I eat too much of the restricted food, I feel tired and nauseous." "I am too scared to eat other foods; I will become sick." "I feel good; I have energy and do everything by myself." "Since on dialysis and the correct diet I am much better - not swollen."	9	30.0
Adherence is important for health: "In order for me to lead a healthy lifestyle, I need to eat healthy." "Eating properly is very important and it is contributing to better health." "To be healthy you must follow the instructions, but in the beginning I was very negative about the diet."	5	16.7
Adherence needs acceptance and autonomy: "I have accepted that I must receive dialysis." "There's nothing I can do about it, it happens and then you can't run away from it." "You should eat it because of the disease, and you can't be negative because you can't take away the disease." "You have to look after yourself because nobody is going to do it for you." "I do not have a choice because it will improve my health. If the dr. says I must do it, I must do it."	4	13.3
Adherence will result in less harm: "If I don't follow all the rules I'll damage my kidneys more." "I want to take the advice so that it helps me; I don't want to worsen the condition."	2	6.7
Family support: "My family changed to make sure we eat the correct food." "I became use to it because of the support at home."	2	6.7
Enjoyment of eating in general: "I like eating"	1	3.3

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Negative thoughts is counterproductive: "If I think negatively about it the whole time it will affect my illness negatively"	1	3.3
Knowledge aids adherence: "Before dialysis you would eat food and it is not advised, but after dialysis with the knowledge what to eat, you become wiser."	1	3.3
Positivity is necessary for good family relationships: "You must feel positive otherwise you make the rest of your family feel negative."	1	3.3
Adherence is important for health AND **Adherence needs acceptance and autonomy**	1	3.3
Trust in health care team: "The people that studied the sickness know what I should eat."	1	3.3
Correct cooking is important for health: "If it is cooked correctly, it does not contain a lot of minerals."	1	3.3
Adjusted to prescribed low-salt eating plan: "I am use to the diet now and salty foods are not tasty for me anymore." AND **Adjusted to prescribed eating plan:** "I am used to eating the way I should."	1	3.3

4.8.1.2 Explanations for feeling negative about adhering to the renal diet

As summarised in Table 4.51, most participants (56.3 %, n= 9) that reported that they felt negative about adhering to the renal diet, explained that the number of food restrictions were too extensive. Around a third (31.3 %, n= 5) felt negative, because favourite foods were restricted. Other reasons included that they felt that food was tasteless without salt (12.5 %, n= 2), usual/typical/traditional foods are restricted (12. 5%, n= 2) and that social interaction was hindered by food restrictions (12.5 %, n= 2).

Table 4.51: Reasons given for having a negative attitude towards prescribed eating pattern for persons with kidney failure on MHD (n= 16)

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Extensive restrictions of food: "There is about nothing that you are allowed to eat e.g. liver." "Because of the limits: you can't eat peanut butter, cheese, toffees, and peanuts" "You are not allowed to eat almost any food" "Too much restriction; if I follow the diet I will not eat completely (the portions are too small of milk and protein)." "Lots of restrictions especially for the food you like e.g. Ice cream." "Everything that you must eat you must limit." "Lots of restrictions on fat, salt and spices." "I am not allowed to eat everything; food mustn't have too much salt or fat." "There is a lot of food that you must restrict but I became use to it; it is important to keep balance and variety."	5	31.3
Favourite foods are restricted: "You like the food and then they tell you, you can't eat it.: "I love spinach and eat it twice a day even though I must only eat it once a day" "All the food that I loved is taken away (milk, grapes, watermelon, cheese, mango, orange and all the green leafy stuff)." "There are foods that I desire to eat but I am not allowed e.g. fruits - watermelon, banana, and naartjies; liver and tomatoes (I love them but can't eat them)." "Most of the foods I like are restricted (coke, orange, banana, viennas and KFC)." "You can't eat what you want, you can't eat salt, and you can't eat fat." "You desire to eat the food but then you are restricted (e.g. yoghurt and braaivleis)." "You want to eat the food e.g. spanspek and then you aren't allowed."	3	18.8

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Usual/Typical/Traditional foods are restricted: "The foods we are not allowed to eat are the food that we usually eat e.g. potatoes, liver and tinned fish." "I am not living the same way as before; I can't eat red meat and orange." "Most of the time it is food that I am not used to eating e.g. mince is mixed with veg at home and now it is served separately" "I am use to eating slap chips, Dorito's, Ultramel (custard) and then I must eat other things instead."	1	6.3
Favourite foods are restricted. AND **Extensive restrictions of foods.** AND **Social interaction is hindered by food restrictions:** "I feel sad about the disease, you can't socialise with friends anymore. I must pour water with the mix veg and I don't eat chips anymore." "When I am at home it doesn't bother me but when I go out to a restaurant it is difficult to remember what not to eat e.g. cheese." "Fluid restriction bothers me the most because you can't go out for drinks anymore." "You can't eat like everybody else, it is somebody else's diet"	1	6.3
Extensive restrictions of foods. AND **Favourite foods are restricted.**	1	6.3
Extensive restrictions of foods. AND **Food selections are tiresome**: "You have to choose meats like chicken livers and choose between the cool drinks"	1	6.3

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Extensive restrictions of foods. AND **Food is tasteless without salt:** "The food does not contain salt, it tastes too bland." "I struggle to eat food without salt." "I can't eat food without salt; that is ridiculous."	1	6.3
Prescribed foods are expensive: "The food is expensive." AND **Usual/Typical/Traditional foods are restricted.** AND **The prescribed eating plan is socially unacceptable:** "If somebody offers you meat to eat when you go and visit then you end up eating it just not to be rude."	1	6.3
Social interaction is hindered by food restrictions.	1	6.3
Food is tasteless without salt.	1	6.3

4.8.1.3 Explanations for feeling neutral about adhering to the renal diet

As summarised in Table 4.52, participants' reasons for being neutral towards the renal diet, included that nobody had explained the diet to them (17.2 %, n= 5). Some of the reasons given, were more negative than neutral, including that favourite foods are restricted (17.2 %, n= 5), that the food is monotonous and dry, that they do not always have an appetite for suggested foods and that usual/typical/traditional foods are restricted. Conversely, some of the reasons given, agreed with the reasons given for feeling positive towards the renal diet, including that the renal diet improves their health and blood values and that they have accepted the disease.

Table 4.52: Reasons given for having a neutral attitude towards prescribed eating pattern for persons with kidney failure on MHD (n= 29)

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Favourite foods are restricted (see Table 4.51 for statements that supported this theme).	5	17.2
No nutrition instruction was given: "Nobody has explained the diet to me yet. Don't know how I should feel." "I was never told what to eat and what not. Nurses gave me a pamphlet to read but I did not follow it." "They did not say which foods to eat and what not."	5	17.2
Food is monotonous and dry: "It is boring (monotonous); if you do not feel like eating an apple, you don't feel like it." "Sometimes I enjoy it, sometimes I don't. The food is dry and I don't have an appetite for chicken." "Sometimes the food is not nice but you have to eat it."	3	10.3
Usual/typical/traditional foods are restricted (see Table 4.51 for statements that supported this theme).	2	6.9
Adherence needs acceptance and autonomy (see Table 4.50 for statements that supported this theme).	2	6.9
Unconvinced about the advantages or disadvantages of the prescribed eating plan: "I am not for it or against it."	1	3.5
Adherence is important for health (see Table 4.50 for statements that supported this theme).	1	3.5
Extensive restrictions of foods (see Table 4.51 for statements that supported this theme).	1	3.5
Extensive restrictions of foods (see Table 4.51 for statements that supported this theme). AND **No raw food allowed**: "Food must be cooked; you are not allowed to eat raw food e.g. beetroot." AND **Food is tasteless without salt** (see Table 4.51 for statements that supported this theme).	1	3.5
Adherence results in feeling better (see Table 4.50 for statements that supported this theme).	1	3.5
Aiming to comply: "I try and eat the correct amounts and stick to the rules."	1	3.5

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Social interaction is hindered by food restrictions (see Table 4.51 for statements that supported this theme).	1	3.5
The disease does not distinguish from others: "I still look like other people who do not receive dialysis."	1	3.5
Adjusted to prescribed low-salt eating plan (see Table 4.50 for statements that supported this theme).	1	3.5
Food is tasteless without salt (see Table 4.51 for statements that supported this theme).	1	3.5
Changing an eating pattern is challenging: "To change your diet is very challenging; I am use to eating food with salt." AND **Food is tasteless without salt** (see Table 4.51 for statements that supported this theme).	1	3.5
No physical experience with the prescribed eating pattern: "I do not feel tired with the diet but I also don't feel stronger."	1	3.5

4.8.1.4 Associations between overall knowledge scores and having a negative attitude towards the diet

Three fifths (60 %, n= 45) of the group had a negative attitude towards the renal diet (see Table 4.49) and of those, half (51.1 %, n= 23), had a poor combined knowledge (<50 % correct answers), 42.2 %, (n= 19) had average knowledge (≥50 – 75 % correct answers) and only 6.7 % (n= 3), had a good knowledge (≥75 % correct answers). No statistically significant differences were found between the groups.

4.8.2 Attitude towards the cost of the renal diet

Answers to the question: "Describe your feelings towards the cost of the eating pattern for persons with kidney failure on hemodialysis." are summarised in Table 4.53. Overall, 15.7 % (n= 11) felt that the prescribed eating pattern for persons with kidney failure on MHD, was cheaper than a regular diet. A quarter (25.7 %, n= 18) indicated that they felt that it was not more expensive than what the rest of their families were eating, but most (52.9 %, n= 37) felt that it was more expensive. The fact that the diet was never explained to some of the participants also came up again.

Table 4.53: Attitude towards the cost of the eating pattern prescribed for persons with kidney failure on MHD (n= 70)

Perceived cost compared to normal diet	Number of participants (n)	Percentage (%)
Cheaper	11	15.7
More expensive	37	52.9
Same cost as the rest of my family	18	25.7
No response to question	1	1.4
Nobody has explained the diet to me, yet	2	2.9
I do not buy anything special, I buy my normal groceries as always	1	1.4

4.8.2.1 Explanations for perceiving the renal diet as cheaper than a regular diet

Almost half (45.5 %, n= 5) of the participants that perceived the renal diet as cheaper (n= 11), pointed out that they bought less food because they had to eat less salt, beef stock, chicken and red meat (Table 4.54). Other participants (36.4 %, n= 4) indicated that they bought cheaper foods (including foods that are restricted) and that most of the expensive foods (e.g. cola drinks and hamburgers) were restricted and therefore it is not bought. The limited variety of foods also came up as a reason for feeling the renal diet is cheaper.

Table 4.54: Reasons given for perceiving the cost of the prescribed eating pattern for persons with kidney failure on MHD as cheaper than a regular diet (n= 11)

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Restrictions necessitates less food being bought: "Chicken is more affordable than red meat and the quantity you have to eat is less." "You only eat small amounts of everything, you do not have to buy special food; you only eat pap and protein." "You buy less because you don't eat too much of meat." "You don't use salt." "I do not buy beef stock anymore."	5	45.5

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Less expensive food are bought regardless if it is restricted or not: "I choose cheap food and not expensive options e.g. cabbage, potatoes, porridge, lettuce, cucumber, brown bread and milk." "I buy cheaper food like beans (that I must not eat) with samp." "Most of the expensive foods are restricted e.g. hamburgers, coca-cola and you drink less tea and coffee." "The vegetables that I can eat are not expensive and it is available everywhere." "Potato, spinach, and milk you are allowed to buy it and it is not expensive."	4	36.4
Limited variety of food: "Every day we eat the same things; there is limited variety." "There is no variety." "The foods are so limited that I am allowed to eat that I don't remember which food are more expensive." "There are a lot of foods that you are not allowed to eat e.g. Vienna's, Russians, inkomazi, oranges, bananas and grapes."	2	18.2

4.8.2.2 Explanations for perceiving the renal diet as more expensive than a regular diet

Most (52.9 %, n= 37) that felt that the prescribed renal diet was more expensive than a regular diet, explained that they had to buy separate/different/non-traditional foods (32.4 %, n= 12), and that the prescribed foods were more expensive than typical/traditional food (29.7 %, n= 11) (Table 4.55). Five participants (13.5 %) indicated that restricted foods were cheaper than prescribed foods (e.g. bananas are cheaper than berries; tinned fish is cheaper than other meat).

Table 4.55: Reasons for perceiving the cost of the prescribed eating pattern for persons with kidney failure on MHD as more expensive than a regular diet (n= 37)

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Separate/ Different/Non-Traditional food should be bought: "I have to buy separate food apart from what is being eaten at home." "I have to buy separate food apart from what is being eaten at home. You can only buy certain food e.g. broccoli and cabbage (and the family does not eat it)." "We are not eating the same food (the family says my food is not nice). Then I have to buy my own and cook my own food. I eat meat and rice and they eat meat and porridge (because porridge has too much water)." "You have to be choosy: there is a lot of salt in my family's porridge and meat and then my food is separate with less salt, cold porridge and olive (veg) oil in my meat and normal (sunflower oil) in my family's meat." "I must buy things the rest of the family does not eat e.g. Futurelife." "Most of the foods that I must eat are not eaten at home; the foods that are regularly eaten at home are food with salt (soup, aromat, tin stuff) and food with too much sugar (chocolates, watermelon, tea with sugar, cookies). " "I have to cook two pots of meat." "I buy my own food and the family separate food e.g. family likes liver and chicken feet and then I buy T-bone beef, they buy 4 x 2L Coke and now I have to also buy 4 x 2L Sprite for myself." "I buy food that other people don't buy. I buy food with vitamins and they buy potatoes and cabbage that is not so expensive and maize porridge is expensive." "We eat separately (I eat fish, mix veg, white bread, apples, pears and just one egg). I cook my food soggy and I don't fry it." "The kids don't like my food (they don't like slap tjips without salt and meat without spices) thus I cook two pots of meat and that is more expensive." "I buy different foods for myself (e.g. oats, bread and rusks) my family eats other food (e.g. chicken livers, butternut, spinach and potato)." "I don't eat the same food as my family and I must buy other foods e.g. rice, meat that does not have a lot of oil (e.g. chicken), I can't drink fizzy cool drink and I can't eat spicy foods." "You must buy different types of food e.g. Apple cool drink for yourself whereas the wife and kids drink Coke and then you can't buy two different cool drinks."	12	32.4

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Prescribed foods are more expensive than typical/traditional food: "Right food is more expensive because you are not use to it. Green vegetables should be eaten instead of potatoes and yellow vegetables. Rice can be stored for one month." "You are not eating normal food e.g. cranberry juice is more expensive than other juice." "Meat without skin is more expensive; long-life milk is more expensive than 2L fresh milk or maas. Yoghurt is also expensive, now I must eat a lot of yoghurt, more than before I became ill." "Protein and fresh veg is not cheap. Quick lunches like a pie you can't have because you should add a salad and cheaper fast foods you can't eat and healthier meals are more expensive." "Appletiser is expensive; fruits are expensive (e.g. pears)." "A lot of food that we must eat are too expensive e.g. fish, jam, rama and pork." "I do not have money to buy carrots, rice and meat." "The grant is too small to afford the food that I must eat e.g. corn flakes and chicken." "Macaroni, Cerelac, rice and oil are expensive; I mustn't eat pap. Even though I am not allowed to eat pap and vetkoek - I eat it because other food is too expensive." "The foods are expensive e.g. Appletiser is more expensive than Coke; you must eat fruits and veg every day and I can't afford it." "Expensive foods: rice, corn flakes, chicken and sugar." "Fruit and veg and meat are expensive." "I only receive pension and fish and apples are expensive." "Oros and brown rice are expensive; you can't buy the cheaper white rice." "Specific foods that you should buy are not always cheap (e.g. fish and butternut)."	11	29.7
Restricted foods are cheaper than prescribed foods: "Bananas are cheaper than berries." "Usual foods that are easy/cheaper to buy are restricted (e.g. normally I would have eaten pap and milk for a week long and drink coffee the whole day but now it is restricted). Usual/ cheaper food also contains salt." "Oil (the usual one) is cheap but I can't buy it." "Fruit like oranges are cheap but I can't eat it, I can only eat naartjies." "You can't buy the cheaper ones (you should buy chicken breasts and pumpkin)." "You are not allowed to eat cheap processed meats." "Tin fish is cheaper but I can't eat it."	3	8.1

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
The family is obliged to buy and eat non-traditional food: "The family must be included; food that they never would have eaten should be bought now." "My family is now obliged to eat almost the same food as me and we do not enjoy it that much. I must eat brown rice and they like white rice. I mustn't eat a lot of maize porridge and my family enjoys eating it."	2	5.4
Did not understand the question: "Did not understand THE question."	1	2.7
Limited variety of food (see Table 4.54 for statements that supported this theme).	1	2.7
Separate/ different/non-traditional food should be bought (see the top of this table for statements that supported this theme). AND **Incorrect nutrition knowledge**: "Oil gives me high blood sugar thus I use less."	1	2.7
Prescribed foods are more expensive than typical/traditional food (see the top of this table for statements that supported this theme). AND **Prescribed food can only be bought at special shops**: "You have to go to a special market (PnP) is far and it has a special aisle for diabetic food: Diabetic fruit juice and sugar that we must use for diabetics." "Correct foods are expensive at Shoprite."	1	2.7
Prescribed foods are more expensive than typical/traditional food (see the top of this table for statements that supported this theme). AND **Restricted foods are cheaper than prescribed foods** (see the top of this table for statements that supported this theme). AND **Less expensive food are bought regardless if it is restricted or not** (see Table 4.54 for statements that supported this theme).	1	2.7
Prescribed foods are more expensive than typical/traditional food (see the top of this table for statements that supported this theme). AND **Food selections are tiresome:** "There are lots of different foods that we must eat and we are used to only eating pap and milk and mix veg." "When I cook and buy groceries I must choose different kinds of meat and chicken and red meat must be excluded."	1	2.7

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Prescribed foods are not available in rural areas: "In the rural areas there is not a lot of food available. There isn't fresh veg every day and there is no provita's and then you can't drive to Bloemfontein for those foods."	1	2.7
Restricted foods are cheaper than prescribed foods (see the top of this table for statements that supported this theme). AND **Prescribed foods are more expensive than typical/traditional food** (see the top of this table for statements that supported this theme). AND **Separate/ Different/Non-Traditional food should be bought** (see the top of this table for statements that supported this theme). AND **Restricted favourite foods will be eaten regardless**: "I buy beef even though I am not supposed to eat it - I like it."	1	2.7
Food selections are tiresome (see the top of this table for statements that supported this theme).	1	2.7

4.8.2.3 Explanations for perceiving the renal diet as not cheaper, nor more expensive than a regular diet

Eighteen participants (25.7 %) did not feel that the renal diet was cheaper, nor more expensive than a regular diet. Most (55.6 %, n= 10) indicated that the costs incurred by their dietary restrictions were not any different to the costs for the rest of the family's diet (Table 4.56), either because the family changed their eating habits to fit those of the participant, or because the participant had not had to change their diets much since diagnosis (e.g. "We never ate a lot of biltong – which is expensive"). Others indicated that the same food was bought for the whole family (33.3 %, n= 6).

Table 4.56: Reasons given for perceiving the cost of the prescribed eating pattern for persons with kidney failure on MHD as neither cheaper, nor more expensive (n= 18)

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Everybody in the family eats the same food: "We are eating more or less the same; my family changed their eating habits for me as prescribed." "I eat the same food as the rest of my family." "We eat at home the same food and we do not go out for take-a ways." "My family eats the same food as me because I cook." "We still eat the same foods as before and foods like biltong, that is restricted, wasn't part of my diet before the disease because it is expensive." "We spend the same amount of money to buy food for the family; the food is not specially for me." "No extra or less food; I eat the same food as the family they just eat less potatoes then I do."	10	55.6
Similar foods are bought for the whole family: "We buy the same groceries for everybody and everybody eats it e.g. cereals, veggies, fruits and we only buy chicken." "When you buy an apple it is the same cost for a person with or without the disease." "I buy chicken for the whole family and I buy in bulk." "We still eat three times per day and the food that I must eat are in the house e.g. apples, chicken, fish and veg." "The same budget as before, I still use now, to buy food." "The same food - only the way of preparation differs."	5	27.8
Prescribed food is available: "The food that I can eat is available at every supermarket."	1	5.6
Similar foods are bought for the whole family (see the top of this table for statements that supported this theme). AND **Same food budget and restricted foods are only eaten by family:** "I buy things that my family wants to eat but then I do not eat it."	1	5.6
Family support: "My family did not complain that my diet is more expensive."	1	5.6

4.8.2.4 Explanations for not being able to answer the question

Three people mentioned that they did know how to perceive the cost of the renal diet, because they were uninformed about the diet, whilst one person indicated that he/she did not understand the question.

4.8.3 Attitudes towards the specific types of foods that are allowed in the renal diet

Answers to the question: "Describe your feelings towards the food that you can eat with the prescribed eating pattern for persons with kidney failure on hemodialysis." are summarised in Table 4.57. More than half (55.7 %, n= 39) reported that they liked the food that they were allowed to eat, whilst 15.7 % (n= 11) said they did not like the food. A fifth (22.9 %, n= 16) reported a neutral feeling towards the allowed foods.

Table 4.57: Reported feelings towards the specific foods allowed on the prescribed eating pattern for persons with kidney failure on MHD (n= 70)

Variable	Number of participants (n)	Percentage (%)
I like it	39	55.7
I do not like it	11	15.7
Neutral feeling	16	22.9
Nobody has explained what food I am allowed to eat and what not	4	5.7

4.8.3.1 Explanations for being positive about the foods allowed in the renal diet

Of the participants (55.7 %, n= 39) that were positive about the specific foods allowed in the renal diet, almost a quarter (23.1 %, n= 9) reported that they felt this way, because they perceived eating as an enjoyable experience (Table 4.58). Around a fifth (18 %, n= 7) reported that they felt that eating the allowed food had health benefits (e.g. "It gives me energy", "It helps me to feel better", and "It keeps me fit"). Another 18 % (n= 7) indicated that they had become used to the required dietary changes (e.g. "It is the same food, but with less salt", "I became used to eating less steak"). Conversely, (12.8 %, n= 5) that indicated they felt positive, reasoned negatively that they did not have an alternative option (e.g. "I have to learn to eat it whether I like it or not") or that food is tasteless without salt (2.6 %, n= 1).

Table 4.58: Reasons for positive attitude towards food that are allowed to be eaten in larger amounts on the prescribed eating pattern for persons with kidney failure on MHD (n= 39)

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Enjoyment of eating: "I feel hungry." "I love to eat because I am hungry. I love pap or rice and meat, Kentucky and Nando's." "I like all kinds of food it's a pity that I am restricted in certain foods." "I like rice, porridge and meat." "I enjoy it, they are tasty." "Appels are tasty. You are not allowed to eat bananas." "I like naartjies, chicken and pork." "I enjoy food I don't just eat food to survive."	9	23.1
Adherence is important and results in health: "It is better for your health." "It gives me energy." "It helps me to feel better." "Adherences keep me fit while on dialysis and that is important." "Food with no salt and oil is good because I cannot excrete salt." "If I eat correctly I am the one who benefits."	7	18.0
Adjusted to the eating pattern: "I do not use a lot of salt and fat and became use to it." "I am already use to peas and cabbage; my family eats a lot of spinach but I am not supposed to eat it." "Food without salt tastes okay for me." "They don't have salt but they are nice e.g. pumpkin, carrots, fish, green beans and apples." "I became used to it because I eat the food every day." "The same food as before but only with less salt." "I became use to eating less steak."	7	18.0

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
No alternative option but to accept it: "I do not have another option." "Because I am instructed to eat; I do not want to eat because I do not have a free choice (even though I love apples, etc.)." "I must eat it because I am ill." "I must eat otherwise I don't survive." "I must accept my disease and thus like the food." "I am ill and must listen to the doctor's instructions." "Veg, I don't like it but I eat it e.g. broccoli." "I have to learn to eat it whether I like it or not." "It is all that I can eat; now I like it but in the beginning, it was tough."	5	12.8
Adherence results in feeling better: "The foods are suitable for you; if I eat correctly I don't vomit." "The foods are helping me to feel better, less swollen and less kidney problems. I must drink Rooibos." "I don't feel bad (e.g. not sleeping well, discomfort, bad feelings of over indulgence) after eating it." "If I don't eat it, I go back to hospital.'	4	10.3
Adherence will result in less harm: "They are not causing any harm to my health." "Help me to live normally and does not cause me any harm. I like meat (chicken and pork)."	2	5.1
Compliant to allowed foods: "No problems / I don't mind."	1	2.6

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Compliant to allowed foods (see above in this table for the statement that supported this theme). AND **Favourite foods are restricted**: "Most of the foods I like are the ones that are being restricted e.g. guava, coca-cola and salt." "I mind being restricted eating foods that I like e.g. watermelon and dairy." "Some food I should eat but they are not my favourites; my favourite foods are meat and soup." "Nice salty foods e.g. meat are restricted. Chicken pies, meatballs, chicken stew - I like, but I can't eat it." "I can't eat dry beans anymore and bananas are not allowed." "You can't eat all kinds of food only certain ones e.g. coke you can't drink but you can drink sprite and ginger beer."	1	2.6
Food is tasteless without salt: "Eggs and porridge does not taste nice without salt. And then you should cook two pots; one with salt and the other without." "The salt restriction makes food not tasty and it depends on your blood pressure - higher BP less salt." "The food tastes bland without salt." "Especially meat and spinach is tasteless without salt. We are not allowed to use salt we must eat the food as it is." "Most of the food does not taste nice due to lack of salt."	1	2.6
Preparing prescribed food is doable accept the soaking and rinsing process: "If there is no brown bread I bake it myself. I like vegetables and it is allowed. The process of soaking and rinsing vegetables and red meat in water takes too long."	1	2.6
Allowed foods are enjoyable if cooked adequately: "I like food; I prepare it for myself in an interesting manner and enjoy it. I fry lamb tjops and frozen stir-fry veggies in olive oil, it is more tasty than just boiled."	1	2.6

4.8.3.2 Explanations for being negative towards the foods allowed in the renal diet

As summarised in Table 4.59, of those participants that had a negative attitude towards the foods allowed in the renal diet, almost half (45.5 %, n= 5) indicated that they felt this way because food was tasteless without salt. Two participants (18.2 %) respectively, felt that

there were extensive restrictions (limited choice of foods) and that favourite foods were restricted.

Table 4.59: Reasons for negative attitude towards food that are allowed to be eaten in larger amounts of the prescribed eating pattern for persons with kidney failure on MHD (n= 11)

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Food is tasteless without salt (see Table 4.58 for the statements that supported this theme).	5	45.5
No alternative option but to accept it (see Table 4.58 for the statements that supported this theme).	1	9.1
Restricted foods are not enjoyable: "I do not like the food in hospital but at home I eat the food I like."	1	9.1
Favourite foods are restricted (see Table 4.58 for the statements that supported this theme). AND **Extensive restrictions and limited variety**: "Too many restrictions." "Limited choice - before I ate everything. I don't like choosing - it is not easy."	1	9.1
Allowed food is monotonous: "You get tired of eating the same food; I am fed up with eating chicken all the time." "I do not like to eat pap every day, and I do not like avoiding a lot of vegetables."	1	9.1
Allowed foods are more expensive than restricted foods: "I don't have enough money to buy the correct food e.g. fruits." "I like milk as well as samp and beans and it is also cheaper but we mustn't eat it." "Apples and pears are more expensive than oranges." AND **Favourite foods are restricted** (see Table 4.58 for the statements that supported this theme).	1	9.1
Extensive restrictions and limited variety (see above in this table for the statements that supported this theme).	1	9.1

4.8.3.3 Explanations for being neutral towards the foods allowed in the renal diet

As summarised in Table 4.60, those participants that reported a neutral attitude towards food that they were allowed to eat on the renal diet, four (25 %) answered that they felt this

way because they did not have another option (e.g. “I have to learn to eat it whether I like it or not.”). Others (25 %, n= 4) explained that favourite foods were being restricted and, thus, they felt neutral. Another reason given for feeling neutral, was prescribed foods are more expensive (12.5 %, n= 2).

Table 4.60: Reasons for neutral attitude towards food that are allowed to be eaten in larger amounts of the prescribed eating pattern for persons with kidney failure on MHD (n= 16)

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
No alternative option but to accept it (see Table 4.58 for the statements that supported this theme).	2	12.5
Food is tasteless without salt (see Table 4.58 for the statements that supported this theme).	2	12.5
Favourite foods are restricted (see Table 4.58 for the statements that supported this theme).	2	12.5
Usual/typical/traditional foods are restricted: “Food that I didn't grow up eating I must eat now like peas, cauliflower, oats and cooked wheat kernels.” “Different food then I am use to eating (I am use to coke and beer) and e.g. veg without salt (I am not use to that).”	2	12.5
No alternative option but to accept it (see Table 4.58 for the statements that supported this theme). AND **Adherence is important and results in health** (see Table 4.58 for the statements that supported this theme).	1	6.3
No alternative option but to accept it (see Table 4.58 for the statements that supported this theme). AND **Favourite foods are restricted** (see Table 4.58 for the statements that supported this theme).	1	6.3
The prescribed diet is similar to the pre-disease diet: “Usually I didn't eat a lot of salt so it wasn't a big change for me.”	1	6.3

Reported reasons (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)	Number of participants (n)	Percentage (%)
Favourite foods are restricted (see Table 4.58 for the statements that supported this theme). AND **Allowed foods are more expensive than restricted foods** (see Table 4.59 for the statements that supported this theme). AND **Restricted food are more available**: "Oranges are more available (found easily) but are not allowed."	1	6.3
Allowed food is monotonous (see Table 4.59 for the statements that supported this theme).	1	6.3
Allowed foods are more expensive than restricted foods (see Table 4.59 for the statements that supported this theme).	1	6.3
Lack of taste if prescribed preparation/cooking method are followed: "Foods that are cooked too long don't taste nice e.g. fish, chicken, spinach, potato, beetroot, green beans, pumpkin and vegetables."	1	6.3
"Difficult to answer."	1	6.3

4.8.3.4 Explanations for not being able to answer the question

Four people mentioned that they did know how to perceive the foods prescribed in the renal diet, because they were uninformed about the diet.

4.9 Practices

Practices regarding adherence to the renal diet is summarised in Table 4.61. Most participants (61.4 %, n= 46) indicated that they could only eat the correct amounts of restricted foods sometimes, thus, adhere to the renal diet. The majority of participants (69.3 %, n= 52) also reported that their families supported them to follow the prescribed diet, but the rest perceived support only occasionally (22.7 %, n= 17) or never (8 %, n= 6).

Only 24 % (n= 18) reported that they always measured their food with scales, spoons and cups, whilst, half of the group (53.3 %, n= 40) indicated that they never do.

Overall, only 26.7 % (n= 20) of the participants reported that they never buy (eat) take-away food, whilst, 41.3 % (n= 31) did so once per week or more often.

Overall, 17.3 % (n= 13) reported that, in the previous week, they had not adhered to the renal diet at all; half (52 %, n= 39) reported that they had followed the diet on 1 – 5 days; and less than a third (30.7 %, n= 23) reported that they had followed the renal diet on 6 – 7 days, which is considered good practice.

Table 4.61: Practices regarding adherence to the prescribed eating pattern for persons with renal failure on MHD (n= 75)

Variable	Number of participants (n)	Percentage (%)
Are you able to eat the correct amounts of restricted food?		
Always	22	29.3
Sometimes	46	61.4
Never	7	9.3
Does your family support you to follow the correct diet?		
Always	52	69.3
Sometimes	17	22.7
Never	6	8.0
Do you measure your food using scales, different size spoons and cups?		
Always	18	24.0
Sometimes	17	22.7
Never	40	53.3
How many times do you eat take-aways (per month or per week)?		
0 x / month/week	20	26.7
1 x / month (0.25 x / week)	12	16.0
2 x / month (0.5 x / week)	11	14.7
3 x / month (0.75 x / week)	1	1.3
1 x / week	15	20.0
2 x / week	4	5.3
3 x / week	9	12.0
4 x / week	2	2.7
5 x / week	1	1.3
Number of days during the previous week that the prescribed eating pattern for persons with kidney failure on hemodialysis were followed		
0 Days	13	17.3
1 Day	5	6.7
2 Days	2	2.7

Variable	Number of participants (n)	Percentage (%)
3 Days	13	17.3
4 Days	11	14.7
5 Days	8	10.7
6 Days	6	8.0
7 Days	17	22.7

4.9.1 Scoring of overall practices regarding adherence to the renal diet

When all the questions in the practices section of the questionnaire were scored as indicated in chapter 3, most participants (61.4 %, n= 46) reported poor adherence practices to the prescribed eating pattern for persons with kidney failure on MHD (Table 4.62). Only one in four participants (25.3 %, n= 19) reported good adherence practices. The other 13.3 % (n= 10) reported average adherence practices.

Table 4.62: Classification of the scoring of reported adherence practices to the prescribed eating pattern for persons with kidney failure on MHD (n= 75)

Classification	Number of participants (n)	Percentage (%)
Poor practice (<50 %)	46	61.4
Average practice (≥50 – 75 %)	10	13.3
Good practice (≥75 %)	19	25.3

4.10 Involvement of a dietitian in the treatment of renal patients

The answers to questions assessing the involvement of the dietitian in the treatment of the participants are summarised in Table 4.63 to Table 4.67.

4.10.1 Source of education regarding the renal diet

As summarised in Table 4.63, most participants (77.3 %, n= 58) indicated that they were educated about the renal diet by a dietitian. Other health professionals that participants reported receiving dietary education from, included nurses (46.7 %, n= 35) and doctors (25.3 %, n= 19), whilst a few participants received dietary information form unit managers (4 %, n= 3) and clinical technicians (4 %, n= 3). Only 17.3 % (n= 13) reported that they made use of

printed or internet educational materials (from trusted sources). Overall, 14.6 % (n= 11) reported receiving dietary advice from family and friends.

Table 4.63: Persons involved in teaching about the prescribed eating pattern for persons with kidney failure on MHD

Person involved (more than one person could be indicated)	Number of participants (n)	Percentage (%)
Healthcare professionals		
Dietitian	58	77.3
Nurse	35	46.7
Doctor	19	25.3
Unit manager and family sessions with unit manager	3	4.0
Professors	1	1.3
Dietetic students	1	1.3
Other professionals		
Clinical technician (renal technicians)	3	4.0
Social worker	1	1.3
Printed or electronic educational material		
Information pamphlets	6	8.0
Internet	5	6.7
Books (self-bought) [#]	1	1.3
Books (available for reading at the renal unit)	1	1.3
Popular media		
Newspaper article	1	1.3
Health magazine	1	1.3
Family and friends		
Mother	2	2.7
Wife	4	5.3
Elders (about traditional herbs)	1	1.3
Uninformed family members	1	1.3
Sister (who is a teacher)	1	1.3
Friend who is also on dialysis	2	2.7

[#] You are not alone, living with kidney disease: one patient to another, by H. Keith McAdams

4.10.2 History of consultations with a dietitian

As summarised in Table 4.64, most of the participants (84 %, n= 63) indicated that they had consulted a dietitian (either in hospital, at the dialysis unit and/or privately) since being on MHD. Overall, 16 % (n= 12) reported that they had never consulted a dietitian.

Table 4.64: History of having consulted a dietitian or not, since being on MHD (n= 75)

Variable	Number of participants (n)	Percentage (%)
Had consulted a dietitian	63	84.0
Had not consulted a dietitian	12	16.0

As summarised in Table 4.65, of those that consulted a dietitian, only half (52.4 %, n= 33) reported that they completely understood the nutrition education given by the dietitian, whilst 47.6 % (n= 30) reported that they had only partially understood the dietitian's dietary education. No one reported that they did not understand the dietitian at all.

Reasons for not fully comprehending the nutritional education rendered by a dietitian are also summarised in Table 4.65. Around a third (31 %, n= 9) reported language barriers as the reason. The second most frequently reported reasons for not understanding completely, were (i) that the motivation (advantages and disadvantages of following the prescribed eating pattern) was not explained clearly (20.7 %, n= 6), and (ii) that the prescribed foods were not always available or was too expensive to buy (20.7 %, n= 6). Other reported reasons included that all the information was new, that the contents of reading material were forgotten, and that it was difficult to comply with the measuring and amounts of food prescribed.

Table 4.65: Self-reported comprehension of nutrition education received from consultations with a dietitian (n= 63)

Variables	Number of participants (n)	Percentage (%)
Level of comprehension (How much did participant understand?)		
Complete comprehension of nutrition education	33	52.4
Partial comprehension of nutrition education	30	47.6
No comprehension of nutrition education	0	0

Variables	Number of participants (n)	Percentage (%)
Reasons for partial comprehension (n= 30) (not understanding all of the information); (under the suggested themes [in bold], similar reasons were clustered together, and some participants gave more than one reason)		
Language barriers: "I did not understand the language." "Difficult to understand the dietitian."	9	31.0
The motivation (advantages and disadvantages of following the prescribed eating pattern) is not clear: "I wondered about the reasons why I can't eat the food I like." "I mustn't drink a lot of water or juice (only 500ml a day); but water was good for me?" "It is difficult to understand why you can't eat your favourite dish e.g. pork chops, red meat, braaiwors." "If they explained advantages and disadvantages it would help me understand why I should follow the diet." "I didn't see the reason why I should follow the diet and that was confusing."	6	20.7
Prescribed foods are not available or too expensive: "The dietitian did not understand that there will be challenges to follow the diet and that the situation isn't always favourable to buy the prescribed food." "I can't afford some of the food." "Money difficulties to buy separate foods." "I understood what they taught but I am restricted in implementation." "All the foods that were mentioned are not in the home, so how can you follow it?"	6	20.7
All information is new: "All the information was new." "The first time I knew little about the kidneys; now I know more." "When I started it was confusing but talking to the nurses often made me realise what to eat and what not."	3	10.4
Reading material is not read or forgotten easily: "The nurses gave me pamphlets to read but I can't remember them." "I forget."	3	10.4
Difficult to comply with measuring and amounts of prescribed food: "Difficult to comply with the amounts of food." "Pap I eat more of that is prescribed." "It is difficult to measure the amounts the dietitian prescribes."	3	10.4

Variables	Number of participants (n)	Percentage (%)
Uncertain of specific foods to eat and avoid: "It wasn't clearly explained which food has more phosphate and which food doesn't have phosphate." "I am not sure if I may eat red meat and how much I can eat of it." "I am not sure if I may eat pasta and how much of it." "Mincemeat and wors may I eat it or not? Is wors like polony that I am not allowed to eat?" "Juice has different varieties but can I only drink red?" "Whiskey - can I drink a bottle a month? I am not sure if I may drink it and how much?"	2	6.9
Medical aids does not pay for dietetic services: "I can't pay the dietitian and the medical aid restricts me."	2	6.9
Uncertain of allowed alternative foods: "The dietitian did not give alternatives." "They did not explain how to make red meat healthier; I've seen the veg sausages but did not try it because I am not a vegetarian."	2	6.9
Level of nutrition education is too difficult: "Complicated." "The terms are confusing/unknown e.g. carbohydrates as well as (and in Afrikaans "Kalium" and "Kalsium")."	2	6.9
Difficult to comply with restriction of favourite foods: "If you like it you will continue to eat it e.g. chocolate."	2	6.9
Extensive restrictions of food: "Too many restrictions." "There is a lot of food that I mustn't eat e.g. yoghurt, russians, chips, all fruit except pear and apple."	2	6.9
Incomplete nutrition education: "They did not talk about what foods I should eat and what not but more about the drinks that I should drink."	1	3.5
Overload of information: "Too much talking and too much information in one consultation."	1	3.5
Excessive pressure to comply; possibly when person is not ready for change: "The dietitian put too much unnecessary pressure on me when explaining what will happen if I do not get the correct food."	1	3.5
Reasons for food restrictions not religiously acceptable: "If God made the food why can't I eat the natural food?"	1	3.5

Variables	Number of participants (n)	Percentage (%)
Reading not the preferred method of learning: "I am too lazy to read myself."	1	3.5
Prescribed food is not typical/ traditional: "Some of the food I am not used to e.g. beetroot."	1	3.5
Appetite loss: "Sometimes you lose appetite."	1	3.5
Working outside the home makes compliance difficult: "If you are a working person you don't follow it - no time to comply." "If you are working outside you buy take-a-ways but at home you can manage yourself."	1	3.5
Fear of peer/social unconformity: "If you are in a group (work) you eat what they do e.g. russians and chips."	1	3.5
Difficulty in planning the eating plan: "I have to think about it (plan) the diet."	1	3.5
Unreliable, and infrequent nutrition education: "They say they will come again for a follow-up and then they don't come."	1	3.5
Unawareness of sub-optimal timing for nutrition education: "I was too tired to listen."	1	3.5
No nutrition education material to refer back to: "I did not get a diet list to check that I am eating correctly every day."	1	3.5
Use of unfamiliar terms in nutrition education: "The labels of food contain brand names and the dietitians only use the general name e.g. they only say margarine and not "Flora" or "Rama"."	1	3.5

4.10.3 Scoring of the dietitian's involvement in the treatment of participants

The scoring of the dietitian's involvement to promote adherence to the prescribed eating pattern for persons with kidney failure on MHD, as indicated in chapter 3, is classified in Table 4.66. Most participants (77.3 %, n= 58) reported zero to one consultation with a dietitian per dialysis year, which, according to NKF recommendations, is insufficient (NKF-K/DOQI, 2000:S46; Fouque et al., 2007:52). Noteworthy, is that 16 % (n= 12) of these participants had never consulted with a dietitian since being on MHD, and a third (34.7 %, n= 26) had consulted a dietitian only once every two years or less.

Few participants (4 %, n= 3) reported average involvement of a dietitian (two to three visits per dialysis year) and only 18.7 % (n= 14) reported sufficient involvement of a dietitian (three or more visits per dialysis year) according to the recommendation by NKF (NKF-K/DOQI 2000:S46).

Table 4.66: Classification of the dietitian's involvement in the treatment of persons with kidney failure on MHD (NKF-K/DOQI 2000:S46; Fouque et al., 2007:52) (n= 75)

Variable	Number of participants (n)	Percentage (%)
Minimal involvement: 0 – 1 visit per dialysis year	58	77.3
Average involvement: 2 – 3 visits per dialysis year	3	4.0
Sufficient involvement: >3 visits per dialysis year	14	18.7

4.10.4 Associations between the involvement of a dietitian and overall knowledge scores

The involvement of a dietitian has the potential to increase knowledge regarding important and demanding concepts of the dietary treatment in MHD. According to Table 4.67, most participants had a rather comprehensive knowledge of food sources high in phosphate regardless the involvement of a dietitian. Concepts that were poorly understood by the small group (18.7 %, n= 14) that had sufficient involvement of a dietitian, were the reason why certain food needs to be restricted (phosphate mineral content of food), and the names and correct use of phosphate binders.

Table 4.67 The association between knowledge and the involvement of a dietitian (NKF-K/DOQI 2000:S46; Fouque et al., 2007:52) (n= 75)

Variable	Minimal involvement: 0 – 1 visits per dialysis year (77.3 %, n= 58)	Average involvement: 2 – 3 visits per dialysis year (4.0 %, n= 3)	Sufficient involvement: >3 visits per dialysis year (18.7 %, n= 14)
Overall knowledge			
Poor knowledge (<50 % correct answers)	46.5 %, n= 27	0	71.4 %, n= 10
Average knowledge (≥50 – 75 % correct answers)	48.3 %, n= 28	66.7 %, n= 2	28.6 %, n= 4
Good knowledge (≥75 % correct answers)	5.2 %, n= 3	33.3 %, n= 1	0

Variable	Minimal involvement: 0 – 1 visits per dialysis year (77.3 %, n= 58)	Average involvement: 2 – 3 visits per dialysis year (4.0 %, n= 3)	Sufficient involvement: >3 visits per dialysis year (18.7 %, n= 14)
Knowledge regarding phosphate concepts			
Knowledge of high phosphate foods			
Poor knowledge (<50 % correct answers)	10.3 %, n= 6	0	7.1 %, n= 1
Average knowledge (≥50 – 75 % correct answers)	12.1 %, n= 7	0	21.4 %, n= 3
Good knowledge (≥75 % correct answers)	77.6 %, n= 45	100.0 %, n= 3	71.5 %, n= 10
Knowledge of mineral content of high phosphate foods that should be restricted			
Poor knowledge (<50 % correct answers)	74.1 %, n= 43	0	85.7 %, n= 12
Average knowledge (≥50 – 75 % correct answers)	13.8 %, n= 8	33.3 %, n= 1	14.3 %, n= 2
Good knowledge (≥75 % correct answers)	12.1 %, n= 7	66.7 %, n= 2	0
Knowledge of phosphate binder medication (name and correct way to consume)			
Poor knowledge (<50% correct answers)	56.9 %, n= 33	66.7 %, n= 2	64.3 %, n= 9
Average knowledge (≥50 – 75% correct answers)	20.7 %, n= 12	33.3 %, n= 1	7.1 %, n= 1
Good knowledge (≥75% correct answers)	22.4 %, n= 13	0	28.6 %, n= 4

4.10.5 Association between the involvement of a dietitian and serum phosphate levels

There were no statistically significant associations between the involvement of a dietitian and serum phosphate levels (Table 4.68). Nonetheless, the majority (78.9 %, n= 15) of participants that had a high phosphate levels (>1.8 mmol/L) reported minimal involvement of a dietitian (0 – 1 visits per dialysis year) (NKF-K/DOQI 2000:S46; Fouque et al., 2007:52; NKF, 2009).

Table 4.68: Association between the involvement of a dietitian in the treatment of persons with kidney failure on MHD and serum phosphate levels (NKF-K/DOQI 2000:S46; Fouque et al., 2007:52; NKF, 2009) (n= 75)

Variable	Minimal involvement: 0 – 1 visit per dialysis year (77.3 %, n= 58)	Average involvement: 2 – 3 visits per dialysis year (4 %, n= 3)	Sufficient involvement: >3 visits per dialysis year (18.7 %, n= 14)
Serum phosphate levels			
Serum phosphate levels (<0.8 mmol/L) (8.0 %, n= 6)	50.0 %. n= 3	0	50.0 %, n= 3
Serum phosphate levels (0.8 – 1.8 mmol/L) (66.7 %, n= 50)	80.0 %, n= 40	2.0 %, n= 1	18.0 %, n= 9
Serum phosphate levels (>1.8 mmol/L) (25.3 %, n= 19)	78.9 %, n= 15	10.5%, n= 2	10.5 %, n= 2

CHAPTER 5: DISCUSSION OF RESULTS

5.1 Introduction

In this chapter, the results are discussed and interpreted in context of the current literature. Limitations encountered in the study and how these may have influenced the findings, are also discussed.

5.2 Socio-demographic information

The socio-demographic information of the participants in the current study, was mainly compared to that of participants in the only two other sub-Saharan African studies to date, that also described the nutritional status of the MHD population: namely a study by Halle et al. (2014) in Cameroon with 113 participants, and another by Botha (2015) in the Eastern Cape, South Africa with 68 participants.

5.2.1 Gender distribution

Although the participants in the current study were conveniently selected, as indicated in chapter 3, the final sample comprised 70.7 % (n= 53) men, thus, representing a male: female ratio of about 2.4:1. Vermaak et al. (2018:1954), that used the same population as the current study, found 59.6 % (n= 59) men. This concurs with the findings of both Halle et al. (2014:545) and Botha (2015:53) who also had predominantly male populations of 66.4 % and 57.4 %, respectively.

A recent study using NHANES 2011-2012 data, found that the prevalence for Stage 3 and 4 CKD was 7.8 % amongst women and 5.9 % amongst men in the United States (Murphy et al., 2016:476). However, a longitudinal 10-year Norwegian population-based study that included 3 047 patients with CKD, found that GFR declined quicker and deteriorate to ESRD faster in men than in women (Eriksen & Ingebretsen, 2006:375), which may explain the findings of the current study. Conversely, a Japanese population-based study found no difference in the decline rate of GFR between men and women (Imai et al, 2008:435). Further studies are needed to determine the role of gender in the decline in kidney function, particularly in SA.

The few South African studies involving participants on CAPD, found only slight gender differences. In a study by Isla et al. (2014:520) in Limpopo province, South Africa, for example, 52 % (n= 79) of the population were men, and in the study by Abdu et al. (2011:151), 54 % (n= 27) were men. The findings of the current study could therefore point to men receiving MHD rather than CAPD as RTT. This concurs with the findings of the International Dialysis Outcomes and Practice Patterns Study (DOPPS) (Hecking et al., 2014:online). This study included data of more than 200 000 patients on MHD from Australia, Belgium, Canada, France, Germany, Italy, Japan, New Zealand, Spain, Sweden, the United Kingdom, and the United States. A global (as yet unexplained) trend towards fewer women than men treated with MHD for RRT of ESRD, at least in developed countries, was found.

5.2.2 Age

The age distribution in the current study indicates that most of participants were middle-aged and older (median age; 50.5 years), which Vermaak et al. (2018:1954) also found, using the same study population as the current study. Halle et al. (2014:547) found a similar age distribution with ages ranging from 18 to 76 years and a mean (± standard deviation) of 49.4 (±13.3) years. Botha (2015:53) also found that the median age of the participants was 54.5 years, whilst the largest percentage of participants (63.2 %), was >50 years of age. Murphy et al. (2016:476), using NHANES 2011-2012 data, found that the prevalence for Stage 3 and 4 CKD was considerably higher amongst older adults, with 21.7 % in the 65 – 79 years age group compared to under 5 % in the 40 – 65 years age group. Notably, in the current study most (70.7 %, n= 53) were in the 40 – 65 year age group, which may indicate ESRD occurring at a younger age in Bloemfontein, which is a medium-sized city in a developing country, compared to the United Stated as a developed country. No nationally representative data on the prevalence of CKD, ESRD and RRT, is however, available for South Africa to make meaningful comparisons.

Conversely, Isla et al., (2014:520) reported an average age of 36.8 ± 11.4 years in a South African, CAPD population. This could possibly reflect that CAPD is sometimes introduced before MHD as illustrated by the current study where 37.0 % (n= 27) of the participants on MHD had received CAPD prior to MHD (Table 4.7).

5.2.3 Education level

Education levels in the current study ranged from Grade 4 to tertiary education level (28 %, n= 21). In the study by Botha (2016:53), 47.1 % of participants had finished secondary school and 47.1 % had a tertiary education. In the Cameroon study (Halle et al., 2014:547), only 25 % (n= 28) had primary education. According to Zimmerman & Woolf (2014:1), research in the developing world has identified educational status as a major predictor of health outcomes. The Dutch Adult Literacy and Life Skills Survey (Van der Heide, et al., 2013:172) found that one of the underlying mechanisms that drive the relationship between low level of education and poor health, is health literacy. Health literacy, in turn, is defined by the U.S. Institute of Medicine as "the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions" (Van der Heide, et al., 2013:172). Acknowledging the wide scope of education levels represented by the MHD population, as seen in the current study, is clearly important for designing appropriate nutritional interventions.

5.2.4 Relationship status

Half of the participants (56.0 %, n= 42) in the current study were married and two (2.7 %) were living with a partner. Similarly, Botha (2016:53) found that 58.8 % participants were married. Halle et al. (2014:547) found a higher number of couples (72 %) amongst the MHD population in Cameroon. In the current study, 40.1 % (n= 31) of the participants were single, divorced, or widowed. A meta-analysis by Ghimire et al. (2015:online) found that being single, divorced or widowed negatively affected adherence to medication therapy, including phosphate binder medication, in patients with MHD. Also, being single may implicate being solely responsible for preparing food, which may negatively influence eating behaviour.

5.2.5 Type of housing and utilities

The majority of participants (97.3 %, n= 73) in the current study lived in formal brick dwellings, with 2.7 % (n= 2) indicating that they lived in shacks (informal housing). This concurs with the findings of Isla et al. (2014:520) in Limpopo, where 87.5 % of their study population on CAPD lived in brick houses.

The majority of the participants in the current study had running tap water (89.3 %, n= 67) and electricity (98.7 %, n= 74) in their homes, whilst in the Limpopo study only 41.4 % had tap water, and 86.2 % had electricity (Isla et al., 2014:520). The difference may be ascribed to the fact that many participants in the Limpopo study lived in rural areas.

5.2.6 Household density ratio

Despite having the necessary utilities, according to the calculated HDR, most participants (64 %, n= 48) in the current study lived in over-crowded conditions. Naicker (2003:S119) mentioned that the high level of over-crowded living conditions in Africa leads to increased risk of infectious diseases in an already vulnerable MHD population.

5.2.7 Travel mode and time to dialysis unit

Almost half (46.7 %, n= 35) of the participants in the current study used their own car to drive to and from the dialysis units, whilst 25.3 % (n= 19) travelled by taxi services. Both modes of transport incur costs that may negatively affect household food security, although this was not assessed in the current study. An additional 18.7 % (n= 14) utilised the government hospitals' ambulance/commuting services, which, while free, may be more time consuming. The median one-way travel time to the dialysis unit was 30 minutes (ranging from five minutes to three hours). Time spent travelling on dialysis days, when long hours are already spent at the dialysis unit, can influence food procurement, preparation and consumption, particularly for a patient that travels six hours to and from the dialysis unit, three times per week.

5.2.8 Household finances

A recent Australian study on the impact of CKD on household income (Morton et al., 2018:610) found that more advanced CKD is associated with increased odds of falling into poverty. In the current study, unemployment rates and reliance on social grants were high, and median per person and household incomes were low. The median percentage of income available for food per person, per month was only 27.3 %, compared to 40 % suggested by PACSA, a social justice organisation that publishes a monthly food basket index, which contextualises the cost of food for working class households against the

backdrop of low wages, social grants and high unemployment levels in South Africa (Peyper, 2016:online). It is not possible to decern to what extent having ESRD and being on MHD contributed to the dire financial situation of a large number of the participants in the current study, but money available for food would clearly be an important determining factor when designing and implementing nutrition interventions in this context. In the current study, the negative impact of a poor financial status was highlighted by a significant association between household income and the quality of protein in the diet (discussed in section 4.6.1.4). Food, however, is also just one vital household need, with housing, utilities and travelling costs being others. For example, in the current study over-crowding was significantly associated with low income (section 4.2.2.1).

5.2.9 Linguistic data

Most participants were SeSotho or Afrikaans speaking. This concurs with the distribution of languages in the Free State, where 62.1 % of the population speaks Sesotho and 14.5 % speaks Afrikaans (Census SA, 2011:32). However, English was the language in which most participants reported having received written (73.4 %, n= 55), as well as verbal nutrition information (60 %, n= 45). Only 21 % (n= 16) and 30.7 % (n= 23) respectively, reported that they had received written and/or verbal education in their home language. Lopez et al. (2007:142) found that 35 % of their Hispanic study group had received diet education in Spanish and, of those that received it in English, 27 % would have preferred Spanish. Preference for language of written and verbal nutrition education was not measured in the current study. Low health literacy, as defined in section 5.2.3 (Van der Heide, et al., 2013:172), is compounded by language issues, thus, receiving instruction in one's home language, contributes to improved health literacy (Larsen, 2007:711).

5.2.10 Person preparing meals in the home

Almost a third (29.3 %, n= 22) of participants were solely responsible for preparing their own meals at home. An additional 18 participants (24 %), shared meal preparation responsibilities with others in the home and for almost half of the group (46.7 %) meal preparation were the responsibility of female family members. Of the 40 participants (53.3 %) who were involved in the preparation of their own meals, most (62.5 %, n= 25) reported

that, when they had to prepare their own meals, they were sometimes tired, whilst, 12.5 % (n= 5) reported that they were always tired. St-Jules et al. (2016:120,122) found that 59 % of 140 participants on MHD in Pennsylvania (US), reported they were too tired to cook. This was statistically significantly inversely associated with energy intake (p= 0.02), thus hindering adherence to the renal diet.

Overall, 26.7 % (n= 20) of the men in the current study, had their meals primarily prepared by their wives. For the rest of the participants, female family members (e.g. mothers and daughters) were also involved in meal preparation. This suggests that family members need to be included in nutrition education as they are the ones mostly preparing the food.

Durose et al. (2004:37) reported that in a UK study of 82 participants on MHD, 45 % of participants were self-responsible for planning and cooking of meals, 41 % reported that a friend/spouse/carer was responsible for the cooking and almost all (93 %) of the friends/spouses/carers, were also planning the meals. Interestingly, 3 % in that study reported that they eat out and therefore do not plan meals. The responsibility of meal planning was not measured in the current study, but it seems reasonable that the person who cooks is also responsible for planning the meal.

In addition, in the current study most participants were men (70.7 %), which, given the traditional gender roles regarding meal planning and preperation, could explain the lower percentage (29.3 %) of participants that were responsible for preparing their own meals. However, in the study by Durose et al. (2004:37), the gender distribution was more equal (58 %, men) and therefore could explain why more (45 %) were responsible for cooking, compared to the current study.

5.3 Medical information

Medical information included in the current study, included participants' history of dialysis, cause(s) of their kidney disease and co-morbidities, as well as data on the prescription medications, self-reported appetites and food intakes, and tobacco use (as this negatively impacts on health and is specifically contra-indicated in patients with kidney failure).

5.3.1 History of kidney failure and comorbidities present

More than a third 37 % (n= 27) of participants had received CAPD before being switched to MHD. After the switch from CAPD to MHD, the difference in dietary recommendations could be confusing to patients. When on MHD, fluid and potassium restrictions are greater than in CAPD, phosphate and salt restrictions stay relatively the same, and protein is somewhat more restricted (1.2 g/kg vs. 1.3 g/kg) than in CAPD. Energy intake from food generally needs to be greater when on MHD than when on CAPD to meet requirements, as the dextrose content of the dialysate in CAPD adds a substantial amount of daily energy (NKF-K/DOQI, 2000, 2006).

Overall, 36 % (n= 27) had been receiving MHD for less than two years. Another quarter (24 %, n= 18) of the group had been on dialysis between two and five years. Furthermore, 25.3 % (n= 19) had been on MHD between six and ten years, and eleven participants (14.7 %) had been on MHD for longer than 10 years. Halle et al. (2014:547) reported that in the Cameroon study, 26 % of patients had been on dialysis for less than one year, 42 % for 1 – 3 years, and 33 % for more than three years. Botha (2016:54) reported that in Eastern Cape, South Africa, a quarter of participants have been on dialysis for a year or less, 48.9 % have been on dialysis for 1 – 5 years and 26.5 % being on dialysis for more than 5 years. This shows that MHD as a treatment modality can be successfully continued over many years. Consequently, despite shorter life expectancy on MHD than in the general population, mortality rates have dropped amongst MHD patients in the US due to improvements in therapy over recent years (Collins et al., 2010:S1).

In the patient files, hypertension was indicated as a single etiology of kidney failure for more than a third of the group (37.3 %, n= 28); for 6.7 % (n= 5) diabetes mellitus was indicated and for a tenth (10.7 %, n= 8), hypertension and diabetes mellitus were indicated together. For 28 % (n= 21) the etiology for kidney failure was missing from the files. Polycystic kidneys were indicated for 4.0 % (n= 3). Isla et al. (2014:521) reported the causes for ESRD in Limpopo, South Africa as hypertension (23 %), diabetes mellitus (9.9 %), obstructive uropathy (5.9 %), chronic glomerulonephritis (8.6 %), autosomal dominant polycystic kidney disease (5.3 %), and unknown cause (47.4 %). This supports that hypertension and diabetes

mellitus are the most common causes for renal failure in South Africa, as stated by Meyers (2015:232).

The most frequent co-morbidities reported in the patient files, were hypertension (54.7 %, n= 41), diabetes mellitus (18.7 %, n= 14) and anemia (21.3 %, n= 16). Overall, 13.3 % (n= 10) of participants had three or more co-morbidities. For 32 % (n= 24) of participants, no co-morbidities were recorded in the file. More attention should be paid to keeping proper record of co-morbidities in the patient files, as this assists the entire health care team to improve care. Dietitians rely greatly on the patients' files for information, because the referral data is not always complete regarding the patients' medical details.

5.3.2 Prescribed medications

Overall, 113 different types of medications were prescribed for participants (Table 4.8). Most participants 82.9 % (n= 58) were prescribed phosphate binders, with calcium carbonate being used most frequently (58.6 %), followed by calcium acetate (36.2 %) and calcium citrate (5.2 %). Calcium based phosphate binders are frequently used for cost-effectiveness (Wang et al., 2015:online), to prevent renal bone disease. Even though it is prescribed, some patients do not take them because of frequent gastro-intestinal disturbances e.g. bloatedness and severe constipation (which is further hampered by the fluid restriction). Other reasons for omitting them include: forgetting, difficult to chew and swallow pills with every meal, do not like being reminded they are sick and they cannot feel a difference after taking them (Wilkens et al., 2017:722). In the current study adherence to phosphate binder medication was not investigated.

Anaemia of renal disease is treated with recombinant human EPO (rHuEPO) which increases erythrocyte production 2.5 fold. The rise in haematocrit (the volume percentage of erythrocytes in the blood) increases the need for iron which is supplemented via intravenous infusion in patients receiving MHD (Wilkens et al., 2012:825). However, in the current study, the administering of intravenous iron was less (58.6 %, n= 41) than the EPO (Eprex, Aranesp and Mircera) administration (78.6 %, n= 55). Moreover, (28 %, n= 21) of the current group had below normal hemoglobin values (<10 g/dL) and 18.9 % (n= 14) had below normal (<20 %) TSAT values (see section 5.5.8), which could indicate an iron shortage and/or EPO insufficiency (Wish, 2006:s5; Nelms & Lacey, 2016:548).

Five participants (6.7 %) did not have scripts in their files. As mentioned in the previous section on co-morbidities, proper record keeping in patient files should be visible for the entire health care team to improve care.

5.3.3 Appetite

Most participants reported that they had good to very good appetites and food intakes on both dialysis days and non-dialysis days. Only around 10 % reported poor, to very poor appetites and food intakes.

Poor appetite increased the mortality rate four times in a study done by Kalantar-Zadeh et al. (2004:299) on 331 MHD patients in the US. The authors found loss of appetite in 38 %. Loss of appetite was associated with a decrease in hemoglobin (Hb), protein intake, quality of life, as well as an increase in inflammation markers, erythropoietin dose and hospitalisation (Kalantar-Zadeh et al., 2004:299). Consequently, even though the rate of poor appetite is lower in the current study, appetite should be assessed regularly and poor appetite may warrant intervention with medical nutrition therapy to minimise poor outcomes (Kalantar-Zadeh et al., 2004:299).

In addition, in the current study, no statistically significant differences were found between the appetite and food intake on dialysis and non-dialysis days. Therefore appetite and food intake should be noted throughout, and individually, and the assumption should not be made that there are specific days (dialysis or non-dialysis) which appetite are always better.

5.3.4 Use of tobacco

Most participants (58.7 %, n= 44) reported that they had never used tobacco. Twenty (26.6 %) of the participants were ex-users and eleven (14.7 %) were using tobacco at the time of the study.

Patients with diabetes who were receiving MHD, and who were smoking, were shown to have higher fibrinogen levels, higher systolic blood pressure values, higher incidence of myocardial infarctions, and significantly decreased 5-year survival rates when compared with non-smoking patients on MHD (Biesenbach & Zazgornik, 1996:625). Gerntholtz et al. (2015:4-5) therefore advised that smoking cessation should be a focus area for the South African population with CKD, to avoid the development of cardiovascular disease.

Of these 11 tobacco users in the current study, four had not changed their habits with regard to the frequency of tobacco usage, whilst the others reported that they were smoking less than in the past. Smoking habits can possibly point to readiness-to-change regarding all aspects of behaviour, and subsequently, readiness for changing dietary habits as well (Prochaska et al., 1994:39).

5.4 Anthropometric data

Anthropometric data collected in this study included post dialysis BMI, muscle mass (measured as AMA) and fat percentage, the risk for CVD based on WC and WHtR as well as their dry weights of three months prior to the study.

5.4.1 Body mass index (calculated using edema-free body weight)

Although CKD and MHD are often associated with PEM, only four participants in the current study were underweight (Grade 1 CED) (BMI <18.5 kg/m^2) (Bethesda, 1998:xiv; WHO, 1995:364; WHO, 2000:9). Conversely, more than half of the participants (56.8 %, n= 42) had above normal BMIs (median 26.4 kg/m^2); 23 % overweight (BMI $\geq$25 kg/m^2) and 33 % were obese (BMI >30 kg/m^2).

In Cameroon, Halle et al. (2014:548) found that 28.3 % had a BMI <20 kg/m^2, whilst, only 21.2 % had a BMI $\geq$25 kg/m^2. In the Eastern Cape study, Botha (2016:60) found that 85.3 % of patients on MHD had a BMI ≥21 kg/m^2; unfortunately the cut-off points were estimated to allocate malnutrition and did not distinguish between normal, overweight and obesity.

In Limpopo, Isla et al. (2014:522) found that patients on CAPD with a lower BMI (mean 22.8 kg/m^2 ± 4.5) were more likely to develop infections, pass away, or change to MHD than those with a higher BMI (mean 25.5 kg/m^2 ±5.4). The mean value for BMI in this study was 24.3 kg/m^2 (n= 152).

An analysis of worldwide trends in population means of BMI from 1980 to 2008, showed an increase of between 0.4 – 0.5 kg/m^2 per decade for men and women (Shisana et al., 2013:144). In South Africa, data from SANHANES-1 indicated mean BMI values above 25 kg/m^2 for the age groups 45 – 54 years of age, 55 – 64 years of age, and 65 years of age and older to be: 31.7 kg/m^2, 31.3 kg/m^2, 30.0 kg/m^2 for women, respectively; and 26.0 kg/m^2, 25.2 kg/m^2, 25.6 kg/m^2 for men, respectively (Shisana et al., 2013:136). The high prevalence

of overweight and obesity in the current study may reflect the high prevalence of overweight and obesity in the surrounding population.

A high BMI may be one of the risk factors for increased CVD risk in the population on MHD and therefore it is advised to maintain a BMI of 25 – 28 kg/m^2 (Raymond & Couch, 2012:755; NKF-KDOQI, 2003:S43). In the current study, a high percentage of participants with ESRD had BMIs above this recommendation. However, in the past decade there are several epidemiological studies indicating that higher BMI (>25 kg/m^2) is associated with significantly better survival in patients with ESRD (including in patients with CVD) (Kalantar-Zadeh et al., 2006:202; Ikizler et al., 2013:1100). Recently, the KDIGO Lipid Workgroup continued to advise that patients with ESRD (receiving dialysis), who present with hypertriglyceridemia, should employ therapeutic lifestyle changes that includes weight loss (KDIGO, 2013b:284).

It is also not clear if the current ideal, 'safer' BMI-range (25 – 28 kg/m^2) (NKF-KDOQI, 2003:S43) applies more to patients with Stage 1 – 4 CKD, where delay to ESRD continues to be a priority.

5.4.2 Arm muscle area

Despite the high mean BMI, more than half the group (56 %, n= 42) had an AMA ≤15th percentile which indicates low muscle mass. In fact, of those (56 %) who had an AMA ≤15th percentile, 31 % (n= 13) had a BMI ≥25 kg/m^2 (indicating being overweight), and 57 % (n= 24) had a normal BMI (>18.5 kg/m^2 – <24.9 kg/m^2). Having a low AMA with normal to high BMI can possibly result in overlooking malnutrition by health professionals.

In the Eastern Cape, Leclercq (2015:67) studied 26 patients on CAPD and found that, based on AMA, only 7.7 % (n= 2) were wasted (AMA <5th percentile) and a further 27 % had an AMA <25th percentile. In the current study, the AMA were remarkably lower than what Leclercq (2015:67) found.

For patients on CAPD, the dietary recommendation for protein intake is higher than for those on MHD, because of greater albumin and amino acid losses in the spent dialysate. Losses with MHD may be less, because dialysis only occurs three times weekly and not daily as in CAPD (Fouque et al., 2011:351). Nevertheless, malnutrition in the MHD population is

prevalent as several studies demonstrated that these patients eat less protein and less energy than prescribed; one reason being decreased appetite (Fouque et al., 2011:349; Fouque et al., 2007:46). Reasons for the unexpected difference in AMA between the participants on MHD in this study, and those of participants on CAPD in the Eastern Cape study, may be that those on CAPD consumed adequate dietary protein and/or adequate energy (from dialysate and diet) so that the dietary protein could be utilised for muscle synthesis.

In the MHD population studied by Halle et al. (2014:546, 548) in Cameroon, muscle mass was evaluated based on mid arm muscle circumference (MAMC), which was calculated from the equation: MAMC (cm) = MAC - 0.314 x TSF (cm). Malnourishment was classified as having a TSF or MAMC less than 90 % of the 50th percentile. Mean MAMC was 23.7 cm (range 11.9 – 31.6), and, according to their classification, 23.9 % of the participants had muscle wasting, which is only about half the level of muscle wasting found in the current study. The different methodology, however, makes it difficult to directly compare results between these two studies.

The prevalence of a high BMI (which may be considered a protective factor) in the current study population, may possibly mask PEM, even though skeletal muscle is not only dependant on dietary protein intake alone, but also on age and resistance exercises. Hidden PEM may be a risk factor for increased morbidity and mortality in the MHD population (Ruperto et al., 2016:44). Gaining a larger body size while losing muscle, is associated with a poorer outcome than losing weight, whilst gaining muscle mass (Kalantar-Zadeh et al., 2010b:991). In the current study this might be the case, as 31 % were overweight but with a low muscle mass (section 4.4.2).

Many studies worldwide have confirmed that PEM is closely associated with major adverse clinical outcomes, increased rates of hospitalisation, and increased mortality amongst patients with ESRD (Ikizler et al., 2013:1096).

5.4.3 Body fat percentage

Almost a third of the group (29.3 %, n= 22) had very low body fat percentages (<5th percentile), whilst a quarter 25.4 % (n= 19), had above normal body fat percentages (>85th

percentile) which includes 11 participants (14.7 %) with excessive body fat (>95th percentile).

This portrays a wide range for body fat percentages in the current study. In the past decade there were several epidemiological studies indicating that higher BMI, regardless of etiology (that is, increased adiposity and/or lean body mass [muscle]), is associated with significantly better survival in patients with ESRD (Kalantar-Zadeh et al., 2006:202; Ikizler et al., 2013:1100). In this study, 38.7 % (n= 29) had a body fat percentage <15th percentile, which could predict poor survival.

Even though high levels of body fat indicate better survival in MHD, it yields a lower quality of life (Kalantar-Zadeh et al., 2006:202). This complicates obesity management, as quality of life is reduced with a high fat mass. In contrast, even 1 % of fat loss has been associated with a mortality risk that was twice that of patients who gained fat (1 %) (Kalantar-Zadeh et al., 2006:202).

5.4.4 Waist circumference

According to WC, 81.8 % (n= 18) of women and 48 % (n= 25) of men were at risk for developing metabolic complications as defined for the general population (Alberti et al., 2009:1642).

Postorino et al. (2011:765) found that, specifically in patients on MHD, a fixed excess in triglycerides (0.56 mmol/L) was associated with a progressive lower risk of all-cause and cardiovascular mortality in patients with a WC <95cm. Above this threshold, a progressive increased risk was found. Patients with CKD have increased expression of pro-inflammatory cytokines and adipokines in abdominal subcutaneous tissue compared with healthy controls (Carrero et al., 2013:81). Thus, although a high BMI in the setting of CKD may signal health and better nutritional status, excessive abdominal fat may be detrimental, because of metabolic derangements.

5.4.5 Waist-to-height ratio

Most of the participants (66.2 %, n= 49) had a WHtR >0.5, putting them at increased risk for metabolic comorbidities, such as hypertension, diabetes and CVD (Ashwell et al., 2012:284). Observational studies in patients with CKD link abdominal fat with inflammation, insulin

resistance, hyperadipokinemia, dyslipidaemia, oxidative stress and cardiovascular events (Cerrero et al., 2013:81). Ruperto et al. (2014:e196) found that increased WHtR was a predictive marker of metabolic syndrome (increased plasma glucose, serum triglycerides and MHDL cholesterol) and higher CV risk in patients on MHD. Moreover, in a study by Vogt et al. (2016:368) that included 98 middle aged patients, half men, the prevalence of metabolic syndrome (using diagnostic criteria from Harmonizing metabolic syndrome) was 74.5 %. Similarly, Vogt et al. (2016:368) also reported that WtHR was independently associated with the diagnosis of metabolic syndrome in patients on MHD (odds ratio, 1.21; 95 % confidence interval [1.09 ; 1.34], $p<0.01$) and predicted metabolic syndrome better than WC and BMI.

Individuals with metabolic syndrome have increased accumulation of abdominal fat and general obesity. Therefore, even though increased body weight seems protective, the distribution of fat in the abdomen seems to continue to hold a risk for increased mortality (Carrero et al., 2013:81).

5.4.6 Dry weight three months prior to the study

Comparing dry weight three months prior to the study to current dry weight showed that more than half (56.8 %, n= 42) of the participants gained weight in the preceding three months. A median of 0.55 kg was gained and weight changes ranged from 7.5 kg lost, to 8.6 kg gained. The researcher, at times, found it difficult to get the information for prior dry weight, as older patient notes were archived. It may be advisable that dry weight be noted quarterly and always be kept in summative manner in the current patient file. This would make it easier to detect weight loss and PEM, or, conversely, excessive weight gain that is not fluid related. Keeping record of dry weight can, thus, precautionary detect malnutrition.

5.4.7 Summary of anthropometry regarding nutritional status

Assessing nutritional status in MHD remains challenging; however, detecting changes in anthropometry seems most relevant. Even though, controversy remains over a high BMI and if it is, indeed, protective in persons who receive MHD; the measurement of body composition changes seems pertinent. In the current study 56 %, had an AMA $\leq 15^{th}$ percentile, 31 % (n= 13) of those had a BMI ≥ 25 kg/m^2 (indicating being overweight), and 57

% (n= 24) had a normal BMI (>18.5 kg/m^2 – <24.9 kg/m^2). Moreover, most of the participants (66.2 %, n= 49) had a WHtR >0.5 (Ashwell et al., 2012:284).

Beddhu et al. (2005:909) argues that, compared with normal BMI patients receiving MHD, who have "healthy" normal or high muscle mass, high-BMI dialysis patients have a survival advantage only if they have normal or high muscle mass, and they have higher mortality if their muscle mass is low. Furthermore, being overweight confers a survival advantage over undernutrition, however, higher muscle mass confers a survival advantage over being overweight, and, therefore, dialysis patients should be encouraged to gain muscle mass rather than fat mass (Beddhu et al., 2005:909); especially having fat in the abdominal area still seems unfavourable (Carrero et al., 2013:81).

5.5 Biochemistry

The recommended biochemical markers for the monitoring of CKD are discussed in context of other studies (NKF, 2009; Nelms & Lacey, 2016:534-536).

5.5.1 Serum albumin

Almost half of the participants (49.3 %, n= 37) had below normal serum albumin levels (<35 g/L). Serum albumin is a measure of both visceral protein status and the level of the acute phase inflammatory response (Nelms & Lacey, 2016:533). De Mutsert et al. (2009:127) did a prospective cohort on 454 MHD patients in the Netherlands and found that a decrease of 10 g/L in serum albumin in patients with MHD was associated with an increase of 47 % in their mortality risk. In their study, the mortality risk was mostly influenced by inflammatory markers and not so much by malnutrition. Therefore, serum albumin cannot be used alone as a marker for nutritional status. In the current study, CRP values as markers of inflammation, were not routinely available and therefore it is impossible to state, with certainty, that the low serum albumin levels were as a result of malnutrition.

Ruperto et al. (2016:38) found that the combined utilisation of serum albumin, percentage of mid-arm muscle circumference and standard body weight as PEM markers appears to be useful for nutritional-inflammatory status assessment and adds predictive value to the traditional indicators. Cut-off values for the combination of these markers have not been established, though.

According to the International society of renal nutrition and metabolism (ISRNM), PEM is diagnosed if three characteristics are present: (i) low serum levels of albumin, pre-albumin, or cholesterol; (ii) reduced body mass (low or reduced body or fat mass or weight loss with reduced intake of protein and energy); and (iii) reduced muscle mass (muscle wasting or sarcopenia, reduced mid-arm muscle circumference) (Fouque et al., 2008:391). Halle et al. (2014:548) found a serum albumin <40 g/L in one third of the participants in the Cameroon study. Twenty one percent of the participants demonstrated simultaneously low albumin, low BMI and low mid arm muscle circumference, a combination that defines PEM according to ISRNM (Fouque et al., 2008:391).

In the Limpopo study on participants who received CAPD, Isla et al. (2014:521) found a low mean serum albumin of 26.6 ± 5.5 g/L in 46.7 % (n= 71), and they were more likely to reach the proposed negative outcomes (change to MHD or pass away) of the study. Conversely, the other group with a higher mean serum albumin of 29.8 ± 4.7 g/L had positive outcomes (continuing on CAPD and no mortality).

Leclercq (2015:69) found that 92 % (n= 23) of the patients on CAPD in the Eastern Cape had serum albumin levels <35 g/L. This is twice the prevalence of low serum albumin levels found in the current study. However, infections are common in the CAPD population and the low albumin levels could thus have been a result of albumin being a negative acute phase protein, thus, indicating inflammation. Leclercq did not measure CRP, in addition, 56 % (n= 14) of the participants had a total dietary protein intake <1.2 g/kg recommended by K/DOQI (2000).

In the current study, of the 49.3 % (n= 37) who had serum albumin levels <35 g/L, 48.7 % (n= 18) simultaneously had an AMA of $\leq 5^{th}$ percentile (wasted). However, in the group with >35g/L serum albumin levels there was also 31.6 % (n= 12), which had an AMA of $\leq 5^{th}$ percentile (wasted). No statistically significant difference was found between the two serum albumin level groups regarding AMA (Chi-Square: p= 0.42). However, the median AMA (50.9 cm^2) of participants with a normal serum albumin level (>35 g/L) was substantially higher than the AMA (45.6 cm^2) of those participants with below normal albumin levels (<35 g/L). This difference of almost 5 cm^2 may be clinically significant, although not statistically

significant (Kruskal-Wallis test, Chi-square: p= 0.17), the difference might be expected to be statistically significant with a larger sample.

Low serum albumin, regardless of the etiology, needs attention to decrease mortality and morbidity and dietitian intervention is warranted if it is combined with other markers of low nutritional status (low body weight and low muscle mass) (Fouque et al, 2008:392).

5.5.2 Serum urea

As the NKF (2009) categorisation of serum urea does not indicate if serum urea values are for pre or post-dialysis, both values were categorised according to the same cut-off values in this study. Below normal (<21 mmol/L) serum urea values were found in (52.5 %, n= 32 calculated from 61) pre-dialysis, and in 97.9 % (n= 46 calculated from 47) post dialysis participants. This could possibly indicate an acute low protein intake or over-hydration as participants had been dialysed two days prior to when the blood was drawn (Nelms & Lacey, 2016:534). Over-hydration seems unlikely to be the reason, because all the participants, that had post-dialysis values, except one, had below normal serum urea levels (post-dialysis implies that extra fluid would have been taken off). Thus, the low serum urea levels could be indicating low protein intakes (see section 5.6.1).

Neither the Cameroon (Halle et al., 2014:548) or SA study (Botha, 2015:51) assessed serum urea therefore no comparisons could be made.

5.5.3 Serum creatinine

Almost all of the participants (90.7 %, n= 68) had normal serum creatinine values (177 – 1326 µmol/L). The value for normal creatinine in the current study, as indicated in chapter 3, was widespread, and according to Nelms & Lacey, (2016:534) even values of <884.2 µmol/L, can indicate muscle wasting and PEM. Whereas, in the current study a limiting factor could be the concealment of PEM, because too low cut-off values for serum creatinine were considered for PEM detection. Moreover, as low muscle mass was prevalent in the current study (section 5.4.2).

Neither the Cameroon (Halle et al., 2014:548) or SA study (Botha, 2015:51) assessed serum creatinine therefore no comparisons could be made.

5.5.4 C-reactive protein

No CRP testing was done to confirm inflammation in any of the participants in the six months prior to the study. According to the unit managers, the frequency of CRP testing was infrequent, if perfomed at all. Occasional testing is only done by special request when an infection is suspected. In the Cameroon study, Halle et al. (2014:548) found that 28 % of the patients on MHD had raised CRP (>6 mg/L).

In the absence of a pathogenic infection, elevation of CRP levels (usually >5 – 10 mg/L) indicates the activation of the inflammatory response due to metabolic stress. In patients with CKD on dialysis, most studies with high applicability found that elevated CRP levels predicted all-cause mortality (NKF, 2005:S84). Currently there is no consensus in the literature with regard to the optimal "cut-off" value for CRP levels to mark the presence of inflammation in patients with CKD (NKF, 2005:S84). However, according to the NKF, CRP levels should be within normal limits of standard reference ranges, which is <8 mg/L (Nelms & Lacey, 2016:534).

5.5.5 Serum electrolytes (phosphate, potassium and sodium)

Overall, around one in four (25.3 %, n= 19) participants had elevated levels of serum phosphate (>1.8 mmol/L) (NKF, 2009), and when the cut-off point for serum phosphate was lowered to >1.42 mmol/L, almost half (49.3 %, n= 37) had elevated phosphate levels.

Halle et al. (2014:548) reported that the median value for phosphate in the Cameroon study was 1.49 mmol/L (>1.4 mmol/L was considered as high), whilst, not reporting on the percentage that had above normal PO4 values.

Phosphate has a large molecular weight and is not easily removed by dialysis. Dietary restrictions of phosphate alone are not adequate to control serum phosphorous and nearly all patients on MHD require phosphate binding medications. Adequate homeostasis of serum phosphorous levels is needed for metabolic bone health and to maintain the phosphorus-calcium balance. High phosphate levels and low levels of serum calcium lead to over-secretion of parathyroid hormone (PTH) and, thus, secondary hyperparathyroidism. Increased PTH levels increase resorption of bone to provide calcium to maintain phosphorus-calcium balance. The reliance on bone calcium is due to dietary calcium not

being available, because the kidney is not able to convert inactive vitamin D to its active form, which is needed to absorb calcium from the gastrointestinal tract. The subsequent bone disease is named, renal osteodystrophy, and includes arteriosclerosis, which increases CVD risk (Wilkens et al., 2012:823).

High serum phosphate levels in the current study may be due to excessive dietary phosphate consumption and/or incorrect intake of phosphate binder medication (see 5.7.2).

Almost a third of the participants had elevated levels of serum potassium (28 %, n= 21). In view of the detrimental effects of high serum potassium levels on the heart (Nelms & Lacey, 2016:535), regulation is important. High potassium levels can be caused by high dietary intake, as well as gastrointestinal bleeding, trauma, hyperglycemia, medications (e.g. diuretics and aldosterone antagonistic overuse), inadequate dialysis or inappropriate dialysate potassium content. If all other causes are eliminated, potassium content in diet should be re-evaluated and restricted to recommendations by the dietitian (Wilkens et al., 2012:819).

Serum sodium levels were elevated in only 10.8 % (n= 8) of the participants. High serum sodium levels can be due to dehydration, but is often masked by water retention or diabetes insipidus, whereas low levels may be due to over-hydration, diuretic use, inappropriate antidiuretic hormone, burns, adrenal insufficiency, nephritis, hyperglycemia, diabetic acidosis, hyperproteinemia, and starvation (Nelms & Lacey, 2016:536). Serum sodium should be evaluated with fluid status, because high sodium levels with high fluid gains could possibly be due to high salty food intake. Conversely, if fluid gains are low this could be due to dehydration, which is rare. Low sodium levels and high fluid gains may be due to high dietary salt intake, which causes thirst and leads to high fluid consumption which has a dilution effect. Too much sodium and water raises blood pressure and can cause fluid overload, pulmonary edema, and congestive heart failure (Wilkens et al., 2012:819). Therefore, a proper evaluation by the dietitian is needed to assess if the serum sodium levels are due to incorrect sodium and fluid consumption.

5.5.6 Kinetic modelling

More than half of the group (54.7 %, n= 41) had Kt/V values below normal <1.4, but, at the same time, 40 % (n= 30) had above normal Kt/V values. Kinetic modelling is a method for evaluating the efficacy of dialysis that measures the removal of urea from the patient's blood over a given period (Wilkens et al., 2012:816). Inadequate dialysis sessions will lead to build up of more nitrogenous waste in the body and this has a negative impact on nutritional status (Wilkens et al., 2012:817). Only one measurement was taken, and an average value over a longer time could have given other results.

Halle et al. (2014:547) recorded a lower efficacy of dialysis in the Cameroon study (mean Kt/V 1.28), but noted that participants were only being dialysed twice weekly for four hours at a time, whereas in the current study, participants were dialysed three times per week for three to four hours at a time, which possibly increased the adequacy of dialysis.

5.5.7 Serum cholesterol

Serum cholesterol can be a marker for atherosclerotic CVD risk in MHD patients (Fouque et al., 2007:51; Wilkens et al., 2012:825). The patient with ESRD typically has an elevated serum triglyceride level with or without an increase in serum cholesterol level. Even though routine treatment for all ESRD patients with diet or pharmacologic agents remains controversial, a good case can be made for dietary and pharmacologic treatment for patients with underlying lipid disorders and evidence of atherosclerosis (Wilkens et al., 2012:825).

Serum cholesterol levels were only reported for 15 participants and of them, 53.3 % (n= 8) had below normal values (<3.8 mmol/L). Halle et al., (2014:548) reported 26.3 % with <4.1 mmol/L cholesterol in Cameroon and considered it an indicator for undernutrition. Low (<1.7 mmol/L) or declining serum cholesterol concentrations are predictive of increased mortality risk. Hypocholesterolemia is associated with chronic PEM due to poor oral intake and/or the presence of comorbid conditions, including inflammation. Individuals with low, low–normal (1.7 – 2.0 mmol/L), or declining serum cholesterol levels should be investigated for possible nutritional deficits, as well as for other comorbid conditions. Use of lipid-lowering drugs should be taken into account in the total cholesterol values and possibly be

cut-back when patients are malnourished or underweight (Fouque et al., 2007:51; Wilkens et al., 2012:825). In the current study, there were participants that used lipid lowering drugs (see 4.3.2) and usage should be evaluated in future with anthropometric review (see 5.4).

Consequently, more frequent cholesterol testing as part of PEM detection can be implemented for patients with ESRD in South Africa.

5.5.8 Hemoglobin A1c

HbA1c levels were only available for four participants, and 100 % of them were within normal values. The reason why only four participants had HbA1c measured was probably because HbA1c is deemed unreliable in the community who is receiving dialysis, although it is a cornerstone of evaluating long-term glucose control in the general diabetic population. During hemodialysis, the uremic environment, blood loss during treatments, anemia and frequent phlebotomy all contribute to decreased red blood cell (RBC) lifespan. Shortened RBC survival, red cell transfusions, EPO and iron administration are likely to lower the glycated process, thus giving a falsely low HbA1c value that does not accurately depict glycemic control (Peacock et al., 2008:1065).

Self-monitoring of blood glucose should be performed if glycated albumin, that reflects glycaemic control over a two-week period, is not available and it may be of greater value for predicting clinical outcomes (NKF-K/DOQI, 2012:867).

5.5.9 Hemoglobin, ferritin, transferrin saturation and white blood cells

Slightly more than a quarter (28 %, n= 21) of the group had below normal hemoglobin values (<10 g/dL). It is less than in the Cameroon study where Halle et al. (2014:548) reported that 82.7 % had hemoglobin values <11 g/dL, thus, had anemia. Untreated anemia can lead to cardiac and ventricular hypertrophy, angina, congestive heart failure, malnutrition, and impaired immunological response, and also has been associated with increased mortality (Nelms & Lacey, 2016:548). Possible reasons for a lower frequency of anemia in the current study is due to EPO treatment (see 5.3.2). Halle et al. (2014:548) did not elaborate on reasons for high anemia or report on erythropoietin stimulants in their study.

Anemia affects quality of life for patients on MHD, causing tiredness, low energy for daily activities (including eating activities), poor appetite, sleeplessness, concentration problems, dizziness, headaches, rapid heartbeat, shortness of breath and low mood (NKF, 2016:online).

More than half of the participants (52 %, n= 38) had above normal ferritin values. Ferritin is a protein that binds iron for storage, and according to Wilkens et al. (2012:825), is an accurate marker for iron stores in renal failure. On the other hand, ferritin is a positive acute phase protein and high levels may act as a marker of inflammation.

Wish (2006:s5) recommended that TSAT should be assessed together with ferritin as TSAT values below 20 %, with a normal or high ferritin value, can still be predictive of anemia, and patients with MHD respond well to iron treatment if EPO is sufficient. Most of the group (74.3 %, n= 55) had normal TSAT values, whilst 18.9 % (n= 14) had below normal (<20 %) TSAT values, which could indicate an iron shortage if EPO is sufficient (Wish, 2006:s5; Nelms & Lacey, 2016:548).

WBCs were normal in participants with available results (73.6 %, n= 34), of which none had elevated WBCs. Thus, no participants had elevated WBCs, which, indicates the absence of major infections, fever or trauma. Elevated ferritin and low albumin can therefore possibly be ascribed to chronic illness and low grade inflammation, and not to infection (Rossouw et al., 2010:89). This, however, cannot be confirmed in the current study, due to unavailable CRP. Nevertheless, 14 participants (26.4 %), had below normal WBCs which usually occur due to overwhelming infections, bone marrow failure and/or dietary deficiencies, but need to be assessed with other clinical signs (Rossouw et al., 2010:89).

5.5.10 Summary of biochemical data

As discussed above, without CRP testing, the low serum albumin levels found in a 49.3 % of the participants as well as hypocholesterolemia and low WBCs, cannot without a doubt be ascribed to malnutrition. Yet, low serum urea levels, together with low protein intakes (particularly low HBV protein), can be a sign of malnutrition. Likewise, PEM can be suspected if serum creatinine is low, along with muscle wasting.

5.6 Dietary intake data

The dietary intake data, collected with a recall of usual dietary intake on a typical non-dialysis day to assess total energy and macronutrient intakes, and with a semi-quantitative FFQ to assess overall dietary patterns, are summarised below. To the researcher's knowledge, based on an in-depth literature review, no other South African studies, other than Leclercq (2015:71), have reported on dietary intake data; even though the study was relating to CAPD patients, it will be used to draw comparisons.

5.6.1 Usual intake on a typical non-dialysis day

Almost half of the participants (44.6 %, n= 33) had an energy intake <30 kcal/kg (dry weight or adjusted edema free body weight). Conversely, the other half of the group had an energy intake >35 kcal/kg (NKF-K/DOQI, 2000, 2006). In the Eastern Cape, Leclercq (2015:71) found that in patients on CAPD, 72 % (n= 18) had an oral energy intake <30 kcal/kg (edema free body weight). This is a higher percentage than in the current study; however on average 60 % of the glucose content of the intraperitoneal dialysate in CAPD is absorbed as energy, decreasing dependence on oral intakes (Nelms & Lacey, 2016:540). In the CAPD population there is a trend that even when energy from dialysate is added, protein and energy intakes are still below recommendations (Nelms & Lacey, 2016:540). Thus, indeed, Leclercq (2015:71) also found that 56 % (n= 14) of participants on CAPD had a total protein intake <1.2 g/kg, with 64 % (n= 16) having less than optimum HBV protein intakes. In the current study, almost half of the participants (48.6 %, n= 36) on MHD had a total protein intake <1.2 g/kg (dry weight or adjusted edema free body weight), whereas the other half (43.3 %, n= 32) consumed more than 1.3 g/kg protein (NKF-K/DOQI, 2000, 2006). Overall, 40 % (n= 30) had inadequate HBV protein intakes (NKF-K/DOQI, 2000, 2006).

Consequently, the low dietary protein intake together with low HBV protein intake, in the current study, in relation to the PEM markers (low AMA, low serum albumin, low serum urea, hypocholesterolemia and low WBCs), could suggest chronic protein depletion and poor nutritional status (see sections 5.4.2 and 5.5).

In the current study, 50.7 % (n= 38) had above recommended intakes of carbohydrates, expressed as a percentage of total energy intake. Leclercq (2015:71) found only 16 % (n= 4),

ate more than the recommended amounts of carbohydrates. There is a possibility that eating too much carbohydrates, through its content of low biological value protein, can contribute to high serum urea and eventually loss of appetite, nausea, vomiting and can lead to malnutrition (Verseput, 2012:A82). High carbohydrate intake can also possibly replace HBV protein (animal protein).

Conversely, total fat intake, expressed as a percentage of total energy, was below recommended in 45.4 % (n= 34) of the participants. Leclercq (2015:71) found that 60 % (n= 15) of the study population on CAPD, consumed inadequate amounts of fat.

5.6.1.1 Association between serum phosphate levels and phosphate dietary intake

The estimated median milligram phosphate intake per day in the current study was 1 313 mg PO4/day. In another study on 20 patients on MHD in the Western Cape, median PO4 intake, measured with one 24h-recall of a typical day, was between 900 and 950 mg PO4/day (Freercks et al., 2012:610). In the current study, 60.8 % of participants (n= 45) had a dietary phosphate intake above the recommendation of 12 mg PO4/g protein (see Table 4.21) (NKF-K/DOQI, 2000, 2006, 2009; Nelms & Lacey, 2016:537).

When serum phosphate levels were stratified, according to phosphate intakes expressed as mg/g of protein, no statistically significantly differences were found between the three different intake groups (Table 4.21). It should be noted that serum phosphate levels are not only influenced by dietary phosphate intake, but also by adherence to phosphate binder medication and the adequacy of dialysis, amongst others. Nonetheless, a lower PO4 dietary intake is advised.

5.6.1.2 Association between years on dialysis and protein intake

No statistically significant difference was found in the current study between the median protein intake and the duration of dialysis. This is unlike the finding of St-Jules et al. (2016:122) where protein dietary intakes decreased after a longer duration of MHD treatment in years, therefore, possibly increasing risk of PEM. Noteworthy, the typical intake for a non-dialysis day in the current study was measured with only one adapted 24h-recall, which may only show possible trends.

5.6.1.3 Association between high biological value protein intake and household finances

In the current study, a statistically significant association was found between income and the intake of HBV protein (Table 4.23). Similarly, a statistically significant association was found between food cost per person and the intake of HBV protein (Table 4.24). The quality of the protein consumed by patients on MHD seems to be dependent on available household finances. This can be expected as meat, fish and poultry are more expensive than sources of low biological value protein.

5.6.2 Dietary patterns

The FFQ results of the current study, are discussed according to the number of participants that consumed the food, as well as frequencies of consumption, expressed in terms of the number of times per month, the food item was consumed. The percentage of participants that consumed a certain portion size (small, medium and large) is also discussed. The foods are grouped in food groups: dairy, meat, meat alternatives, bread and grains, snack products, vegetable, fruit, fat, condiments, miscellaneous foods, alcohol and take-away consumption. To the researcher's knowledge, based on an in-depth literature review, there has not been a FFQ executed in a South African, MHD population before.

5.6.2.1 Dairy

Milk is restricted due to the high PO4 content (110 mg PO4/ 125 ml), as well as the fluid contribution (Renalsmart, 2008:online; Herselman & Esau, 2005:51-57). Full cream and low fat milk were consumed by 65.3 % (n= 49) and 28 % (n= 21) of participants and median consumption was daily (28 times / month), mostly in small portion sizes (63 ml) by 77.6 %, and 62 %, respectively. In addition, other dairy products were also consumed, though less frequently than full cream milk. Overall, 70.7 % (n= 53) consumed yoghurt (at a median of four times per month) and 66.7 % (n= 50) consumed custard (at a median of twice per month); mostly in medium portion sizes (125 ml) (Table 4.26). The FFQ is, however, limited in identifying if certain foods, like milk, yoghurt and custard, were consumed on the same day, thus, raising concern for phosphate overconsumption (Renalsmart, 2008:online; Herselman & Esau, 2005:51-57).

5.6.2.2 Meat

Boerewors (sausage made with coarsely grounded beef and pork, seasoned with salt and spices, and therefore high in sodium [>430 mg Na/ 60 g]) (Herselman & Esau, 2005:51-57), was eaten by almost all (90.7 %, n= 68), at a median intake of four times per month; mostly (72 %) in a medium portion size (15 cm). Patients receiving MHD with high blood pressure, water retention and pulmonary edema should restrict high sodium foods like boerewors (Renalsmart, 2012b:online). Alternatively, low-salt recipes to manufacture boerewors could be developed.

More affordable, high salt (>430 mg Na/ portion) (Herselman & Esau, 2005:51-57), processed meat products (polony [70.7 %], viennas [49.3 %], and russians [53.3 %]), were eaten by slightly more participants and more frequently (median 4 – 8 times per month) than other expensive, and lower in sodium meat (beef [49.3 %] or mutton [61.3 %]) with a median of four times per month (Table 4.27).

Chicken and mince were not mentioned in the FFQ (limitation of the study) and only two (2.7 %) and seven (9.3 %) respectively, pointed it out when the question was asked if any other meat is consumed. Thus, chicken and mince probably needs a distinct mention in future FFQ's.

Home-cooked fish were eaten at a median of three times per month by four fifths (81.3 %, n= 61), with 70.5 % that fried it in egg-and-flour batter, and the majority (63.9 %) that ate a medium (90 g) portion size. The home-cooked fish in egg-and-flour batter could possibly increase the phosphate content of the diet (Herselman & Esau, 2005:51-57) and needs further investigation.

Tinned pilchards, a high PO4 meat (>100 mg PO4/ portion) (Herselman & Esau, 2005:51-57), were eaten by more (65 %, n= 45) participants compared to tinned tuna (32 %, n= 24), a low PO4 meat (<100 mg PO4/ portion) (Herselman & Esau, 2005:51-57). The reason for this needs to be explored further, as tinned tuna could be a good HBV, low phosphate protein.

5.6.2.3 Meat alternatives

Almost all (94.7 %, n= 71) consumed eggs with a median intake of 12 times per month and half (56.6 %) ate a medium portion size (2 eggs). In the South African renal exchange lists of

2005, egg is listed as a high, PO4 meat alternative and no mention is made of only egg whites (Herselman & Esau, 2005:51-57). Although, in the recently developed phosphate pyramid tool, egg white is prescribed as a low phosphate protein (5 mg PO4/ 3.6 g protein in one large egg white), which can be consumed unrestricted (Kalantar-Zadeh et al., 2010a:521; D'Alessandro et al., 2015:5). Furthermore, whole egg has a 10.5 mg PO4/g protein aDA, which is under the suggested rate of <12 mg PO4/g protein adjusted for digestion and absorption (NKF/KDOQI, 2009:S87). The South African renal exchange lists needs to be updated, to include egg whites and/or whole eggs where the phosphate digestion and bioavailability factors are considered, as this seems to be a frequent, low-cost protein intake.

Peanut butter, is another protein alternative that needs clarification regarding restriction, and is still classified as a high PO4 meat alternative according to the, 2005, South African renal exchange lists (Herselman & Esau, 2005:51-57). However, according to NKF/KDOQI (2009:S87) peanut butter is under 12 mg PO4/g protein aDA. Peanut butter was eaten by half (53.3 %, n= 40), with a median intake of four times per month. Subsequent clarity regarding the phosphate content is needed, in order to attain certainty, if it can be suggested as a lower cost HBV protein.

Cottage cheese, a low PO4 meat alternative (<100 mg PO4/ portion) (Herselman & Esau, 2005:51-57), was only eaten by few (4 %, n= 3). The reason for the low intake could possibly be that it is culturally unfamiliar, expensive or that participants are uneducated about it being a low PO4 protein.

Dried beans (legumes) could be a more affordable, high in fiber and low in saturated fat HBV protein option for MHD patients, where in the past it was restricted due to high PO4 content, which excluded digestion and bioavailability factors (NKF/KDOQI, 2009:S87). Dried beans were also specifically mentioned as one of the reasons for a negative attitude because it is a favourite food that is being restricted (Table 4.59). Increased legume intake could be encouraged in MHD patients, if it is re-classified in South Africa as under 12 mg PO4/g protein aDA (D'Alessandro et al., 2015:5). In the current study, dried beans were only consumed by 30.7 % (n= 23) with a twice monthly median intake. However, it should be noted that some participants mentioned it would be eaten more frequently in winter and

the first half of the FFQ's data measuring were done at the end of summer (end of April) which did not include the winter season in the prior six months. Samp and dried beans were not specifically asked in the FFQ; nonetheless, one participant did mention it under other food that is eaten often, and should therefore be included in future FFQs.

More participants (78.7 %, n= 59) ate canned sugar beans, which is high in sodium (357 mg Na/ 90 g) (Herselman & Esau, 2005:51-57), than cooked dried beans. Possible reasons for higher consumption could be that canned sugar beans are probably more convenient because it does not need prior soaking and lengthy cooking time as dried beans, which entails energy costs.

5.6.2.4 Bread and grains

Bread seems to be a staple food, as all (100 %, n= 75) consumed bread with a median intake of 28 times per month. In June 2016, legislation in South Africa had been passed in order to reduce the sodium content of bread per 100 g to 400 mg/ 100 g, and further to 380 mg/ 100 g in June 2019 (SA Gov. Gazette, 2013). Before 2013, the average slice of bread contained 650 mg/ 100g Na and contributed 1.6 g Na/person/day. (Bertram et al., 2012:744; SA Gov. Gazette, 2013). This legislation would be beneficial to this study's population, as bread was eaten daily and dietary sodium should be restricted (NKF-KDOQI, 2000, 2006).

Stiff maize porridge, was also eaten by a majority (96 %, n= 72), with a median intake of 12 times per month. Three quarters (75 %) ate a medium portion size (½ cup).

Corn flakes, a high sodium cereal (484 g Na/ 40 g) (Herselman & Esau, 2005:51-57), were eaten by almost half (49.3 %, n= 37) with a median intake of eight times per month. The high dietary sodium contribution from corn flakes could potentially increase BP, fluid overload and pulmonary edema (Renalsmart, 2012b:online). However, since June 2016, South African legislation enforces that cereal should have a sodium content of 500 mg/ 100 g or less (SA Gov Gazette, 2013). Some of the manufacturing companies did lower corn flakes sodium content to 301 mg Na/ 40 g but it still yields 752 mg Na/ 100 g (Kellogg's 2016:online). Conversely, according to the Food Finder® III (Version 1.1.3), the same incorrect sodium value analysis, which is 484 g Na /100 g corn flakes, are still used by the

South African renal exchange lists (2005), and therefore, possible incorrect dietary sodium intake analysis.

Crumbly maize porridge (8 %), instant maize/sorghum porridge (8 %), rice (6.7 %) and samp (6.7 %) were not considered in the FFQ (limitation of the study), and should therefore be included in future FFQs in this population.

5.6.2.5 Snack products

Biscuits were eaten by three quarters (78.7 %, n= 59) with a median intake of four times per month and more than half (57.6 %) ate a large portion size (4 biscuits). Moreover, biscuits are a high energy and fat but low potassium and fluid food source (Herselman & Esau, 2005:51-57). Subsequently, a renal friendly biscuit recipe could be developed and possibly increase the energy intake of participants with low BMIs, as it is already consumed often in this population.

Potato/maize chips, a high potassium, energy and fat starch (>100 mg K/ 50 g) (Herselman & Esau, 2005:51-57), were eaten by almost two thirds (64 %, n= 48), with a median intake of three times per month. The majority (81.2 %) ate a medium portion size (a small packet). South African legislation enforces a sodium reduction of potato crisps to 650 mg Na/ 100 g whereas maize chips (savoury snack) are only reduced to 800 mg Na/ 100 g (SA Gov. Gazette, 2013). Although potato chips should be lower in sodium, in accordance with legislation, the potassium content can still be a concern for MHD patients. With the current analysis program, and information on potato and maize chips labelling, there are discrepancies regarding the exact sodium and potassium content. In Food Finder® III (Version 1.1.3), potato chips contains 1 000 mg Na/ 100 g and 1 447 mg K/ 100 g. Furthermore, according to the Food Finder® III (Version 1.1.3), maize chips has 1 067 mg Na/ 100 g and 109 mg K/ 100 g. However, according to one of the manufacturers labelling, maize chips has 778 mg Na/100 g, and no online info on potassium (Simba, 2018:online). The above mentioned discrepancies can encumber accurate electrolyte dietary intake analysis. In addition, it is probable that there should be a differentiation made between the intake of potato and maize chips in FFQs for MHD patients, due to dissimilar sodium content.

Chocolate, is high in protein, potassium, phosphate and sodium (Herselman & Esau, 2005:51-57), and were eaten by 44 % (n= 33), with a median intake of twice per month. Most (66.7 %) ate a small portion size (¼ slab). In order to ensure a low phosphate intake, chocolate is restricted together with dairy. In order to avoid overconsumption of electrolytes (especially phosphates), it is advised that half a cup of milk/yoghurt/custard/inkomazi, should not be eaten simultaneously with half a slab chocolate on the same day (Renalsmart, 2008:online). The FFQ, in the current study, was limited in measuring whether chocolate was eaten together with other restricted dairy products on the same day.

5.6.2.6 Vegetables

Vegetables are restricted in MHD mostly due to potassium, which is most common in fruit and vegetables with orange and yellow coloured flesh (Wilkens et al., 2012:823). However, this could pose a problem as vegetables also contain fiber (Tappenden, 2017:11), that can help regulate bowel movement. Constipation is often a problem for MHD patients taking phosphate binders (Wilkens et al., 2017:722) (see section 5.3.2). Furthermore, interest arose on the use of a Mediterranean diet (rich in fruit and vegetables), in the CKD population, for its anti-inflammatory properties, improving lipid profile and reducing oxidant stress (Fouque et al., 2011:355). In the current study, vegetables that were included in the FFQ were consumed infrequently with median intakes of four to twelve times per month (Table 4.31), which could result in low fiber intake. Moreover, low to moderate potassium vegetables (e.g. cabbage and big leave spinach) (Herselman & Esau, 2005:51-57), were often cooked with potatoes, which can escalate the potassium content of otherwise low to moderate potassium vegetables.

Almost all (97.3 %, n= 73), consumed potato, a high potassium starchy vegetable (>100 mg K/ 100 g) (Herselman & Esau, 2005:51-57), with a median intake of eight times per month, and more than half (54.8 %) ate a medium portion size (100 g/ 1 medium) and three out of ten (31.5 %) ate two medium potatoes (large portion), which is considered double the recommendation (Herselman & Esau, 2005:51-57; Renalsmart, 2012a:online). Furthermore, the current study did not measure soaking practices (Beto et al., 2016:26), to reduce the

potassium content of potato and considering the large portion size for some, it could indicate overconsumption.

In addition, more people ate spinach with potato (65.3 %, n= 49), which would be higher in potassium than spinach without potato (33.3 %, n= 25) (Herselman & Esau, 2005:51-57). The median monthly consumption of spinach with potato was four times and almost three quarters (73.5 %) ate a medium portion size (½ cup). In the FFQ there was not a differentiation between cooked Swiss chard, bigger leave spinach (moderate potassium, 120-200 mg K / portion) and small leave spinach (high potassium, >200 mg K/ portion) (Herselman & Esau, 2005:51-57). Furthermore, some of the participants (5.3 %, n= 4) indicated that they did not eat "morogo", which included spinach as well as cabbage ("morogo", is a collective term in Sesotho for green leafy vegetables). The reason for this avoidance is because they were advised to avoid "morogo"; this could indicate a possible language barrier because cabbage are allowed (<120 mg K/ portion) (Herselman & Esau, 2005:51-57).

Almost all (89.3 %, n= 67) ate cabbage with a median intake of eight times per month; interestingly, almost a third (31.3 %, n= 21) of those prepared cabbage with potato and one participant cooked green beans with potato. This could increase the potassium content of these otherwise classified as low and moderate potassium vegetables (Herselman & Esau, 2005:51-57).

Four out of five (82.7 %, n= 62) participants ate tomatoes and furthermore, two fifths (42 %), of those, ate home-cooked tomato and onion gravy, which is considered high in potassium (>200 mg K/ 75 g) (Herselman & Esau, 2005:51-57). An alternative recipe for home-cooked tomato and onion gravy could be developed.

Almost all (92 %, n= 69) consumed onion, a low potassium vegetable (<120 mg K/ 30 g) (Herselman & Esau, 2005:51-57) with a median intake of 12 times per month and two thirds (66.7 %) ate a small portion size (30 ml/ 1 large spoon). Onion flavours food in the absence of salt. Onion could be incorporated in renal friendly recipes more often, as it is eaten by all.

In addition, in the Cameroon study, Halle et al. (2014:550) found high vegetable consumption (amongst others), was a main determinant of poor nutrition, defined by a BMI

<20 kg/m^2. In the current study, vegetable consumption was infrequent and often only four times a month (Table 4.31).

5.6.2.7 Fruit

Fruit intake, are also a dilemma in MHD as it contains potassium, but intake can help relieve constipation and hold possible anti-inflammatory properties (see section 5.6.2.6). Apples and pears (low potassium fruits, <120 mg K / 100 g) (Herselman & Esau, 2005:51-57), were consumed by 93.3 %, (n= 70), and 72 % (n= 54) of participants, respectively. The median consumption was 12 and eight times per month, respectively. In the current study, apples and pears were eaten by more participants, and more often, than other high potassium vegetables (Table 4.32).

Almost two thirds (65.3 %, n= 49), drank 100 % fruit juice, with a median intake of four times per month, whilst (28.6 %) consumed a large portion (250 ml). Interestingly, 19 out of 49 (38.8 %) consumed orange juice and may possibly be overconsuming on potassium. The FFQ did not differentiate between commercial orange juice (ceres/ liquifruit), which is classified as low in potassium, or fresh orange juice, which is classified as high in potassium (>200 mg K / portion) (Herselman & Esau, 2005:51-57).

In addition, Halle et al. (2014:550) found in the Cameroon study, low fruit intake (amongst others), were a main determinant of poor nutrition, defined by a BMI <20 kg/m^2. In the current study, the median fruit intake was also not daily (intake ranged between 1 – 12 times per month).

5.6.2.8 Fat

The Mediterranean diet (rich in olive oil), and its efficacy in the CKD population, to reduce CVD risk (anti-inflammatory properties, improving lipid profile and reducing oxidant stress), are more being focused on (Fouque et al., 2011:355). In the current study, sunflower oil (78.7 %, n= 59) was dominant in use over canola (17.3 %, n= 13) and olive oil (17.3 %, n= 13), where median intakes were daily, 16 times, and 12 times per month, respectively. Therefore, participants in the current study are probably not experiencing the possible benefit of olive oil; noteworthy, it is much more expensive than sunflower oil.

Due to the restriction of fresh milk, some participants might, out of ignorance, opt for non-dairy, coffee/tea creamers. Conversely, non-dairy, coffee/tea creamers should also be restricted to 10 g per day due to high PO4, K and Na content (Herselman & Esau, 2005:51-57). One third (34.7 %, n= 26) consumed non-dairy, coffee/tea creamers with a median intake of 14 times / month. A quarter (26.9 %) of those consumed a large portion size (30 ml/ 1 large spoon), which is more than the recommendation by Herselman & Esau (2005:51-57).

5.6.2.9 Condiments and miscellaneous foods

The importance of regulating dietary sodium, is discussed in detail, in section 2.7.3. The majority (88 %, n= 66) used salt every day (median intake of 28 times / month). Furthermore, stock cubes were also used to flavour food by two thirds (69.3 %, n= 52) (median intake, 8 times / month). Furthermore, 14.7 % (n= 11) used salt in combination with stock cubes on a daily basis (28 times / month), similarly, 10.6 % (n= 8) used salt in combination with sodium rich, mixed meat spice, to flavour food each day. Moreover, 6.7 % (n= 5) used three to four sodium rich flavourants (e.g. salt, stock cubes, meat spice and soup powder) on a daily basis. The daily combination of salty flavourants can pose a risk for sodium overconsumption.

Contrary to the salt flavourants, fewer participants (58.7 %, n= 44) used green herbs and other non-salt flavourants (e.g. garlic, pepper, curry, and coriander) and less frequent (median intake of 12 times / month), than salt. Nutrition education should thus focus on herbs and non-salt spices that can be used as an alternative to salt, as well as provide recipes, since these flavourants can possibly be non-traditional.

The amount of inorganic phosphorus absorbed from food additives in soft drink beverages, is almost complete, compared to that of animal and plant proteins, which is about half (Kalantar-Zadeh et al., 2010a:525). The phosphate content in a 100 ml cola drink is 58 mg (Wickham, 2014:e1-e2). In the current study, one out of five (21.3 %, n= 16) consumed cola cool drinks which should be restricted due to high PO4 content (Herselman & Esau, 2005:51-57), with a median intake of four times per month. Half (50 %) consumed a medium portion size (250 ml), which according to Wickham (2014:e2) will amount to 145 mg PO4 / 250 ml

(contributing about 14.4 % of daily PO4 recommendation for a 70 kg person with recommendation of <12 mg PO4 / g protein [Nelms & Lacey, 2016:537]).

5.6.2.10 Alcohol

Certain types of alcohol are restricted due to potassium content (wine and ciders), and due to potassium and phosphate content (beer) (Herselman & Esau, 2005:51-57). Alcohol on dialysis is allowable, if it does not interfere with blood pressure and glucose lowering medication, and is part of the fluid allowance (DaVita, 2018:online). The principles for the general population still applies (if alcohol is permitted by the nephrologist); a maximum of one drink per day for women, and two drinks per day for men (1 drink equals: 1 tot spirits, 60 ml / 1 sherry glass of sherry) (DaVita, 2018:online). In the current study, alcohol seems to be consumed by only a small percentage of participants, with the allowed spirits contributing the largest percentage (18.7 %, n= 14), amongst the alcohol types with a median intake of once per month. Three fifths (64.3 %) of those that drank spirits, used a large portion size (100 g/ 2 tots); the study had 70.7 % men, thus, probably the correct allowable amount.

5.6.2.11 Take-away foods

Take-away foods tend to be high in sodium and frequent consumption (>3 times per week) could possibly indicate non-compliance (Lopez et al., 2007:142). In the current study, 41.3 % (n= 31), ate take-away foods once per week or more often (see section 4.9). The majority (65.3 %, n= 49) ate take-away fish, with a median intake of twice per month. Pies were also eaten (65 %, n= 45) with a median of twice per month.

5.7 Knowledge, attitudes and practices

Results with regard to KAP regarding the renal diet are discussed below.

5.7.1 Knowledge regarding restricted foods and minerals

The relationship between dietary adherence and knowledge is controversial. Some studies have found that there is a relationship between knowing the restrictions of the diet and adherence, whereas others have found no association (Lopez et al., 2007:145; Macías & Glasauer, 2014:55; St-Jules et al., 2016:122). Based on an in-depth literature search, the

current study, which describes KAP in the MHD population, appears to be the first of its kind in South Africa. The responses to the questions about foods, and about the mineral content of foods that need to be restricted, as well as knowledge regarding phosphate binder medication, are discussed below.

5.7.1.1 Knowledge regarding phosphate content of foods

The results of the study indicated that, while certain foods were readily recognised as a high phosphate food that needs to be restricted, e.g. cola drinks (92 %, n= 69) and milk (84 %, n= 63), others, like organ meat (liver), were not as easily recognised; only 68 % (n= 51) knew that liver needs to be restricted. These results were slightly more favourable than those of Lopez et al. (2007:138), which assessed the differences in dietary adherence between Hispanic (n= 17) and non-Hispanic (n= 17) MHD patients in New York (US). Lopez et al. (2007:142) found that 76 % of the patients in the Hispanic group and 71 % of the comparison group could identify the high phosphate foods. Possible reasons for the discrepancy, could be that the current study only measured three high phosphate foods (>110 mg PO4 per portion) (Herselman & Esau, 2005:51-57), whereas Lopez et al. (2007:139) included 15 high phosphate foods, thus, broadening the measuring coefficient. Furthermore, Durose et al. (2004:38) investigated 71 MHD patients in the UK, to assess whether knowledge of the diet and medical consequences of non-compliance influences dietary compliance. The authors found that 53.5 % of their study population had a good knowledge (≥65 % answers correct) regarding phosphate; which was less in comparison to the current study. Their study assessed other high PO4 food sources: chocolate, eggs, yoghurt and cheddar cheese (Durose et al., 2004:38). Notably, it is possible that participants in the current study may have recognised milk and cola drinks as restricted foods based on their fluid content, rather than their high phosphate content. This may be confirmed by the fact that most of the participants were unaware that milk (76 %, n= 57), and cola drinks (69.3 %, n= 52) are high in phosphate. In addition, most were unaware that organ meat (82.7 %, n= 62) were high in phosphate.

Almost half (44 %, n= 33) of the participants were unaware that cooked chicken breast, a low phosphate food, should not be restricted. Similarly, almost three out of four persons (77.3 %, n= 58) did not know that cooked chicken breast is not high in any of the restricted

minerals. This could possibly indicate poor knowledge regarding alternative options for restricted foods and escalate a negative attitude, because the renal diet is perceived as too restrictive/limited (section 5.8.1.2).

Even though knowledge is not the only factor that influences adherence (Macías & Glasauer, 2014:55), these results could possibly explain poor adherence to the renal diet, which should be confirmed with elevated biochemical markers, (namely serum phosphate and calcium), as well as a negative attitude.

Understanding the reason (the medical complication) why a certain mineral in a food source should be restricted could possibly increase compliance (Durose et al., 2004:36). Silent symptoms do possibly not provoke behaviour change, but perhaps knowledge thereof could. Also, compliance could be improved, when noticeable symptoms occur and persons are able to self-assess (Durose et al., 2004:36). Silent symptoms of prolonged elevated serum phosphorous are renal bone disease and arteriosclerosis, whilst, noticeable symptoms are pruritus, red, irritated and painful eyes, as well as dull aching bone pain and bone fractures (Wilkens et al., 2012:823; Klaassen-Broekema & Van Bijsterveld, 1992:271; Renalsmart, 2008:online). However, Durose et al. (2004:40) found the opposite. Patients were more compliant with potassium restriction (overconsumption has less obvious symptoms), than phosphate restriction (with more obvious symptoms of overconsumption).

In the current study, knowledge of: (i) the reasons why certain high phosphate foods should not be eaten and/or portion-control should be strictly adhered to; (ii) adverse symptoms associated with an increased serum phosphate levels; and (iii) whether knowing the reasons for food and mineral restrictions improves outcomes or not, were not measured.

5.7.1.1.1 Association between serum phosphate levels and knowledge of phosphate-related concepts

No statistically significant associations were found between serum phosphate levels and knowledge of phosphate-related concepts (Table 4.39). Nonetheless, of those (25.3 %, n= 19) with high serum phosphate levels (>1.8 mmol/L), most (68.4 %; n= 13) had poor combined knowledge of phosphate-concepts regarding food and phosphate binder medication.

5.7.1.2 Knowledge regarding potassium content of foods

Most participants in the current study knew that the high potassium foods, baked potato in skin (78.7 %, n= 59) and oranges (81.4 %, n= 61), should be restricted. Lopez et al. (2007:142) found a higher percentage (94 %) that recognized high potassium foods, and ascribed it to the fact that in their study centre, patients were frequently (once to twice per week) educated by dietitians, on high potassium foods and the immediate danger thereof. Other reasons for good knowledge were ascribed to: (i) the fact that the dietitian to patient ratio was 1:100 as recommended by the NKF; (ii) that bloodwork was taken once a month and reviewed with the patient; as well as (iii) that educational materials were available in home languages (Lopez et al., 2007:144).

About half of the participants (48 %, n= 36) did not know that butternut should also be restricted. Conversely, about one in three persons (29.3 %, n= 22) did not know that apples need not be restricted, but could be consumed as a low-potassium alternative.

Kalantar-Zadeh et al. (2015:164) suggested a different approach for dietary education in patients with ESRD, by relaxing the focus on restricted foods and rather educating patients regarding the different sources of low-potassium foods that can be eaten in larger amounts. They argued that restricting dietary potassium may be depriving patients on dialysis (who already have an increased CVD risk) of 'heart-healthy' diets and lead to intake of more atherogenic diets. According to Kalantar-Zadeh et al. (2015:164) patients should rather be empowered to make choices which fall within the "heart healthy sphere" including fresh fruits and vegetables, fresh squeezed juices, legumes, and grains in order to obtain the most benefit from a diet with moderate amounts of potassium. This strengthens the notion to increase knowledge of low to moderate potassium foods (e.g. apples, pears, litchi's, cabbage, etc.) (Herselman & Esau, 2005:51-57), that can be eaten more freely. In addition, when high potassium "heart healthy" foods are eaten, the knowledge of portion size and frequency should be enforced.

Furthermore, in the current study, the knowledge of the above mentioned foods as specifically being sources of high potassium, serving as the reason for restriction, was not good. Most of the participants answered incorrectly or did not know that baked potato in skin (57.3 %, n= 46), oranges (69.3 %, n= 52) and butternut (86.7 %, n= 65) are high in

potassium. Understanding the reason why a certain mineral in a food source should be restricted; thus being aware that too low or too high values of blood potassium may cause adverse symptoms such as cardiac arrest, muscle weakness and atrial fibrillation (Nelms & Lacey, 2016:535), were not assessed in the current study. In addition, whether or not knowing the reasons for food and mineral restrictions really improves outcomes, was also not evaluated.

In contrast, 60 % (n= 30) of participants in the current study did not know that apples are not high in any of the restricted minerals. This can have a negative effect on other health outcomes, because these foods are also high in other vitamins and minerals, antioxidants and fiber (Tappenden, 2017:11). Possibly excluding or disregarding them in the diet because of poor knowledge regarding low potassium content, could contribute to overall fruit and vegetable intake being too low. It can also escalate a negative attitude because the renal diet is perceived as too restrictive/limited (section 5.8.1.2).

5.7.1.3 Knowledge regarding sodium content of foods

Slightly more people (82.7 %, n= 62) in the current study knew that instant soup powder is high in sodium, compared to the study by Durose et al. (2004:37) where 73.2 % (n= 52) could identify it correctly. Durose et al. (2004:38) used other foods to assess sodium knowledge (e.g. crisps, bacon and smoked fish), than what was used in the current study (e.g. viennas and corn flakes cereal). They found the overall sodium knowledge regarding sodium-rich foods to be 69.2 %, which can be classified as average knowledge ($\geq$50 – 75 %).

In the current study, however, 26.6 % (n= 20) (around one in four participants) answered that they did not know or answered incorrectly that they may consume viennas without restriction. Half of the participants (49.3 %, n= 37) were unaware about corn flakes. Conversely, the majority of participants (82.7 %, n= 62) were uninformed that chilli pepper powder (red/cayenne pepper) could be used as a low sodium alternative and this can cause a negative attitude (section 5.8.1.2), because foods taste bland without salt and poor knowledge causes that other spice alternatives are also not utilised.

In the current study, the knowledge of the above mentioned foods as specifically being sources of sodium, were not good. About a third of the participants answered incorrectly or

did not know that viennas (38.7 %, n= 29) and instant soup powders (41.3 %, n= 31) were high in sodium and almost all (96 %, n= 71) were uninformed about the mineral content of corn flakes. Durose at al. (2004:39) reported that less than 20 % of the participants knew the medical complications of dietary non-compliance regarding excessive sodium. Although it was not directly measured in the current study, similar results could possibly be expected. Conversely, 85.3 % (n= 64) of the current participants did not know that chilli powder is not high in any of the restricted minerals and may be used to flavour food without the negative effect of too much salt.

In the current study, knowledge of: (i) the reasons why certain high sodium foods should not be eaten and/or portion-control should be strictly adhered to (e.g. may cause thirst, water retention, and increased blood pressure, resulting in further damage to the heart, brain and eyes [Durose et al., 2004:38; Renalsmart, 2012b:online; Verseput, 2012:A82]); (ii) adverse symptoms associated with an increased serum sodium levels; and (iii) whether knowing the reasons for sodium restrictions improves outcomes or not, were not measured.

5.7.2 Overall knowledge of restricted foods and minerals

When the overall knowledge of restricted foods and minerals were scored, only about half of the participants (54.7 %, n= 41) were found to have good knowledge (≥75 % correct answers) of foods that must be restricted. This was less than the 71.8 % found by Durose et al. (2004:37), who had a good overall knowledge (defined as >65 %). However, Durose et al., (2004:37) did not report on the education level of the participants, but did note that consultations with a dietitian usually occurred annually and that patients receive verbal and written renal diet instruction (assumedly in their home language). Moreover, their study was conducted in a developed country (UK). Lopez et al. (2007:143) did not report on combined knowledge of restricted foods in their study.

The mineral content of food is a more in-depth expansion of knowledge regarding foods that need to be restricted, and incorporate the possible connection between excessive intake of certain minerals that could lead to further negative health outcomes, depending on the mineral (phosphate, potassium and/or sodium). Therefore, focusing only on overall knowledge of mineral content of food, only 2.6 % (n= 2) had a good knowledge (≥75 %

answers correct) of the foods that they were shown, whilst 74.7 % (n= 56) had a poor knowledge. This could probably also mean that participants did not know which mineral is linked to which corresponding negative health outcome related to excessive dietary intake of restricted minerals, even though it was not assessed in the current study. Conversely, it can also be reasoned that if food knowledge and education level is low, as mentioned in the previous paragraph, this needs to be addressed first, and less focus should be put on knowledge of the actual mineral content of food, as not to make nutrition education overly complicated.

5.7.2 Knowledge regarding phosphate binders

Only about one in four participants (26.6 %, n= 20) could correctly identify the phosphate binder amongst their prescribed medications (e.g. Phosphosorb and Titrilac). The answers of most participants (54.7 %, n= 41), indicated uncertainty or ignorance. Along with ignorance to phosphorous dietary intake, this could lead to an increased risk of renal osteodystrophy and arteriosclerosis that leads to CVD. Because phosphate binder medication is not distinguished from other medication, it could mean that it is also not being ingested with every meal as it should. Even though knowledge is not the only predictive factor of non-compliance, it inclines to be asserted as the starting point of compliance (Macías & Glasauer, 2014:55).

In a meta-analysis by Karamanidou et al. (2008:2) that included 34 studies to assess non-adherence to phosphate medication, predictors of adherence to phosphate were identified as demographic factors (age, gender, education, etc.), clinical factors (time on dialysis, diabetic status, etc.) and psychosocial factors (knowledge, social support, active coping, etc.). The authors found only four studies that assessed knowledge of phosphate binder medication (Karamanidou et al., 2008:2). One of these studies, included in the previously mentioned meta-analysis was performed by Gago et al. (2000:4), and they found no relation between knowledge of prescribed medication and compliance. Those with better academic education level were found to be 89.6 % compliant; similarly, 83.7 % with a poor academic education level were also compliant (Gago et al., 2000:4).

A limitation of the current study was that participants knew that a certain pill needed to be consumed three times per day with meals (and they were possibly compliant), but they did

not know the mechanism/indication of the pill (e.g. it binds phosphate). Therefore, the manner in which the question was posed in the current study, namely: "What is the name of your phosphate binder medication?" may have yielded biased answers (Appendix H). Nevertheless, compliance may increase if a person understands why they should be compliant with certain behaviour (e.g. phosphate binder medication prevents bone disease and for best functioning it should be consumed with meals).

Overall, only about two fifths (37.3 %, n= 28) of the participants knew how and when to use phosphate binders correctly, namely: "Chewing it three times per day with meals". Gago et al. (2000:4) found the most frequent cause of non-compliance was the wrong interpretation of treatment (33.9 %) and this may possibly also have been true in the current study, because 28 % (n= 21) gave answers of how to take other prescribed medications.

When the knowledge regarding phosphate binder medication, including the name of the phosphate binder medication and the correct time to consume the phosphate binder medication, were combined and classified, more than half of the participants (58.7 %, n= 44) were found to have poor knowledge, 18.7 % (n= 14) had average knowledge, and only 22.7 % (n= 17) of the participants had good knowledge. Poor knowledge could be a defining factor for health outcomes that are not being reached, and may ultimately increase morbidity and mortality (Escott-Stump, 2012:876).

Even though there was no statistically significant association between knowledge of phosphate binders and serum phosphate levels (Table 4.39). Amongst those (25.3 %, n= 19) that had a high serum phosphate level (>1.8 mmol/L), 36.8 % (n= 7) had poor knowledge regarding phosphate binders.

In addition, there was a statistically significant association between phosphate dietary intake and knowledge amongst the group with a lower phosphate intake (<10 mg PO4/ g protein) (22.8 %, n= 17) which shows better knowledge of phosphate binders and their use compared to the group with a higher phosphate intake (>12 mg PO4/ g protein) (95 % CI for the median percentage difference [52.5 % ; 2.9 %]) (section 4.7.3.1). Hence, more attention needs to be given to phosphate binders when educating the patient.

5.7.3 Combined overall knowledge scores

The overall knowledge scores (combined knowledge of restricted foods, mineral content of food and phosphate binder medication) revealed that half of the participants (49.4 %, n= 37) had poor knowledge regarding these important concepts. The rest mostly had average overall knowledge (45.3 %, n= 34) and only a very small percentage (5.3 %, n= 4) had good knowledge.

Accurate nutrition knowledge may be particularly important when individuals are ready to make dietary changes (Durose et al., 2004:40). Readiness to change can be evaluated with the trans-theoretical model of change (Chapman-Novakofski, 2012:328,335).

Changing dietary behaviour and improving adherence, thus, needs multiple approaches which includes increasing accurate knowledge of patients. According to Karavetian et al. (2014:471), the following strategies have also been identified as effective in changing dietary behaviour: (i) use of self-evaluation and self-regulation techniques within educational tools, along with easy-to-apply skills; (ii) individualised counselling by a renal dietitian provided just before the hemodialysis session; (iii) high-intensity education; and (iv) long duration of interventions. Future studies should focus on conducting randomised controlled trials with powered samples to help generate stronger evidence within different populations to see what works best.

5.7.2.1 Association between combined knowledge scores and linguistic data

Planning nutrition education should include being language sensitive. This can be challenging in a multinational country like South Africa. There are eleven South African languages being spoken in the larger Free State province area. Amongst them, Sesotho and Afrikaans are spoken by most (Sesotho [64.2 %], Afrikaans [12.7 %], IsiXhosa [7.5 %], Setswana [5.2 %], IsiZulu [4.4 %], and English [2.9%]) (Census SA, 2011:34). In the current study, a quarter (24 %, n= 18) did not receive written and verbal nutrition education in their home language and/or second language. There was a statistically significant better knowledge between those that did receive written and verbal nutrition education in their home language and/or second language compared to those that did not (95 % CI [3.7 % ;

49.5 %]). Consequently, nutrition knowledge can possibly be improved if it is presented in a familiar language.

5.7.2.2 Associations between combined knowledge scores and education level

Schooling needs to be considered when nutrition education is planned and executed as it seems to be influential in nutrition knowledge. Verseput & Piccoli (2017:online) suggested posing nutrition education at grade 5 level. Participants with tertiary education (diploma, degree and post-graduate degree) (28 %, n= 21), had statistically significant better combined knowledge scores compared to those (6.7 %, n= 5) with only a primary education (grade 4 – 7) (95 % CI [3.9 % ; 73.5 %]), and those (17.3 %, n= 13) who only partially completed secondary school (grade 8 – 10) (95 % CI [6.3 % ; 64 %]).

5.8 Attitude

Attitude towards the renal diet has seemingly not been studied in the South African context before, based on an in-depth literature search. Therefore, drawing comparisons between other research were limited.

5.8.1 Attitude towards adhering to the renal diet

Attitudes are emotional, motivational, perceptive and cognitive beliefs that positively or negatively influence the behaviour or practice of a person. An individual's eating behaviour is influenced by his/her emotions, motivations, perceptions and thoughts. Attitudes influence future behaviour no matter the individual's knowledge and help explain why a person adopts one practice and no other alternatives (Macías & Glasauer, 2014:10).

In the current study, only 40 % (n= 30) of participants reported feeling positive about the renal diet. Macías & Glasauer (2014:54) stressed that, if a desired/positive attitude is lower than 70 %, nutrition-education intervention is urgent.

Nutrition-education intervention could certainly be applied for a population group, e.g. this group who scored low on positive attitude, or for an individual within a group. Following a structured, consistent program that formally measures attitude will prevent individuals "falling through the cracks". When a person scores low on attitude, urgent nutrition-

education intervention should be provided for the individual (Macías & Glasauer, 2014:54), irrespective of good knowledge.

Additionally, other psychological factors could also influence adherence, and not only KAP. Gibson et al. (2016:1864) studied 51 patients on MHD in the UK, to assess if dietary adherence was influenced by psychological factors (stress, personality traits related to substance abuse, and health locus of control). Health locus of control refers to, who the patient believes, in their internal or external psychosocial world, has control over their health outcomes. Internal control refers to self-efficacy and external control refers to other factors or persons e.g. chance, doctors, family, etc. (Gibson et al., 2016:1864).

Gibson et al. (2016:1864) further found that, for persons who adhered to PO4 and fluid guidelines, their health locus of control was externally in doctors, and for potassium adherers, in other health professionals. Therefore, less reliance on self, than non-adherers. Furthermore, adherers reported les stress and presented less sensation seeking personality traits (that is often found in substance abusers) (Gibson et al., 2016:1864). Psychological factors were not assessed in the current study, but together with assessing KAP, it can in future provide further insight, on the success rate of behaviour change programs.

5.8.1.1 Explanations for feeling positive about adhering to the renal diet

The majority of participants (30 %) who reported a positive attitude about the diet, motivated it because they felt better when they adhered to the renal diet (e.g. not nauseas or swollen). In addition, 16.7 %, (n= 5) felt that adhering to the renal diet was important to improve their health. Other motivations included having no choice due to the disease, accepting the disease, family support, and becoming adjusted to a lower salt threshold.

Lopez et al. (2007:143) found that 75 – 90 % felt positive about the renal diet, in response to one of the questions, assessing whether they felt better when following the renal diet.

5.8.1.2 Explanations for feeling negative about adhering to the renal diet

Amongst those (21.3 %, n= 16) that reported feeling negative about adhering to the renal diet, most (56.3 %, n= 9) explained that the number of food restrictions were too extensive. Around a third (31.3 %, n= 5) felt negative, because favourite foods were restricted. Lopez et

al. (2007:143) found that around 29 – 35 % of their study population felt that the renal diet interfered with life. The current study broadened on this statement and asked participants to elaborate on the reasons why they felt that the diet interferes with life. Reasons given included that they felt that food was tasteless without salt (12.5 %, n= 2), usual/typical/traditional foods are restricted (12.5 %, n= 2), and that social interaction was hindered by food restrictions (12.5 %, n= 2).

The explanations given above, highlights the importance of including ample alternatives for favourite foods and/or traditional foods, providing renal-friendly modifications to recipes of traditional food, educating on alternative ways to use spices and herbs to flavour food, and to including family members in education sessions to strategize how social interaction around meals can be inclusive of persons who receive MHD.

5.8.1.3 Explanations for feeling neutral about adhering to the renal diet

In the current study, participants' reasons for being neutral towards the renal diet, included that nobody had explained the diet to them (17.2 %, n= 5). This is concerning as the diet forms such a large part of life and improved health outcomes. Some of the other reasons given, were more negative than neutral, including that favourite foods are restricted (17.2 %, n= 5), that the food is monotonous and dry, including that they do not always have an appetite for suggested foods and that usual/typical/traditional foods are restricted.

The negative responses could possibly indicate an actual negative attitude or may indicate that the participant is ambivalent and/or not ready to change. On the other hand, a participant may have given neutral answers for not wanting to offend the researcher; thus instead of answering negatively, may have rather chosen middle ground. Conversely, some of the reasons given, agreed with the reasons given for feeling positive towards the renal diet, including that the renal diet improves their health and blood values. Another reason given is that they have accepted the disease, counter to the same response when having a positive attitude, this response under a neutral attitude could mean that they are complying out of necessity; whilst, not really enjoying the process.

5.8.2 Attitude towards the cost of the renal diet

Most participants (52.9 %, n= 37) in the current study, felt that the renal diet is more expensive than a regular diet. This differs from the US study of Lopez et al. (2007:143) where only 25 % of the Hispanic group, and nobody in the comparison group thought that the diet was more expensive. This may possibly reflect the high prevalence of food insecurity among the general population in South Africa. Shisana et al. (2013:64) reported that in SANHANES-1, 39 % of 5 972 households indicated that their households did not have enough money for basic things, such as food and clothes.

"Perceived barriers reflect an individual's beliefs regarding the difficulties arising from engaging in a practice." (Macías & Glasauer, 2014:12). The perception that the renal diet is more expensive than a regular diet is a significant barrier to overcome in order to eventually comply. Possible means of overcoming this problem can involve providing the patient with easily obtainable, low-cost food options and to focus on low-cost options that the whole family can eat (Beto et al., 2016:28).

Peyper (2016:online) suggested that in SA, 40 % of income per person, per month should be spent on food. In the current study, the majority of participants (78.9 %, n= 56 calculated from n= 71), reported spending less than 40 % of income per person per month on food. Additional solutions, outside the field of nutrition, could include education on financial planning, expenditure and budgeting and non-governmental funding projects.

Overall, 15.7 % (n= 11) of the participants felt that the prescribed eating pattern for persons with kidney failure on MHD, was cheaper than a regular diet. A quarter (25.7 %, n= 18) indicated that they felt that it was similar to the cost of what the rest of their families were eating. The fact that the diet was never explained to some of the participants also came up again.

5.8.2.1 Explanations for perceiving the renal diet as cheaper

Almost half (45.5 %, n= 5) of the participants that perceived the renal diet as cheaper (n= 11), pointed out that they bought less food, because they had to eat less salt, beef stock, chicken and red meat. Buying less salty flavourants is possibly showing a positive attitude, but it can also indicate that these participants might not know what type of alternative non-

salt spices and herbs they can buy to flavour food. Eating less chicken and red meat could possibly contribute to PEM; as one participant pointed out that the explanation for a cheaper diet is that the advised protein portion is smaller.

On account of the above reason given, it is probable that the method of explaining protein portions should be scrutinised. It is probably correct to explain to patients to eat a smaller protein portion. For example, 90 g (hand palm size) of meat/chicken/fish per meal (after calculating it according to an individual's needs, taking into account: age, edema free body weight, dialysis modality, etc.). Conversely, in the case of MHD, often, the smaller protein portion should be consumed twice per day or doubled if it is only eaten in one meal, in order to consume enough HBV protein. Subsequently, the possibility arises for miscommunication regarding portions per day and per meal. For example, a person is advised to eat a 90 g meat/fish/chicken portion, and the educator has in mind twice per day but does not mention it per se. Hence, the patient only eats one 90 g protein portion with one main meal (because the custom is to only eat meat once per day) and this could result in too low daily protein intake.

Other participants indicated that they bought cheaper foods (including foods that are restricted). This could possibly be due to poor knowledge of the renal diet and recommended foods. On the other hand, they may also be buying cheaper foods that are restricted, but they stick to the recommended portion size (e.g. one potato per day) (Renalsmart, 2012a:online).

Dried beans (legumes) were considered in the past as high in phosphate and patients were educated to restrict the intake. In 2009, however, NKF-K/DOQI published guidelines regarding the ratio of phosphate (mg) to protein (g), adjusted for digestion and absorption (e.g. phytates in legumes reduces PO4 absorption). The introduction of this ratio opens up traditionally restricted foods that can now be eaten as low phosphate, protein-rich alternatives (e.g. chunky peanut butter, kidney beans, unsalted roasted peanuts, chickpeas, etc.) (NKF-K/DOQI, 2009:S87). In addition, Jones (2001:online), reported a reduction of 48 % in phosphate levels when legumes are boiled. It is noteworthy, that boiling reduces the phosphorus content with a negligible loss of nitrogen, leading to a more favourable phosphorus to protein ratio (Cupisti et al., 2006:online). Hence, legumes may offer a good

low-cost alternative especially if persons perceive legumes as cheap and/or as traditional foods. In contrast, however, the long cooking time of legumes could result in additional energy costs, even though considered a low-cost protein initially.

Another explanation for feeling the renal diet was cheaper, is that most of the expensive foods (e.g. cola drinks and hamburgers) were restricted (36.4 %, n= 4). This perception could possibly let people feel deprived of social standing if they cannot eat expensive foods. The contrary could also be true, as they may feel that they have more money available for other material things (e.g. clothes, décor, etc.), which can perhaps elevate social class.

5.8.2.2 Explanations for perceiving the renal diet as more expensive

Most (32.4 %, n= 12) of the participants that felt that the prescribed renal diet was more expensive, explained that they had to buy separate/different/non-traditional foods, and that the prescribed foods were more expensive than typical/traditional food (29.7 %, n= 11). Introducing patients to traditional foods and recipes that are adapted to be renal-friendly, encouraging the whole family to participate in developing the recipes, and eating together, can possibly overcome this barrier (Conradie, 2008:online; Beto et al., 2016:30).

Furthermore, five participants (13.5 %) indicated that restricted foods were cheaper than prescribed foods (e.g. bananas are cheaper than berries and tinned fish is cheaper than other meat). This can be possibly be overcome by giving ample alternatives for restricted foods in all price ranges.

5.8.2.3 Explanations for perceiving the renal diet as not cheaper, nor more expensive

Eighteen participants (25.7 %) did not feel that the renal diet was cheaper, nor more expensive than a regular diet. Most of them indicated that the costs incurred by their dietary restrictions were not any different to the costs for the rest of the family's diet (55.6 %, n= 10), either because the family changed their eating habits to fit those of the participant, or because the participant did not have to change their diets much since diagnosis (e.g. "We never ate a lot of biltong – which is expensive"). Others indicated that the same food was bought for the whole family (33.3 %, n= 6).

5.8.3 Attitudes towards the specific types of foods that are allowed in the renal diet

More than half (55.7 %, n= 39) of the participants reported that they liked the food they were allowed to eat, whilst 15.7 % (n= 11) said they do not like the food. Lopez et al. (2007:143) reported that a higher percentage, of around 83 % in both groups, enjoyed the allowed food on the renal diet, but did not investigate the reasons.

A fifth (22.9 %, n= 16) of participants in the current study reported a neutral feeling towards the allowed foods. Four participants indicated again that they were uniformed about the renal diet.

5.8.3.1 Explanations for being positive about the foods allowed in the renal diet

Of the participants that were positive about the specific foods allowed in the renal diet, almost a quarter (23.1 %, n= 9) reported that they felt this way, because they perceived eating as an enjoyable experience. Around a fifth (18 %, n= 7) reported that they felt eating the allowed foods had health benefits (e.g. “It gives me energy.”, “It helps me to feel better.”, and “It keeps me fit.”). These reasons can possibly be used in verbal and written nutrition-education to motivate other persons who receive MHD. Another 18 % (n= 7) indicated that they had become used to the required dietary changes (e.g. “It is the same food, but with less salt.”, “I became used to eating less steak.”).

Moreover, (12.8 %, n= 5) indicated that they felt positive, because they did not have another option (e.g. “I have to learn to eat it, whether I like it or not”), which can possibly indicate more favourable internal locus of control, which shows reliance on self to reach health outcomes (Gibson et al., 2016:1864). Nonetheless, health locus of control was not assessed in the current study.

5.8.3.2 Explanations for being negative towards the foods allowed in the renal diet

Amongst participants (15.7 %, n= 11) that had a negative attitude towards the foods allowed in the renal diet, almost half (45.5 %, n= 5) indicated that they felt this way because food was tasteless without salt. St-Jules et al. (2016:120) reported that one out of two (57 %) MHD patients in the Balance-Wise US study, found the renal diet bland and tasteless. This problem can possibly be overcome with regular, focussed and consistent nutrition-

education on non-salt flavour options. Two participants (18.2 %) felt that there were too many restrictions (limited choice of foods) and that favourite foods were being restricted. This negative attitude can possibly be overturned by focusing on giving ample information on allowed food alternatives, as well as for favourite foods and recipes.

5.8.3.3 Explanations for being neutral towards the foods allowed in the renal diet

Most of the responses explaining a neutral attitude, towards allowed food, were more negative. Amongst the participants (22.9 %, n= 16) that felt neutral, four participants (25 %) answered that they felt this way, because they did not have another option (e.g. “I have to learn to eat it whether, I like it or not.”). Others (25 %, n= 4) explained that favourite foods were being restricted and thus they felt neutral and 12.5 % (n= 2) felt that prescribed foods were more expensive. Moreover, this possibly reflects again that knowledge of food recommendations is not enough to promote adherence and attitude is a key concern (Macías & Glasauer, 2014:10).

5.8.3 Explanantions for being unable to answer the questions on attitude

Three participants mentioned that they did know how to perceive the cost of the renal diet and, four, did not know how to feel about allowed foods on the renal diet. The reason being that they were uninformed about the diet; as similarly seen in section 5.8.1.3. As mentioned before, it is concerning as the diet forms such a large part of life and improved health outcomes. Whilst, one person indicated that he/she did not understand the attitude question on cost of the renal diet, which possibly indicated a language barrier, even though, the person did not indicate before the interview that they preferred an interpreter.

5.9 Practices

Most participants (61.4 %, n= 46) indicated that they could only, “sometimes”, eat the correct amounts of restricted foods (thus, adherence was infrequent). This does not correspond with the findings of Lopez et al. (2007:144), where 65 % reported that they could eat the recommended portions of the restricted foods. Verseput & Piccoli (2017:online) also conveyed that estimating portion sizes in the South African context can be difficult due to some cultures “eating from one pot”.

The majority of participants (69.3 %, n= 52) reported that their families supported them to follow the prescribed diet. Lopez et al. (2007:144) also found that 70 % of both groups perceived that their family supported them to comply with the diet. The rest of the group in the current study perceived support only occasionally (22.7 %, n= 17). A few, 8 % (n= 6), felt no support from family, which could hinder consistent compliance to the diet.

Only, 24 % (n= 18) reported always measuring their food with scales, spoons and cups, whilst, half of the group (53.3 %, n= 40), indicated that they never do. Lopez et al. (2007:144) also reported infrequent measuring of food; in the Hispanic group, where 22 % and in the comparison group only 30 % measured their food. Ameh et al. (2016:online) gave an alternative for using scales, spoons and cups in the South African CKD context and that is to use the hand as a measuring tool (e.g. tip of thumb = one teaspoon [oils], fist size = one cup of starch [maize porridge, samp, rice]). It could be reasoned that, given the high prevalence of overweight/obesity in the MHD population in South Africa, this approach may pose additional health risks as stiff maize porridge could be over consumed. For example, one fist (one cup) of stiff maize porridge or cooked samp yields more energy than one fist (one cup) of rice. Provision is made for this difference in the, 2005, South African renal exchange lists; one low potassium starch exchange equals, 100 g stiff maize porridge/cooked samp. In contrast, a portion of white rice equals three heaped tablespoons (75 g) (Herselman & Esau, 2005:51-57).

Overall, only 26.7 % (n= 20) of the participants reported that they never buy (eat) take-away food, whilst, 41.3 % (n= 31) did so once per week or more often. Additionally, 16 % (n= 12) reported eating take-away food three or more times per week. This was less than what Lopez et al. (2007:145) found where 35 % of the comparison group ate take-away food more than three times per week. Lopez et al. (2007:145) suggested that eating take-away food may represent non-adherent behaviour, because it is probably more difficult to follow the renal diet when one is exposed to foods that are not ideally part of the renal diet (usually due to high salt and inorganic phosphate additive content). However, the patient can still make adequate food choices if diet education was received and the patient is aware of these restrictions.

Overall, 17.3 % (n= 13) reported that, in the previous week, they had not adhered to the renal diet at all; half (52 %, n= 39) reported that they had followed the diet for 1 – 5 days. In the Hispanic group, Lopez et al. (2007:145) found a higher percentage (55 %) that followed the renal diet for 6 - 7 days, compared to the current study, where less than a third (30.7 %, n= 23) followed the renal diet for 6 – 7 days; which is considered good adherence. St-Jules et al. (2016:120) found that only 19 % of participants indicated that they followed the renal diet for 90 – 100 % of the week. Factors causing hindrances to adhere to the renal diet more days per week, were not assessed and it could be a useful assessment for dietitians, to understand individual practices and possibly help facilitate solutions.

5.9.1 Overall practices regarding adherence to the renal diet

When all the questions regarding dietary practices were combined and scored, most participants (61.4 %, n= 46) were found to have reported poor adherence practices to the prescribed eating pattern for persons with kidney failure on MHD. Only one in four participants (25.3 %, n= 19) reported good adherence practices. With this in mind, dietitians should assess adherence more often and not just focus on imparting the knowledge regarding food restrictions.

5.10 Involvement of a dietitian in the treatment

The discussion regarding the involvement of the dietitian in the treatment of the participants follows.

5.10.1 Source of education regarding the renal diet

Overall, 77.3 % of the participants indicated that they were educated about the renal diet by a dietitian; thus, about one in four were not. The NKF-K/DOQI (2000:S45) recommends that a dietitian should lead the assessment of every patient in renal failure concerning nutritional status, nutrition history, and patient preferences, and should take into account the nutritional prescription to plan and implement, as well as quarterly monitor, an individualised eating plan that ensures adequate intake of energy, protein and electrolytes. This nutrition care plan should be reviewed quarterly, in a multidisciplinary fashion that

includes the patient and/or caregiver (often the patient's spouse), doctor, nurse, social worker, and dietitian (NKF-K/DOQI 2000:S45).

Possible reasons why all the participants in this study were not consulted by a dietitian, is the shortage of health workers in South Africa and Africa (Naicker et al., 2009:S60; Anyangwe & Mtonga, 2007:93). Ameh et al. (2016:online) reported that at Groote Schuur Hospital (Cape Town, South Africa), a 900-bed hospital, only 10 dietitians are responsible for the care of all in-patients (not only renal patients), as well as the out-patients referred from various clinics. These responsibilities should ideally be undertaken by at least 19 dietitians (Ameh et al., 2016:online).

Other health professionals that provided dietary education, included nurses (46.7 %, n= 35), doctors (25.3 %, n= 19), unit managers (4 %, n= 3) and clinical technicians (4 %, n= 3). This outlines the importance of the involvement of a multi-disciplinary health team, but, as the NKF-K/DOQI (2000:S45) recommended, the nutrition care plan should be led by a dietitian.

In the current study, only 17.3 % (n= 13) of participants reported that they made use of printed or internet-based nutrition educational materials (from trusted sources). This could point to a scarcity of standardised printed, or internet-based educational material available that is suited for South Africans (and is provided in their home languages). This shortage could further compound low health literacy (Van der Heide, et al., 2013:172).

Overall, 14.6 % (n= 11) of participants reported receiving dietary advice from family and friends. Better education of family members on correct renal nutrition, could be utilised in future, to improve KAP and influence compliance (Macías & Glasauer, 2014:55; St-Jules et al., 2016:122).

5.10.2 History of consultations with a dietitian

Most of the participants (84 %, n= 63) indicated that they had consulted a dietitian in hospital, at the dialysis unit, or privately, since being on MHD. Notably, 16 % (n= 12) reported that they had never consulted a dietitian. Eating is a major and integral part of everyday life, and of reaching the health outcomes in the MHD treatment modality, and it is disconcerting that one out of seven participants did not have access to the expertise of a dietitian for whatever reason.

Of those that had consulted a dietitian, only half (52.4 %, n= 33) reported that they had completely understood the nutrition education given by the dietitian, whilst 47.6 % (n= 30) reported that they had only partially understood. This is much lower than the rate of reported comprehension found in a study by Lopez et al. (2007:142), in which 71 % of a Hispanic group and 82 % of the comparison group reported that they understood the renal diet. It should be noted that self-reported comprehension may be biased, because the participant may not want to disappoint the researcher or him/herself.

Lopez et al. (2007:142) did not explore the reasons for incomprehension, but noted that 35 % of the Hispanic group received the diet education in Spanish, and of those that received it in English, 27 % said that they would have preferred it in Spanish. In the current study, around a third (31 %, n= 9) reported language barriers as the reason for partial comprehension. Other most frequently reported reasons for not understanding completely were that the motivation (advantages and disadvantages of following the prescribed eating pattern), was not clearly explained (20.7 %, n= 6), and that the prescribed foods were not always available or were too expensive to buy (20.7 %, n= 6). Various other reasons reported for partial comprehension included that all the information was new, that the contents of reading material had been forgotten, and that it was difficult to comply with the measuring and the amounts of food prescribed.

In hindsight, the question: “Why did you not understand?”, which was asked to probe for explanations for partial comprehension, may have been better phrased. To clarify, rephrasing the question, and letting the onus fall on the dietitian, for example: “What could the dietitian have done/said differently to help you understand better?”, could have yielded different responses.

5.10.3 The involvement of a dietitian in the treatment of participants

Three quarters of the participants (77.3 %, n= 58) reported zero to one consultation with a dietitian per dialysis year, which, according to NKF recommendations, is insufficient (NKF-K/DOQI, 2000:S46; Fouque et al., 2007:52). Noteworthy, is that 16 % (n= 12) of these participants had never consulted with a dietitian and 34.7 % (n= 26) only consulted a dietitian once, since being on MHD. With this in mind, the current study observed, that 64

% of participants were receiving MHD for longer than 2 years. Only 18.7 % (n= 14) of participants had consulted with a dietitian three or more times per dialysis year as recommend by NKF (NKF-K/DOQI 2000:S46).

No previous study amongst the population on MHD in South Africa, has assessed the frequency of dietetic consultations. Morey et al. (2008:173) found that in the UK, increased frequency of dietetic consultations (monthly as opposed to once every six months), as well as a ratio of one dietitian per sixty patients, was found to improve phosphate control in the short term.

5.9 Limitations

The following limitations were present in the current study.

5.9.1 Sample size

Although a larger sample size would have improved the statistical power, there were only 177 patients that received MHD in Bloemfontein at the time of the study. Of these, everybody that fitted the exclusion and inclusion criteria (n= 75) were included in the sample.

5.9.2 Biochemical values

A limiting factor in the current study could be the concealment of PEM, because too low cut-off values for serum creatinine were considered for PEM detection. Moreover, as low muscle mass was prevalent in the current study (section 5.4.2), therefore the prevalence of of PEM in this study were probably underestimated.

Even though dialysis usually corrects metabolic acidosis (Kopple, 2012:1356) it could have been useful in the current study to assess if metabolic acidosis was present by assessing blood pH and serum bicarbonate, especially in view of the low muscle mass (section 5.4.2), low reported fruit and vegetable intake (section 5.6.2), and low plant protein intake (section 5.6.2.3).

Triglyceride levels were not assessed and patients on MHD typically display elevated triglyceride levels (Nelms & Lacey, 2016:541). Subsequently, the high BMI (section 5.4.1),

WC (section 5.4.4) and high carbohydrate intake (section 5.6.1) noted in this study population, it could have been useful to consider.

All the needed biochemistry were not routinely assessed and yielded incomplete data.

5.9.3 Measuring dietary intake

One adapted 24h-recall is not ideal to represent usual intake and methods relevant to SA is needed to overcome barriers to measure dietary intake (section 3.8.10.2).

Chicken, mince, crumbly maize porridge, instant maize/sorghum porridge, rice and samp were not mentioned in the FFQ and needs to be considered in future, as it seems to be eaten amongst the specific population.

The FFQ is limited in identifying if certain foods, like chocolate, milk, yoghurt and custard, were eaten on the same day, thus raising concern for phosphate overconsumption (Renalsmart, 2008:online; Herselman & Esau, 2005:51-57). A different measuring tool needs to be considered or developed to measure if high phosphate foods are overconsumed on one day.

5.9.4 Knowledge questionnaire

Foods high in phosphate (milk and cola drinks) are fluid and participants could have correctly identified it needs to be restricted based on fluid content and not actually due to the intended measurement of phosphate content.

A limitation of the current study was that participants could have known that a certain prescribed tablet needed to be consumed three times per day with meals (and they were possibly compliant), but they did not know the mechanism/indication of the pill (e.g. it binds phosphate). Therefore, the manner in which the question was posed in the current study, namely: “What is the name of your phosphate binder medication?” may have yielded biased answers (Appendix H).

To assess involvement of a dietitian, the question: “Why did you not understand?” which was asked to probe for explanations for partial comprehension, may have been better phrased. To clarify, rephrasing the question, and letting the onus fall on the dietitian, for

example: “What could the dietitian have done/said differently to help you understand better?” could have yielded different responses.

Knowledge of medical complications of dietary non-compliance (to phosphate, potassium and sodium restriction) and if knowledge translates to improved outcomes, were not assessed.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

In this chapter conclusions and recommendations will be drawn from the findings of the study regarding the socio-demographic and medical information of the sample, their nutritional status, which included anthropometry, biochemical information and dietary patterns, as well as their KAP, with regard to dietary modifications and restrictions that are recommended for persons with ESRD who are receiving MHD. In addition, these conclusions and recommendations include the involvement of dietitians in the treatment.

6.2 Conclusions

This is the first study to describe the nutritional status of the MHD patient population in Bloemfontein, South Africa.

6.2.1 Socio-demographic profile

Participants were mostly men (70.7 %), even though studies in MHD populations in sub-Saharan Africa is scarce, similar results were found in Port Elizabeth (Eastern Cape province, South Africa) (Botha, 2015:53), and in a study in Cameroon (Halle et al., 2014:545). Likewise, more men formed part of South African studies involving CAPD participants (Isla et al., 2014:520; Abdu et al., 2011:151). This concurs with the findings of International Dialysis Outcomes and Practice Patterns Study (DOPPS) (Hecking et al., 2014:online), which found a global (as yet unexplained) trend towards fewer women than men treated with MHD for RRT of ESRD (at least in developed countries).

Most participants were middle aged and older with a median age of 50.5 years (ranging from 25 to 78.9 years). This is similar to findings found in Port Elizabeth and Cameroon (Botha, 2015:53; Halle et al., 2014:547). Furthermore, in contrast, to other South African studies in specifically CAPD, the current study, also represents an older age (Isla et al., 2014:520; Leclercq, 2015:117). Conversely, in the US, CKD seems more prevalent in an older age bracket (>65 yrs.) (Murphy et al., 2016:476).

More than half (65.3 %), completed secondary school, partially or fully, and 28 % (n= 21) had tertiary education. The tertiary education level was lower than in Port Elizabeth, where 47.1 % had tertiary education (Botha, 2016:53). Nevertheless, the education level seems higher than in the Cameroon study, where 25 % of the group had primary education (Halle et al., 2014:547), and in the current study only (6.7 %), had primary education.

Half of the participants (56 %) in the current study were married and 2.7 % were living with a partner. This seems similar to findings in Port Elizabeth, where half of the participants (56 %) were married and two (2.7 %) lived with a partner (Botha, 2016:53). In the Cameroon study, the couple rate was higher (72 %) than in South Africa (Halle et al., 2014:547). Overall, two out of five (40.1 %) in the current study were single, divorced, or widowed. Being alone can possibly have a negative influence on eating activities.

The majority of participants lived in formal brick dwellings (97.3 %), had running tap water (89.3 %), and electricity (98.7 %) in their homes, respectively. Only, two participants (2.7 %) indicated that they lived in shacks (informal housing). The living conditions seem better than in another South African study, amongst CAPD patients in Limpopo, where (87.5 %) lived in brick houses, (41.4 %) had tap water in home, and (86.2 %) had electricity in the home (Isla et al., 2014:520). Even though, living conditions seem reasonable in the current study, the HDR suggests that most (64 %) lived in overcrowded conditions.

Travel modes to dialysis units included: own car (46.7 %), taxi services (25.3 %), and government hospitals' ambulance/commuting services (18.7 %). The median, one-way travel time to the dialysis unit, was 30 minutes. Time-consuming travel time on dialysis days can possibly influence food procurement, preparation and consumption.

Almost half (46.7 %) of the group was Sesotho speaking, and 24 % were Afrikaans speaking. Most (61.4 %) indicated that their second language was English, whilst, about a fifth of the group (18.7 %) indicated Sesotho as their second language. The language, in which written nutrition and verbal nutrition information had been received, was mostly English (73.4 % and 60 %, respectively). Only, a fifth (21 %) received written nutrition education in their home language and almost a third (30.7 %) received verbal nutrition education in their home language. Language, in which nutrition education has been received, has not been researched in the South African, MHD population before.

Almost a third (29.3 %) of participants was solely responsible for preparing their own meals at home. This is less than the UK study by Durose et al. (2004:37), where 45 %, were cooking their own meals. Furthermore, in the current study, an additional 24 %, shared meal preparation responsibilities with others in the home, and for almost half of the group (46.7 %) meal preparation were the responsibility of female family members. Most of those who were involved in the preparation of their own meals reported that they were sometimes tired (62.5 %), whilst 12.5 % reported that they were always tired. This is similar to a US study, which, associated tiredness when cooking with a low energy intake (St Jules et al., 2016:120,122).

6.2.2 Medical profile

More than a third (37 %), of participants had received CAPD before being switched to MHD. The impact of diet adherence and insight into the different diet recommendations (energy, protein and potassium) (NKF-K/DOQI, 2000, 2006), after the switch from CAPD to MHD could be confusing.

The duration of receiving MHD in this study varied from less than 2 years (36 %), 2 – 5 years (24 %), 6 – 10 years (25.3 %), and more than 10 years (14.7 %). This seems similar to the Port Elizabeth and Cameroon study (Botha, 2016:54; Halle et al., 2014:547), and it possibly suggests that MHD as treatment modality for ESRD, can be successful for a number of years, even in a developing country. In the US, a developed country, survival rate amongst MHD patients seems to be improving (Collins et al., 2010:S1).

In the patient files, hypertension was indicated as a single etiology of kidney failure for more than a third of the group (37.3 %, n= 28); for 6.7 % (n= 5) diabetes mellitus was indicated and for a tenth (10.7 %, n= 8), hypertension and diabetes mellitus were indicated together. This supports that hypertension and diabetes mellitus are the most common causes for renal failure in South Africa, as stated by Meyers (2015:232).

Most participants 82.9 % (n= 58) were prescribed calcium based phosphate binders. Calcium based phosphate binders are frequently used for cost-effectiveness (Wang et al., 2015: online), in the prevention of renal bone disease. Counter to phosphate binders being prescribed regularly, the knowledge thereof seems poor, as only, 26.6 %, in the current

study had a good knowledge on their name and correct use. This could result in inadequate use and ineffectiveness.

To emphasize, for 28 % (n= 21) the etiology for kidney failure was missing from the files, and for 6.7 % (n= 5), there was no medication prescription in the patient files. To stipulate co-morbidities and adding prescriptions needs attention, as detailed medical files, aid the entire health care team to improve care.

6.2.3 Appetite

Most participants reported that they had good to very good appetites and food intakes on both dialysis days and non-dialysis days. Only around 10 % reported poor, to very poor appetites and food intakes. Assessing and correcting poor appetite on a regular basis can possibly prevent a downgrade in nutritional status with improved Hb, protein intake, inflammation, EPO dosage and quality of life (Kalantar-Zadeh et al., 2004:299).

In addition, in the current study, no statistical significant differences were found between the appetite and food intake on dialysis and non-dialysis days. Therefore, appetite and food intake should be noted throughout, and individually, and the assumption should not be made that there are specific days (dialysis or non-dialysis) which appetite are always better.

6.2.4 Use of tobacco

Tobacco use is detrimental to health, and in the CKD population can accelerate CVD, especially if DM is a co-morbidity (Biesenbach & Zazgornik, 1996:625). Gerntholtz et al. (2015:4-5), therefore, advised that smoking cessation should be a focus area for the South African population with CKD. Most participants (58.7 %) reported never having used tobacco, possibly suggesting less smoking-related, CVD risk. Nevertheless, a quarter (26.6 %), of the participants was ex-users, and eleven (14.7 %) were using tobacco at the time of the study, proposing increased CVD risk.

Furthermore, of these 11 tobacco users, four had not change their habits with regard to the frequency of tobacco usage, whilst, the others reported that they were smoking less than in the past. Smoking habits can possibly point to readiness-to-change regarding all aspects of behaviour, and subsequently, readiness for changing dietary habits as well (Prochaska et al.,

1994:39). In future, it would be interesting to assess if smoking habits correlates to adherence of dietary restrictions in MHD.

6.2.5 Nutritional status

The nutritional status of MHD patients is concluded and includes information regarding anthropometry, biochemical information and dietary patterns.

6.2.5.1 Anthropometric data

The BMI results seem similar to those in other South African studies, amongst patients receiving RRT, where the majority BMI in the RRT population is above normal (>25 kg/m^2) (Botha, 2016:60; Isla et al., 2014:522; Leclercq, 2015:118). More than half (56.8 %), had above normal BMIs; of these, 17 were overweight (BMI >25 kg/m^2) and 25 were obese (BMI >30 kg/m^2). The median BMI was 26.4 kg/m^2.

Only four participants were underweight (Grade 1 CED) (BMI <18.5 kg/m^2 – >17 kg/m^2) (Bethesda, 1998:xiv; WHO, 1995:364; WHO, 2000:9). In the Cameroon study, there is a higher percentage of the underweight group, 28.3 % (BMI <20 kg/m^2), and only one fifth, 21.2 % were overweight ($\geq$25 kg/m^2) (Halle et al., 2014:548). The high prevalence of overweight and obesity in the current study, reflect the high prevalence of overweight and obesity in the surrounding South African population (Shisana et al., 2013:136). Noteworthy, in the past decade there were several epidemiological studies indicating that higher body mass index (>25 kg/m^2) is associated with significantly better survival (including patients with cardiovascular disease), in ESRD patients (Kalantar-Zadeh et al., 2006:202; Ikizler et al., 2013:1100).

Regardless of the high BMI, half of the group (56 %) had an AMA equal to and under the 15th percentile which shows low muscle mass, and subsequently, almost a third of the group (29.3 %), also had very low body fat percentages (<5th percentile). In fact, of those (56 %) who had an AMA $\leq$15th percentile, 31 % (n= 13) had a BMI $\geq$25 kg/m^2 (indicating being overweight), and 57 % (n= 24) had a normal BMI (>18.5 kg/m^2 – <24.9 kg/m^2). Having a low AMA with normal to high BMI, can possibly result in, overlooking malnutrition by health professionals.

The rest of the group had normal to above AMA and body fat. In another South African study on CAPD, the prevalence of low muscle mass was not so substantial, even though, the BMI was also high (Leclercq, 2015:67).

The prevalence of a high BMI (even though it is considered a protective factor), whilst, having a low muscle mass or losing body fat, can possibly mask PEM, resulting in increased morbidity and mortality (Kalantar-Zadeh et al., 2006:202). Gaining a larger body size, while losing muscle, has a poorer outcome than, conversely, losing weight, but gaining muscle mass (Ruperto et al., 2016:44; Kalantar-Zadeh et al., 2010b:991).

Additionally, in the current study, WC indicated that 81.8 % of women and 48 % of men, had a, too high WC, indicating android obesity (Alberti et al., 2009:1642). Moreover, WHtR (>0.5) another marker for android obesity, also indicated, 66.2% of participants, were at risk for developing metabolic complications as defined for the general population (Ashwell et al., 2012:284). Thus, although a high BMI in the setting of CKD may signal health and better nutritional status, excessive abdominal fat may be detrimental because of pro-inflammatory metabolic derangements in abdominal subcutaneous tissue (Carrero et al., 2013:81; Ruperto et al., 2014:e196), such as high triglyceride levels (Postorino et al., 2011:765).

6.2.5.2 Biochemical information

Without CRP testing, the low serum albumin levels (<35 g/L) found in 49.3 % of the participants as well as hypocholesterolemia (53.3 %, n= 8), and low WBCs (26.4 %, n= 14), cannot without a doubt be ascribed to malnutrition. Yet, pre-dialysis, low serum urea levels (<21 mmol/L) (52.5 %, n= 32 calculated from 61), in presence of low protein intakes (particularly low HBV protein), can be a sign of malnutrition. Likewise, PEM can be suspected if serum creatinine is low together with muscle wasting.

Overall, around one in four (25.3 %, n= 19) had elevated levels of serum phosphate (>1.8 mmol/L). When the cut off point for serum phosphate is lowered to, ≥1.42 mmol/L, almost half (49.3 %, n= 37) had elevated phosphate levels. This may reflect poor knowledge and compliance to dietary phosphate restrictions and correct use of phosphate binder medication which leads to secondary hyperparathyroidism and its complications (Wilkens et al., 2012:823).

Almost a third (28 %, n= 21) had elevated levels of serum potassium which could be fatal (Nelms & Lacey, 2016:535). If all other causes are eliminated, potassium content in diet should be re-evaluated and restricted to recommendations (Wilkens et al., 2012:819).

Serum sodium levels were elevated in only one tenth (10.8 %, n= 8) of the participants. Serum sodium should be evaluated with fluid status, and be corrected if abnormal values are due to high sodium and fluid intake in order to prevent high blood pressure and the resulting negative effects (Nelms & Lacey, 2016:536; Wilkens et al., 2012:819).

Half of the group (54.7 %, n= 41) had Kt/V values below normal <1.4, possibly indicating inadequate dialysis but shows better dialysis efficacy than in the Cameroon study (Halle et al., 2014:547). Only one measurement was taken and an average value over a longer time could have given other results.

Slightly more than a quarter (28 %, n= 21) had below normal hemoglobin values (<10 g/dL). Anemia seems less than in the Cameroon study (Halle et al., 2014:548).

More than half (52 %, n= 38) had ferritin values above normal (>500 ng/ml) which could be indicative of high iron stores or indicate an acute phase response (thus, act as a marker of inflammation). Almost a fifth (18.9 %, n= 14) had below normal TSAT values (<20 %), which could indicate an iron shortage, if EPO is sufficient and ferritin levels is high (Wish, 2006:s5; Nelms & Lacey, 2016:548).

6.2.5.3 Dietary Intake

The typical intake of one, non-dialysis day cannot accurately represent energy and macronutrient intake, but it can possibly highlight trends that need further research (Fouque et al., 2007:52).

There seems to be two extremes regarding energy and protein intake with one half consuming below recommendations and the other half above (NKF-K/DOQI, 2000, 2006). Low energy and protein intake need to be assessed together with other factors. Whilst, there is an unintentional low energy intake (<25 kcal/kg/day) and protein intake (<0.8 g/kg) for longer than two months together with at least two other signs (e.g. BMI <23 kg/m^2, low serum albumin, low cholesterol and low muscle mass), it can be diagnosed of having PEM which increases morbidity (Fouque et al., 2011:350). In this sample where half had BMIs

above 25 kg/m^2, PEM can be overlooked, in contrast half of the group had a low muscle mass (AMA), serum albumin and low cholesterol. Nutrition intervention is needed to correct low energy and protein intake and it needs to be monitored and evaluated regularly together with other clinical signs (BMI, muscle mass, serum albumin, and cholesterol) to be maintained in order to improve health.

Quality of protein is important and overall, 40 % of the participants had inadequate HBV protein intakes (NKF-K/DOQI, 2000, 2006). This seems slightly better than in another South African study with CAPD as RRT (Leclercq, 2015:71).

In the current study, half of the group had above adequate intakes of carbohydrates expressed as a percentage of total energy intake, this is not present in another South African study among CAPD patients (Leclercq, 2015:71). There is a possibility that eating too many carbohydrates (which includes low biological value protein), could lead to high serum urea and eventually loss of appetite, nausea, vomiting, which could lead to malnutrition (Verseput, 2012:A82). Another consequence of high carbohydrate intake, might be the replacement of HBV protein (animal protein). Conversely, total fat intake expressed as a percentage of total energy was below adequate in 45.4 % (n= 34) of the participants, whilst, Leclercq (2015:71) found 60 % (n= 15) with inadequate fat consumption.

6.2.5.3.1 Dietary patterns

Dietary patterns in the FFQ showed that dairy that is restricted due to the high PO4 content (110 mg PO4/ 125 ml), as well as the fluid contribution (Renalsmart, 2008:online; Herselman & Esau, 2005:51-57), and specifically milk, was consumed every day per month, by most (93.3 %, n= 70) and in small portions. The FFQ is, however, limited in identifying if certain foods, like milk, yoghurt and custard, were eaten on the same day, thus raising concern for phosphate overconsumption (Renalsmart, 2008:online; Herselman & Esau, 2005:51-57).

Meat products, eaten by more participants and more frequently, tends to be high in sodium (>430 mg Na/ potion) (Herselman & Esau, 2005:51-57). Most (90.7 %, n= 68) ate boerewors (sausage made with coarsely grounded beef and pork, seasoned with salt and spices and therefore high in sodium), at a median intake of four times per month. More affordable, high salt, processed meat products (polony [70.7 %], viennas [49.3 %], and russians [53.3

%]), were eaten by slightly more participants and more frequently (median 4 – 8 times per month), than other expensive and lower in sodium meat (beef [49.3 %] / mutton [61.3 %]), with a median of four times per month (Table 4.27). Patients receiving MHD with high blood pressure, water retention and pulmonary edema, should restrict high sodium meats (Renalsmart, 2012b:online).

A meat alternative that were eaten often were eggs; 94.7 % (n= 71) consumed eggs with a median intake of 12 times per month, and half (56.6 %) ate a medium portion size (2 eggs). The South African renal exchange lists (2005) needs to be updated to include egg whites and/or whole eggs where the phosphate digestion and bioavailability factors are considered; as this seems to be a frequent, low-cost protein intake.

Peanut butter, and dried beans, is protein alternatives that need clarification regarding PO4 content. It was eaten by half (53.3 %, n= 40), and 30.7 % (n= 23), respectively. According to NKF/KDOQI (2009:S87) peanut butter and dried beans are under 12 mg PO4/g protein aDA and therefore, not a high phosphate meat alternative which can be suggested as a low cost HBV protein.

Bread seems to be a staple food, as all (100 %, n= 75) consumed bread every day. Recently, legislation in South Africa, had been passed on bread to reduce the sodium content of bread to 380 mg/ 100 g by June 2019. Before 2013 the average slice of bread contained 650 mg/ 100 g Na, and contributed 1.6g Na/person/day. (Bertram et al., 2012:744; SA Gov. Gazette, 2013). This legislation would be beneficial to this study's population because bread is eaten daily and dietary sodium should be restricted (NKF-KDOQI, 2000, 2006).

Stiff maize porridge, was also eaten by a majority (96 %, n= 72), with a median intake of 12 times per month. This is a low potassium starch (Herselman & Esau, 2005:51-57), and therefore could contribute valuable energy to the diet, if it does not replace HBV protein.

Vegetables were consumed infrequently with median intakes of four to twelve times per month (Table 4.31), which could result in low fiber intake and escalate constipation (Wilkens et al., 2017:722). Moreover, it was found that low to moderate potassium vegetables (e.g. cabbage and big leave spinach) (Herselman & Esau, 2005:51-57), were often cooked with

potatoes, which can escalate the potassium content of otherwise low to moderate potassium vegetables.

Fruits seem to be eaten more frequently than vegetables. Apples and pears (low potassium fruits, <120 mg K / 100 g) (Herselman & Esau, 2005:51-57), were consumed by 93.3 %, (n= 70) and 72 % (n= 54) of participants, and median consumption was 12 times, and eight times per month, respectively. In the current study, apples and pears were eaten by more, and more often, than other higher potassium vegetables (Table 4.32).

Sunflower oil (78.7 %, n= 59) was dominant in use over canola (17.3 %, n= 13) and olive oil (17.3%, n = 13), where median intakes were daily, 16 times, and 12 times per month, respectively. Therefore, participants in the current study are probably not experiencing the possible benefit of olive oil to reduce CVD risk (Fouque et al., 2011:355); noteworthy, it is much more expensive than sunflower oil.

On the contrary to salt (88 %, n= 66), fewer participants (58.7 %, n= 44) used green herbs and other non-salt flavourants (e.g. garlic, pepper, curry, and coriander) and less frequent (median intake of 12 times / month) than salt, which is used every day. Nutrition education should thus focus on herbs and non-salt spices that can be used as an alternative to salt as well as give recipes because these flavourants can possibly be non-traditional. Moreover, focus should also be placed on not combining different salty flavourants (e.g. salt, stock cubes and mixed meat spice) as this practice can pose a risk for sodium overconsumption (section 5.6.2.9).

One out of five (21.3 %, n= 16) consumed cola cool drinks, which should be restricted due to high inorganic, PO4 content (Herselman & Esau, 2005:51-57; Kalantar-Zadeh et al., 2010a:525; Wickham, 2014:e1-e2).

Alcohol seems to be consumed by only a small percentage of participants, with the allowed spirits contributing the largest percentage (18.7 %, n= 14), amongst the alcohol types with a median intake of once per month.

Take-away foods tend to be high in sodium and frequent consumption (>3 times per week) could possibly indicate non-compliance (Lopez et al., 2007:142). In the current study, 41.3 % (n= 31) ate take-away foods once per week or more often (see section 4.9). The majority ate

take-away fish (65.3 %, n= 49) and pies (65 %, n= 45), with a median intake of twice per month for both.

6.2.6 Knowledge, attitudes and practices regarding dietary modifications and restrictions that are recommended for persons with end stage renal disease who are receiving MHD

Conclusions will be made regarding the knowledge of restricted foods and minerals, phosphate binder medication, and when these are combined.

6.2.6.1 Knowledge of restricted foods and minerals

Only about half (54.7 %) of the participants were found to have a good overall knowledge (≥75 % correct answers) of foods that must be restricted, this seems less than in one other study in the UK (a developed country) (Durose et al., 2004:37). The fact that MHD patients are consulted regularly by dietitians, receive renal diet instruction verbally and in print, and possibly receive education at their education level could possibly explain the higher knowledge of foods that need to be restricted.

Three quarters (74.7 %) had poor knowledge regarding the mineral content of food. This could translate that participants also do not know which minerals lead to additional negative health outcomes, related to excessive dietary intake of restricted minerals.

6.2.6.2 Knowledge regarding phosphate binders

The combined knowledge regarding the name of the phosphate binder medication as well as the correct time to consume the phosphate binder medication revealed poor knowledge in three out of five persons (58.7 %). Poor knowledge together with dietary ignorance to phosphorous intake, could lead to an increased risk of renal osteodystrophy and arteriosclerosis that leads to CVD. This could be a defining factor for health outcomes not being reached and in the end increased morbidity and mortality (Escott-Stump, 2012:876). Indeed, participants with lower phosphate intakes (<10 mg PO4/g protein) (23 %), scored statistically significantly better on knowledge regarding phosphate binders, than those (60.8 %) with a higher phosphate intake (>12 mg PO4/g protein) (95 % CI [2.9 % ; 52.5 %]).

6.2.6.3 Combined knowledge scores

The overall knowledge scores (combined knowledge of restricted foods, mineral content of food and phosphate binder medication), revealed that half of the group (49.4 %) had poor knowledge regarding these important concepts.

In the current study better knowledge was associated with a higher education level and receving NE in a home or second language. Participants with tertiary education (28 %) had statistically significantly better knowledge than those with only primary school education (6.7 %) (95 % CI [3.9 % ; 73.5 %]), and to those who had only partially completed secondary school (17.3 %) (95 % CI [6.3 % ; 64.0 %]). Only, 21 % had received written and 30.7 % verbal, nutrition education (NE) in their home language. Overall, 24 % had not received NE in their home and/or second language. Having received NE in a home language and/or second language was associated with statistically significantly higher overall knowledge scores (95 % CI [3.7 % ; 49.5 %]).

Accurate nutrition knowledge may be particularly important when individuals are ready to make dietary changes (Durose et al., 2004:40). Even though knowledge is not the only predictive factor of non-compliance, it inclines to be asserted as the starting point of compliance.

Similarly, Shisana et al. (2013:178) conveyed that three out of five persons in the general population of South Africa, had average nutrition knowledge according to the SANHANES-1 report. Very few had good nutrition knowledge.

Nutrition education at a similar schooling level and in the home-language of the patient needs more research and consideration when developing and implementing programs.

6.2.6.4 Attitude towards adhering to the renal diet

Only 40 % (n= 30), reported feeling positive. Macías & Glasauer (2014:54) stress that if a desired/positive attitude is less than 70 %, nutrition-education intervention is urgent. Attitude towards the renal diet has not been studied in the South African context before and could possibly be transferred to other chronic diseases requiring life altering intervention.

The major reason for feeling negative about adhering to the renal diet, was that the number of food restrictions was too extensive. Around a third felt negative, because favourite foods were restricted. Other minor reasons included that they felt that food was tasteless without salt, usual/typical/traditional foods are restricted, and that social interaction was hindered by food restrictions. Feeling neutral towards the renal diet, was considered having a negative attitude, and one of the major reasons included that nobody had explained the diet to them. This is concerning, as the diet is such a large part of life and improved health outcomes.

The major explanation for a positive attitude regarding the diet, was the fact that they felt better when they adhered to the renal diet (e.g. not nauseas or swollen). This is similar to a one study in a developed country (Lopez et al., 2007:143).

6.2.6.5 Attitude towards the cost of the renal diet

More than half (52.9 %) felt that the renal diet was more expensive. This differs from a developed country (US), where food cost was not a major factor regarding attitude (Lopez et al., 2007:143). This can also reflect the general population in South Africa's perception, where 39 % of households felt they do not have enough money for food (Shisana et al., 2013:64).

Most of the participants that felt that the prescribed renal diet was more expensive, explained that they had to buy separate/different/non-traditional foods (32.4 %), and that the prescribed foods were more expensive than typical/traditional food (29.7 %).

6.2.6.6 Attitudes towards the specific types of foods that are allowed in the renal diet

More than half (55.7 %) of the participants reported that they liked the food they were allowed to eat, whilst, 15.7 % said they do not like the food. This seems lower than in one study in a developed country (US), where eight out of ten persons like the prescribed food on the renal diet (Lopez et al., 2007:143).

Almost half (45.5 %) that had a negative attitude towards the foods allowed in the renal diet, indicated that they felt this way because food was tasteless without salt. This is similar

to one study in a developed country (US) (St Jules et al., 2016:120). Another reason included that restrictions were too extensive.

Four people mentioned that they did know how to perceive the foods prescribed in the renal diet, because they were uninformed about the diet.

6.2.6.7 Practices

Most participants (61.4 %), reported poor adherence practices to the prescribed eating pattern. Indeed, even if there was good knowledge, poor practices, shows poor adherence (Macías & Glasauer, 2014:18). Overall, in the current study, one in six (17.3 %) reported that, in the previous week, they had not adhered to the renal diet at all; half (52 %) reported that they had followed the diet for 1 – 5 days, which is considered poor adherence (following the diet for six or more days per week equals good adherence) (Lopez et al., 2007:145; St Jules et al., 2016:120). Furthermore, most participants (61.4 %) indicated that they could only sometimes eat the correct amounts of restricted foods (thus, adhere to the renal diet). In conclusion, practices needs to be assessed and if poor needs to be addressed.

6.2.7 The Involvement of dietitians in the treatment of renal patients

Only three out of four participants (77.3 %) indicated that they had received nutrition education from a dietitian. NKF-K/DOQI (2000:S45) recommends that a dietitian should lead the assessment of nutritional status of patients on MHD on a quarterly basis. Possible reasons why all the participants were not consulted by a dietitian, as seen in the current study, is the shortage of health workers in South Africa and Africa (Naicker et al., 2009:S60; Anyangwe & Mtonga, 2007:93; Ameh et al., 2016:online). Another reason could be that the multidisciplinary team, that includes the patient and/or caregiver (often the patient's spouse), nephrologist, nurse, and social worker, are not aware of how regularly the dietitian should be involved and the valuable nutrition therapy that can be contributed.

A few reported that they made use of printed or internet nutrition educational materials (from trusted sources). This could be that there are limited standardised printed or internet educational material available, suited to South Africans (and in their home language).

Family and friends could be an under resourced avenue that could be involved in nutrition education and support to influence compliance (Macías & Glasauer, 2014:55; St-Jules et al., 2016:122).

One out of seven participants did not have access to the expertise of a dietitian for whatever reason which is disconcerting. Half of the sample reported that they completely understood the nutrition education given by the dietitian, whilst, the other half reported that they only partially understood the dietitian's dietary education. No one reported that they did not understand the dietitian at all. The comprehension rate seems lower than what Lopez et al. (2007:142) found in a developed country.

Even in a developed country like the US, Lopez et al. (2007:142) reported that language barriers could be a reason for partial comprehension of nutrition education, equally was the case in the current study. For example, the major reason for partial comprehension, in the current study, was language barriers. The second most frequently reported reasons for not understanding completely was that the motivation (advantages and disadvantages of following the prescribed eating pattern), was not explained clearly and that the prescribed foods were not always available or found to be too expensive.

Three quarters of the participants reported zero to one consultation with a dietitian per dialysis year, which, according to NKF recommendations, is insufficient (NKF-K/DOQI, 2000:S46; Fouque et al., 2007:52). Frequency of dietetic consultations from a patient's perspective has not been researched in South Africa before.

6.3 Recommendations

The following recommendations are made for dietitians, healthcare service providers and for future research.

6.3.1 Recommendations for dietitians

Nutrition knowledge regarding MHD dietary modifications and restrictions as well as aspects regarding phosphate binder medication need to be improved amongst South African patients, care givers and other health professionals. This should be done with standardised nutrition education material, preferably in the individuals' home language. Insight on how

to apply nutrition education could possibly be improved if instruction is in a familiar language. Research to test the effectiveness of these programmes is also needed.

Monitoring of patients' compliance and knowledge regarding phosphate binder medication is vital and needs more prominence.

The development of structured support programmes by the dietitians and the healthcare team to detect and aid single, divorced, or widowed, MHD patients. Being single and solely responsible for cooking could possibly negatively influence eating behaviour. Ghimire et al. (2015:online) found in a meta-analysis that living single, being divorced and widowed were factors that influenced non-adherence to medication therapy including phosphate binder medication in MHD patients.

Development of strategies to include family members, and especially female family members, in nutrition education, if they are the ones mostly planning and preparing the food.

Development of user-friendly, unambiguous nutrition education guidelines for patients to explain the different dietary modifications and restrictions for each stage of CKD including stage 1 – 4, ESRD (no RRT [conservative treatment], MHD or CAPD) and kidney transplant.

Measurement and standardised note-keeping of muscle mass, body fat, WHtR, WC to gain information regarding the South African population receiving MHD, which can possibly be used in retrospective studies.

Attitudes of groups and individuals regarding nutrition, need to be assessed and addressed in innovative and culturally inclusive means. Macías & Glasauer (2014:54) stress that if a desired/positive attitude is fewer than 70 % then nutrition-education intervention is urgent. Development and implementation of a focussed, structured, consistent programme that measures and improves attitude formally, could prevent individuals "falling through the cracks".

Possible solutions for addressing a negative attitude that needs to be communicated amongst dietitians, patients, care-givers and health professionals are: ample alternatives for favourite foods and/or traditional foods, renal-friendly modifications to recipes of traditional food (e.g. boerewors and biscuits), education on alternative ways to use spices

and herbs to flavour food. Instead of teaching to avoid restricted food (especially fruits, vegetables and low-cost protein options), rather teach to only eat set-portions sizes, few times per week, and to include family members in education sessions to strategise how social interaction around meals can be inclusive of persons who receive MHD. Also, providing easily, attainable, low—cost food options and to focus on low-cost options that the whole family can eat (Conradie, 2008:online; Beto et al., 2016:28).

Improving a negative attitude regarding the cost of the renal diet can be further solved by educating and including low PO4, protein alternatives that were restricted in the past e.g. dried beans (legumes), chunky peanut butter, kidney beans, unsalted roasted peanuts, chickpeas, eggs, etc. (Jones, 2001:online; Cupisti et al., 2006:online; NKF-K/DOQI, 2009:S87).

Additional solutions outside the field of nutrition, to improve a negative attitude regarding the cost of the renal diet, could include education on financial planning, expenditure and budgeting.

The reasons for a positive attitude that were given in this study can be included in verbal and written nutrition-education to motivate other persons who receive MHD.

Nutrition practices need to be assessed and addressed in innovative and culturally inclusive means. Ways to improve the desirable practice of eating enough (protein and energy) foods needs a different measuring method instead of using scales, spoons and cups. The hand as a measuring tool in the South African CKD context might need to be adjusted to avoid overconsumption of dense starches (Ameh et al., 2016:online).

Factors that cause hindrance to adhere to the renal diet for more days per week (ideally 6 – 7 days per week), were not assessed and it could be a useful question in a consultation for dietitians to appreciate individual practices and possibly help facilitate solutions.

Develop and standardise nutrition educational materials (printed, visual media or internet format), that are suited for South Africa, and providing it in the home language of patients and their families.

Increase comprehension of the renal diet by including the motivation (advantages and disadvantages of following the prescribed eating pattern) in nutrition education material.

The SA renal exchange lists needs to be updated to include plant proteins, for which the phosphate content is adjusted for bioavailability and absorption (NKF-K/DOQI, 2009:S87).

6.3.2 Recommendations for healthcare service providers including government and private sectors

Development of national strategies to regularly monitor anthropometry and intervene when MHD patients are losing weight or muscle.

Standardised cut-off values for serum creatinine needs to be clarified as normal values for MHD are vaguely indicated for small and larger persons (small pt. on dialysis, 708-1062 µmol/L; large pt. on dialysis, 1 328 – 1 770 µmol/L) (NKF, 2002). It is unclear whether, small and large, indicate frame size, gender and/or muscle mass and complicates interpretation.

Individuals with low, low–normal (1.7 – 2 mmol/L), or declining serum cholesterol levels should be investigated for possible nutritional deficits, as well as for other comorbid conditions. Use of lipid-lowering drugs should be taken into account in the total cholesterol values and possibly be cut-back when patients are malnourished or underweight (Fouque et al., 2007:51; Wilkens et al., 2012:825). Therefore, more frequent cholesterol testing as part of PEM detection can be implemented in South Africa.

Develop awareness programs, of the required frequency (every 4 – 6 months) and value of dietetic visits, amongst medical aids, patients and/or caregivers (often the patient's spouse), nephrologists, nurses, and social workers for MHD patients (NKF-K/DOQI, 2000:S45).

Mandate the dietitian to patient ratio of 1:100 for policy makers in order to improve the quality of care, as staff shortages could result in insufficient and infrequent dietetic visits. Three quarters of the participants reported zero to one consultation with a dietitian per dialysis year, which, according to NKF recommendations, is insufficient (NKF-K/DOQI, 2000:S46; Fouque et al., 2007:52; NKF, 2004; Lopez et al., 2007:144; Ameh et al., 2016:online).

Development of regular, advanced, accredited training for dietitians (e.g. performance-based short courses above and beyond continuing professional development [CPD]) regarding all aspects of CKD (Brommage et al., 2009: 1618).

Improvement of note keeping in patient files to include the etiology for kidney failure, co-morbidities and prescriptions, as this aids the entire health care team to improve care. Dietitians especially rely on patient files for information because referrals are not always complete regarding the patients' medical details.

Dietitians can be responsible for educating other health professionals and family members regarding dietary aspects, as participants also received dietary education from nurses, doctors, unit managers, clinical technicians, and family.

6.3.3 Recommendations for future research

Further research in the MHD population is needed in other provinces in South Africa to determine nutritional status, KAP as well as the involvement of a dietitian.

Preference of language of written and verbal nutrition education need further research in upcoming studies.

Development of educational videos, in the home language of patients, and researching whether it improves outcomes (e.g. improved serum phosphate levels) (Baldwin, 2013:437).

Further studies to measure over-crowdedness and its effect on the MHD population. Naicker (2003:S119) mentioned that in Africa the prevalence of over-crowdedness is higher which could lead to more infectious diseases and that could increase the disease burden on an already vulnerable MHD population. HDR could also have a negative impact on household food security as money available for food per person, per month could be below 40 % of income per person (Coetzee, et al., 1988:354; Peyper, 2016:online).

Randomised control trials to measure if a higher ratio of plant proteins will affect serum phosphate values in patients receiving MHD in SA.

REFERENCES

Abdu, A., Ladeira, N., Naidoo, S. & Naicker, S., 2011. The nutritional status of continuous ambulatory peritoneal dialysis patients at a Johannesburg hospital. *South African Journal of Clinical Nutrition*, 24(3):150-153

Alberti, K.G.M.M., Eckel, R.H., Grundy, S.M., Zimmet, P.Z., Cleeman, J.I., Donato, K.A., Fruchart, J.W., James, P.T., Loria, C.M. & Smith, S.C. 2009. Harmonising the metabolic syndrome: A joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity. *Journal of the American Heart Association*, 120:1640-1645

Ameh, O.I., Cilliers, L. & Okpechi, I.G. 2016. A practical approach to the nutritional management of chronic kidney disease patients in Cape Town, South Africa. *Biomed Central Nephrology*, 17(1), https://bmcnephrol.biomedcentral.com/articles/10.1186/s12882-016-0297-4 [20 Dec 2017]

American Dietetic Association (ADA). 2011. International dietetics and nutrition terminology (IDNT), reference manual's pocket guide: Standardised language for the nutrition care process. 3rd Ed., Chicago: American Dietetic Association:279

Anyangwe, S.C. & Mtonga, C. 2007. Inequities in the global health workforce: the greatest impediment to health in sub-Saharan Africa. *International Journal Environmental Research and Public Health*, 4(2):93-100

Ashwell, M., Gunn, P. & Gibson, S. 2012. Waist-to-height ratio is a better screening tool than waist circumference and BMI for adult cardio metabolic risk factors: systematic review and meta-analysis. *Obesity Reviews*, 13:275-286

Baldwin, D.M. 2013. Viewing an educational video can improve phosphorus control in patients on hemodialysis: A pilot study. *Nephrology Nursing Journal*, 40(5):437

Beddhu, S., Ramkumar, N. & Samore, M.H. 2005. The paradox of the "body mass index paradox" in dialysis patients: associations of adiposity with inflammation. *American Journal of Clinical Nutrition*, 82:909

Berger, T.G. & Steinhoff, M. 2011. Pruritus and renal failure. *Seminars in Cutaneous Medicine and Surgery*, 30(2):99-100, June

Bertram, M. Y., Steyn, K., Wentzel-Viljoen, E., Tollman, S., Hofman, K.J. 2012. Reducing the sodium content of high-salt foods: Effect on cardiovascular disease in South Africa. *The South African Medical Journal*, 102(9):743-745

Bethesda, M.D. 1998. National Heart LaBI: Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. *National Institutes of Health*, xiv (14)

Beto, J.A., Schury, K.A. & Bansal, V.K. 2016. Strategies to promote adherence to nutritional advice in patients with chronic kidney disease: a narrative review and commentary. *International Journal of Nephrology and Renovascular Disease*, 9:21-33, February

Biesenbach, G. & Zazgornik, J. 1996. Influence of smoking on the survival rate of diabetic patients requiring hemodialysis. *Diabetes Care*, 19(6): 625- 628, June

Botden, L., Naicker, S., Muranda, A.Z. & Nel, J. 1997. Assessment of serum albumin status in the CAPD patient. In*: Abstracts of the Congress of the African Association of Nephrology*, Durban.

Botha, A. 2015. Assessing risk of malnutrition in adult patients on hemodialysis in Port Elizabeth. Unpublished MSc. Dissertation. *University of the Free State*, Bloemfontein.

Bradley N. 1998. Assessment of the nutritional status and the factors affecting nutritional status of CAPD patients attending the dialysis clinic of Addington Hospital. Unpublished B.Sc. Dietetics (Honours) thesis, *University of Natal,* Durban.

Brommage, D., Karalis, M., Martin, C., McCarthy, M., Benner, D., Goeddeke-Merickel, C.M., Wiesen, K., Byham-Gray, L., House, J.L., Pavlinac, J. & McCann, L. 2009. American Dietetic Association and the National Kidney Foundation: Standards of practice and standards of

professional performance for registered dietitians (generalist, specialty, and advanced) in nephrology care. *Journal of American Dietetic Association*, 109(9):1618

Burmeister, J.E., Mosmann, C.B., Costa, V.B., Saraiva, R.T., Grandi, R.R., Bastos, J.P., Gonçalves, L.F. & Rosito, G.A. 2014. Prevalence of cardiovascular risk factors in hemodialysis patients: The CORDIAL study. *Arquivos Brasileiros de Cardiologia*, 102(5):473-480

Carrero, J.J., Stenvinkel, P., Cuppari, L., Ikizler, T.A., Kalantar-Zadeh, K., Kaysen, G., Mitch, W.E., Price, S.R., Wanner, C., Wang, A.Y.M., Ter Wee, P. & Franch, H.A. 2013. Etiology of the protein-energy wasting syndrome in chronic kidney disease: a consensus statement from the international society of renal nutrition and metabolism (ISRNM). *Journal of Renal Nutrition*, 23(2):77-90, March

Census 2011. Provincial Profile: Free State / *Statistics South Africa*. Pretoria: Statistics South Africa, 2014:32, http://www.statssa.gov.za/publications/Report-03-01-73/Report-03-01-732011.pdf [2 May 2018]

Chapman-Novakofski, K. 2012. Education and counselling: behaviour change. In Mahan, K.L., Escott-Stump, S. & Raymond, J.L. (eds). *Krause's Food and the Nutrition Care Process*. 13th ed., Philadelphia: W.B. Saunders Company: 325-337

Coetzee, N., Yach, D. & Joubert, G. 1988. Crowding and alcohol abuse as risk factors for tuberculosis in the Mamre population. *South African Medical Journal*, 74:354

Collins, A.J., Foley, R.N., Herzog, C., et al. 2010. Excerpts from the US renal data system 2009, annual data report. *American Journal of Kidney Diseases*, 55:S1.

Conradie, N. 2008. Renalsmart Recipes. http://blogs.sun.ac.za/renalsmart/recipes/ [16 Dec 2017]

Cupisti, A., Comar, F., Benini, O., Lupetti, S., D'Alessandro, C., Barsotti, G. & Gianfaldoni, D. 2006. Effect of boiling on dietary phosphate and nitrogen intake. *Journal of Renal Nutrition*, 16(1), January. http://www.sciencedirect.com/science/article/pii/S1051227605001767 [20 Dec 2017]

D'Alessandro, C., Piccoli, G.B., & Cupisti, A. 2015. The "phosphorus pyramid": a visual tool for dietary phosphate management in dialysis and CKD patients. *BMC Nephrology*, 16(9):2-6, January

DaVita. 2018. Alcohol and chronic kidney disease. https://www.davita.com/kidney-disease/diet-and-nutrition/lifestyle/alcohol-and-chronic-kidney-disease/e/5330 [12 June 2018]

De Mutsert, R., Grootendorst, D.C., Indemans, F., Boeschoten, E.W., Krediet, R.T. & Dekker, F.W. 2009. Association between serum albumin and mortality in dialysis patients is partly explained by inflammation, and not by malnutrition. *Journal of Renal Nutrition*. 9: 127–135, March

Devraj, R. & Wallace, L.S. 2013. Application of the content expert process to develop a clinically useful low-literacy Chronic Kidney Disease Self-Management Knowledge Tool (CKD-SMKT). *Research in Social and Administrative Pharmacy*, 9:633–639

Durose, C. L., Holdsworth, M., Watson, V., & Przygrodzka, F. 2004. Knowledge of dietary restrictions and the medical consequences of non-compliance by patients on hemodialysis are not predictive of dietary compliance. *Journal of the American Dietetic Association*, 104(1): 35–41

Encyclopaedia Britannica. 2017. Physiology: Renin-angiotensin system. https://www.britannica.com/science/renin-angiotensin-system [2 May 2018]

Eriksen, B.O. & Ingebretsen, O.C. 2006. The progression of chronic kidney disease: A 10-year population-based study of the effects of gender and age. *International Society of Nephrology*, 69:375–382

Escott-Stump, S. 2012. *Nutrition and Diagnosis Related Care*. 7th ed. Baltimore: Lippincott Williams & Wilkens: 860-896

Fouque, D., Kalantar-Zadeh, K., Kopple, J.D., Cano, N., Chauveau, P., Cuppari, L., Franch, H., Guarnieri, G., Ikizler, T.A., Kaysen, G., Lindholm, B., Massy, Z., Mitch, W., Pineda, E., Stenvinkel, P., Trevinho-Becerra, A., & Wanner, C. 2008. A proposed nomenclature and

diagnostic criteria for protein–energy wasting in acute and chronic kidney disease. *Kidney International*, 73:391–398

Fouque, D., Pelletier, S., Mafra, D. & Chauveau, P. 2011. Nutrition and chronic kidney disease. *Kidney International,* 80: 348-357, March

Fouque, D., Vennegoor, M., Ter Wee, P., Wanner, C., Basci, A., Canaud, B., Haage, P., Konner, K., Kooman, J., Martin-Malo, A., Pedrini, L., Pizzarelli, F., Tattersall, J., Tordoir, J. & Vanholder, R. 2007. EBPG guideline on nutrition. *Nephrology Dialysis Transplantation*, 22(Suppl 2):45-87

Freercks, R., Swanepoel, C., Carrara, H., Moosa, S., Lachman, A. & Rayner, B. 2012. Vascular calcification in South African dialysis patients: Ethnic variation, prevalence, detection and haemodynamic correlates. *Journal of Nephrology*, 7:607-615

Frisancho, A.R. 2011. Anthropometric Standards: An interactive nutritional reference of body size and body composition for children and adults. 3rd Edit. USA: The University of Michigan Press

Gago, C., Gónzalez, S., Marco, B., Fernández, J., Jarriz, M.D.A., Martinez, S., Gónzalez, A., Gálvez, C., Andrea, C., Hernando, P., Hernández, J. & Gruss, E. 2000. Compliance of hemodialysis patients with prescribed medication. *Journal of Renal Care*, 26 (4):4-6, October.

Gerntholtz, T., Paget, G., Hsu, P., Meyers, A.M. 2015. Management of patients with chronic kidney disease. *South African Medical Journal*, 105(3):3-6, March

Ghimire, S., Castelino, R.L., Lioufas, N.M., Peterson, G.M., Zaidi, S.T.R. 2015. Nonadherence to medication therapy in hemodialysis patients: A systematic review. *Plos one*, 10(12): e0144119. doi:10.1371/journal.pone.0144119 [21 Dec 2017]

Gibson, E.L., Held, I., Khawnekar, D. & Rutherford, P. 2016. Differences in knowledge, stress, sensation seeking, and locus of control linked to dietary adherence in hemodialysis patients. *Frontiers in Psychology*, 7:1864, November

Gibson, R.S. 2005. *Principles of Nutritional Assessment*. 2nd Ed. New Zealand: Oxford University Press: 47

Goraya, N., Simoni, J., Jo, C. & Wesson, D.E. 2013. A comparison of treating metabolic acidosis in CKD stage 4 hypertensive kidney disease with fruits and vegetables or sodium bicarbonate. *Clinical Journal of the American Society of Nephrology*, 8:371–381

Grassmann, A., Gioberge, S., Moeller, S. & Brown, G. 2005. ESRD patients in 2004: global overview of patient numbers, treatment modalities and associated trends. *Nephrology Dialysis Transplant*, 20:2587–2593

Halle, M.P., Zebaze, P.N., Mbofung, C.M., Kaze, F., Mbiatat, H., Ashuntantang, G. & Kengne, A.P. 2014. Nutritional status of patients on maintenance hemodialysis in urban sub-Saharan Africa: evidence from Cameroon. *Journal of Nephrology*, 27:545-553, January

Hammond, K.A. & Litchford, M.D. 2012. Clinical: inflammation, physical and functional assessments. In Mahan, K.L., Escott-Stump, S. & Raymond, J.L. (eds). *Krause's Food and the Nutrition Care Process*. 13th ed., Philadelphia: W.B. Saunders Company: 163-165

Hammond, K.A. 2012. Intake: analysis of the diet. In Mahan, K.L., Escott-Stump, S. & Raymond, J.L. (eds). *Krause's Food and the Nutrition Care Process*. 13th ed., Philadelphia: W.B. Saunders Company: 129, 137

Hecking, M., Bieber. B.A., Ethier, J., Kautzky-Willer, A., Sunder-Plassmann, G., Saemann, M.D., Ramirez, S.P., Gillespie, B.W., Pisoni, R.L., Robinson, B.M., Port, F.K. 2014. Sex-specific differences in hemodialysis prevalence and practices and the male-to-female mortality rate: The dialysis outcomes and practice patterns study (DOPPS). *PLoS Med*, 11(10):e1001750. https://doi.org/10.1371/journal.pmed.1001750 [9 June 2018]

Herselman, M. G. & Esau, N. 2005. Development of the South African renal exchange lists. *South African Journal of Clinical Nutrition*, 18(2): 51-57

Herselman, M.G., Esau, N., Steel, K.S., Allen, N.A. and Lang, N. 2005. Nutritional management of chronic renal failure by dietitians – the South African experience. *South African Journal of Clinical Nutrition*, 18(2):60-66

Ikizler, A., Cano, N.J., Franch, H., Fouque, D., Himmelfarb, J., Kalantar-Zadeh, K., Kuhlmann, M.K., Stenvinkel, P., TerWee, P., Teta, D., Wang, A.Y. & Wanner, C. 2013. Prevention and treatment of protein energy wasting in chronic kidney disease patients: a consensus

statement by the International Society of Renal Nutrition and Metabolism. *Kidney International*, 84:1096-1107, May

Imai, E., Horio, M., Yamagata, K ., Iseki, K., Hara, S., Ura, N., Kiyohara, Y., Makino, H., Hishida, A., & Matsuo, A. 2008. GFR decline rate in Japanese general population: a longitudinal 10 year follow-up study. *Hypertension Research*, 31: 435–443

Isla, R.A.T., Mapiye, D., Swanepoel, C.R., Rozumyk, N., Hubahib, J.E. & Okpechi, I.G. 2014. Continuous ambulatory peritoneal dialysis in Limpopo province, South Africa: predictors of patient and technique survival. *Peritoneal Dialysis International*, 34:518–525

Jones, W.L. 2001. Demineralization of a wide variety of foods for the renal patient. *Journal of Renal Nutrition*, 11(2), April http://www.sciencedirect.com/science/article/pii/S1051227601387514 [20 Dec 2017]

Kalantar-Zadeh, K., Block, G., Humphreys, M.H. & Kopple, J.D. 2003. Reverse epidemiology of cardiovascular risk factors in maintenance dialysis patients. *Kidney International*, 63:793–808

Kalantar-Zadeh, K., Block, G., McAllister, C.J., Humphreys, M.H., Kopple, J.D. 2004. Appetite and inflammation, nutrition, anemia, and clinical outcome in hemodialysis patients. *American Journal of Clinical Nutrition*, 80(2):299-307

Kalantar-Zadeh, K., Gutekunst, L., Mehrotra, R., Kovesdy, C.P., Bross, R., Shinaberger, C.S., Noori, N., Hirschberg, R., Benner, D., Nissenson, A.R. & Kopple, J.D. 2010a. Understanding sources of dietary phosphorus in the treatment of patients with chronic kidney disease. *Clinical Journal of the American Society of Nephrology*, 5:519-530

Kalantar-Zadeh, K., Kuwae, N., Wu, D.Y., Shantouf, R.S., Fouque, D., Anker, S.D., Block, G. & Kopple, J.D. 2006. Associations of body fat and its changes over time with quality of life and prospective mortality in hemodialysis patients. *American Journal of Clinical Nutrition*, 83:202-210

Kalantar-Zadeh, K., Streja, E., Kovesdy, C.P., Oreopoulos, A., Noori, N., Jing, J., Nissenson, A.R., Krishnan, M., Kopple, J.D., Mehrotra, R. & Anker, S.D. 2010b. The obesity paradox and mortality associated with surrogates of body size and muscle mass in patients receiving hemodialysis. *Mayo Clinic Proceedings*, 85(11):991-1001

Kalantar-Zadeh, K., Tortorici, A.R., Chen, J.L.T, Kamgar, M., Lau, W., Moradi, H., Rhee, C.M., Streja, E. & Kovesdy, C.P. 2015. Dietary restrictions in dialysis patients: Is there anything left to eat? *Seminars in Dialysis*, 28 (2):159–168, April

Karamanidou, C., Clatworthy, J., Weinman, J., & Horne, R. 2008. A systematic review of the prevalence and determinants of nonadherence to phosphate binding medication in patients with end-stage renal disease. *BMC Nephrology*, 9(1): 2

Karavetian, M., De Vries, N., Rizk, R. & Elzein, H. 2014. Dietary educational interventions for management of hyperphosphatemia in hemodialysis patients: a systematic review and meta-analysis. *Nutrition Reviews*, 72(7):471-482, July

Katzenellenbogen, J. & Joubert, G. 2007. Data collection and measurement. In *Epidemiology. A Research Manual for South Africa*. Joubert, G. & Ehrlich, R. (eds). 2nd ed. South Africa: Oxford University Press:106-123

Kellogg's website. 2016. http://www.kelloggs.co.za/en_ZA/corn-flakes-product.html [4 April 2018]

Kidney Disease: Improving Global Outcomes (KDIGO). 2013a. 2012 Clinical Practice Guideline for the evaluation and management of chronic kidney disease. *Kidney International Supplements*, 3(1):1-150, January

Kidney Disease: Improving Global Outcomes (KDIGO) Lipid Work Group. 2013b. KDIGO Clinical practice guideline for lipid management in chronic kidney disease. *Kidney International Supplements*, 3:259–305

Klaassen-Broekema, N. & Van Bijsterveld, O.P. 1992. Red eyes in renal failure. *British Journal of Ophthalmology*, 76:268-271

Kopple, J.D. 2012. Nutrition, diet and the kidney. In Ross, A.C., Caballero, B., Cousins, R.J., Tucker, K.L. & Ziegler, T.R. (eds). *Modern nutrition in health and disease*. 11th ed. Philadelphia: Wolters Kluwer: Lippencott, Williams & Wilkens:1356

Kraut, J.A. & Madias, N.E. 2016. Metabolic acidosis of CKD: An update. *American Journal of Kidney Diseases*, 67(2):307-317

Kruger, H., Venter, C., Vorster, H. & Margetts, B. 2002. Physical inactivity is the major determinant of obesity in black woman in the North West Province, South Africa. The THUSA study. *Nutrition*, 18:422-427

Larsen, K. 2007. Health literacy: In *Immigrant Medicine*. Walker, P.F., Barnett, E.D., Stauffer, W. & Jaranson, J.M. (eds). 1st Ed., Elsevier Health Sciences:711-724

Leclercq, B. 2015. A randomised controlled clinical trial of protein supplementation on the nutritional status in patients receving continuous ambulatory peritoneal dialysis (CAPD) in Frere Hospital, East London. Unpublished MSc. Dissertation. *University of the Free State*, Bloemfontein

Lee, R.D. & Nieman, D.C. 2013. *Nutritional Assessment*. 6th Edit. Singapore: McGraw-Hill

Lillegaard, I.T.L., Øverby, N.C. & Andersen, L.F. 2005. Can children and adolescents use photographs of food to estimate portion sizes? *European Journal of Clinical Nutrition*, 59(4):611–617

López, C.M., Burrowes, J.D., Gizis, F. & Brommage, D. 2007. Dietary adherence in hispanic patients receiving hemodialysis. *Journal of Renal Nutrition*, 17(2): 138-147, March

Macías, Y.F., Glasauer, P. 2014. Guidelines for assessing nutrition-related knowledge, attitudes and practices manual. *Food and Agriculture Organization of the United Nations (FAO)*, Rome

Meyers, A.M. 2015. Chronic Kidney Disease. *South African Medical Journal*, 105(3):232

Mitch, W. & Ikizler, T. 2010. *Handbook of Nutrition and the Kidney*. 6th Edit. Philadelphia: Lippincott-Williams and Wilkens: 197-198

Morey, B., Walker, R. & Davenport, A. 2008. More dietetic time, better outcome? A randomized prospective study investigating the effect of more dietetic time on phosphate control in end-stage kidney failure hemodialysis patients. *Nephron Clinical Practice*, 109:173–180

Morton, R.L., Schlackow, I., Gray, A., Embersohn, J., Herrington, W., Staplin, N., Reith, C., Howard, K., Landray, M.J., Cass, A., Baigent, C. & Mihaylova, B. on behalf of the SHARP

Collaborative Group. 2018. Impact of CKD on household income. *Kidney International Reports*, 3(3): 610-618, May

Muranda, A.Z., Naicker, S., Botden, L. & Nel, J. 1999. Patient function and well-being on CAPD (abstract). *Kidney International*, 55:2120

Murphy, D., McCulloch, C.E., Lin, F., Banerjee, T., Bragg-Gresham, J.L., Eberhardt, Morgenstern, H., Pavkov, M. E., Saran, R., Neil R. Powe, N.R. & Hsu, C. 2016. Prevalence of chronic kidney disease in the United States. *Annals of Internal Medicine*, 165(7):473-481, August

Naicker, S. 2002. Nutritional problems associated with end-stage renal disease in the developing world. *Artificial Organs*, 26(9):757–759

Naicker, S. 2003. End-stage renal disease in Sub-Saharan and South Africa. *Kidney International*, 63:S119-122

Naicker, S. 2009. End-stage renal disease in Sub-Saharan Africa. *Ethnicity and Disease*, 19(S1):13-15

Naicker, S., Plange-Rhule, J., Tutt, R.C. & Eastwood, J.B. 2009. Shortage of healthcare workers in developing countries–Africa. *Ethnicity and Disease*, 19(1):60

National Kidney Foundation (NKF-K/DOQI). 2000. Nutrition in chronic renal failure guidelines. American Journal of Kidney Diseases, 35(6), Suppl 2:S1-S140, June

National Kidney Foundation (NKF-K/DOQI). 2002. K/DOQI Clinical practice guidelines for chronic kidney disease: Evaluation, classification and stratification. *American Journal of Kidney Diseases*, 39:S1-S266, (suppl 1):S126

National Kidney Foundation (NKF-K/DOQI). 2003. K/DOQI Clinical practice guidelines for managing dyslipidemias in chronic kidney disease. *American Journal of Kidney Diseases*, 41 (4), Suppl 3 (April):S1-S91

National Kidney Foundation (NKF-K/DOQI). 2005. K/DOQI Clinical practice guidelines for cardiovascular disease in dialysis patients. *American Journal of Kidney Diseases*, 45, Suppl 3:S1-S154

National Kidney Foundation (NKF-K/DOQI). 2006. K/DOQI Clinical practice guidelines and clinical practice recommendations for anemia in chronic kidney disease. *American Journal of Kidney Disease*, 47, Suppl 3:S1-S146

National Kidney Foundation (NKF-K/DOQI). 2007. K/DOQI Clinical practice guidelines and clinical practice recommendations for diabetes and chronic kidney disease. *American Journal of Kidney Diseases*, 49 (2), Suppl 2:S1-S180

National Kidney Foundation (NKF-K/DOQI). 2009. K/DOQI Clinical practice guideline for nutrition in children with CKD: 2008 Update. *American Journal of Kidney Disease*, 53:S1-S124

National Kidney Foundation (NKF). 2009. Pocket guide to nutrition assessment of the patient with chronic kidney disease (CKD). 4th ed. New York, NY: *National Kidney Foundation*: "Laboratory Tests" table.

Naylor, H. L., Jackson, H., Walker, G. H., Macafee, S., Magee, K., Hooper, L., Stewart, L. & Maclaughlin, H. L. 2013. British Dietetic Association evidence-based guidelines for the protein requirements of adults undergoing maintenance hemodialysis or peritoneal dialysis. *The British Journal of Human Nutrition and Dietetics*, 26:315-318

Nelms, M. & Lacey, K. 2016. Diseases of the renal system. In Nelms, M., Sucher, K.P., & Lacey, K. (eds). *Nutrition Therapy and Pathophysiology*. 3rd ed. China: Cengage Learning: 521-549

NKF. 2016. Anemia and Chronic Kidney Disease (A to Z health guide for patients). https://www.kidney.org/atoz/content/what_anemia_ckd [29 Dec 2017]

Peacock, T.P., Shihabi, Z.K., Bleyer, A.J., Dolbare, E.L., Byers J.R., Knovich, M.A., Calles-Escandon, J., Russell, G.B. & Freedman, B.I. 2008. Comparison of glycated albumin and hemoglobin A1c levels in diabetic subjects on hemodialysis. *Kidney International*, 73:1062–1068

Peyper, L. 2016. Minimum wage of R8 000 decent, says social body: PACSA. Table: May 2016 http://www.fin24.com/Economy/minimum-wage-of-r8-000-decent-says-social-body-20160722 [24 July 2016]

Postorino, M., Marino, M., Tripepi, G., & Zoccali, C. 2011. Abdominal obesity modifies the risk of hypertriglyceridemia for all-cause and cardiovascular mortality in hemodialysis patients. *Kidney International*, 79:765–772

Prochaska, J.O., Velicer, W.F., Rossi, J.S., Goldstein, M.G., Marcus, B.H., Rakowski, W., Fiore, C., Harlow, L.L., Redding, C.A., Rosenbloom, D., & Rossi, S. R. 1994. Stages of change and decisional balance for 12 problem behaviors. *Health Psychology*, 13(1):39-46

Raymond, J.L. & Couch, S.C. 2012. Medical nutrition therapy for cardiovascular disease. In Mahan, K.L., Escott-Stump, S. & Raymond, J.L. (eds). *Krause's Food and the Nutrition Care Process.* 13th ed., Philadelphia: W.B. Saunders Company: 742-781

Renalsmart. 2008. Low phosphate diet. http://blogs.sun.ac.za/renalsmart/files/2008/09/phosphate-pamphlet.pdf [16 Dec 2017]

Renalsmart. 2012a. Low potassium diet. http://blogs.sun.ac.za/renalsmart/files/2012/06/Low-potassium-non-DM-RenalSmart1.pdf [20 Dec 2017]

Renalsmart. 2012b. Low salt diet. http://blogs.sun.ac.za/renalsmart/files/2012/06/Low-Salt-non-DM.pdf [18 Dec 2017]

Rossouw, H., Du Plessis, M., Vorster, C., Oberholster, B., Corcoran, C., Van Rooyen, C. & Botha, A. 2010. Ampath desk reference: guide to laboratory tests. Pretoria: Ampath Pathalogists:15, 26, 89

Ruperto, M, Barril, G. & Sánchez-Muniz, F.J. 2014. Waist-to height ratio as a metabolic risk factor in hemodialysis patients. *Atherosclerosis*, 235:e195-e196

Ruperto, M., Sanchez-Muniz, F.J., Barril, G. 2016. Predictors of protein-energy wasting in hemodialysis patients: a cross-sectional study. *Journal Of Human Nutrition And Dietetics*, 29:38-47

SAMF. 2008. *South African Medicines Formulary*. The division of clinical pharmacology, faculty of health sciences, university of Cape Town. 8th edition, Claremont (Cape Town): Health and medical publishing group: 86, 138, 154, 102, 417, 144, 157, 117, 150, 37, 41, 165, 151, 388, 40, 151, 86, 115, 256, 161, 323

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N.P., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M.G., Jacobs, L., Faber, M., & SANHANES-1 Team. 2013. South African National Health and Nutrition Examination Survey 2012 (SANHANES-1). Cape Town: HSRC Press

Simba. 2018. http://www.simba.co.za/brands/niknaks/cheese#.Wskj5dRuYdU [8 April 2018]

Songpol, T., Jaranit, K., Wijitr, F., Udomsak, S., Pasakorn, A. & Pramuan, S. 2005. The association between environmental factors and tuberculosis infection among household contacts. *Southeast Asian Journal of Tropical Medicine and Public Health*, 36 (Suppl 4): 221-224

South African Government Gazette, vol 573, no 36274. 2013, March 20.

Southern African Society for the Study of Obesity (SASSO). 2003. *Guidelines for the Prevention and Management of Overweight and Obesity in South Africa*: 5-6, December

Steyn, N., Senekal, M., Brits, S., Alberts, M., Mashego, T. & Nel., J. 2000. Weight and health status of black female students. *South African Medical Journal*, 90(2):146-152

St-Jules, D.E., Woolf, K., Pompeii, M.L. & Sevick, M.A. 2016. Exploring problems in following the hemodialysis diet and their relation to energy and nutrient intakes: The BalanceWise study. *Journal of Renal Nutrition*, 26(2): 118-124, March

Stopler, T. & Weiner, S. 2012. Medical nutrition therapy for anemia. In Mahan, K.L., Escott-Stump, S. & Raymond, J.L. (eds). *Krause's Food and the Nutrition Care Process*. 13th ed., Philadelphia: W.B. Saunders Company: 725-741

Sucher, K. 2016. Role of the dietitian in the health care system. In Nelms, M., Sucher, K.P., & Lacey, K. (eds). *Nutrition Therapy and Pathophysiology*. 3rd ed. China: Cengage Learning:2

Tang, W.H.W., Wang, Z., Kennedy, D.J., et al. 2014. Gut microbiota- dependent trimethylamine N-oxide (TMAO) pathway contributes to both development of renal insufficiency and mortality risk in chronic kidney disease. *Circulation Res*, 116(3):448-455

Tappenden, K.A. 2017. Intake: digestion, absorption, transport, and excretion of nutrients. In Mahan, K.L. & Raymond, J.L. (eds). *Krause's Food and the Nutrition Care Process*. 14th ed., St. Louis, Missouri: Elsevier:11

Van der Heide, I., Wang, J., Droomers, M., Spreeuwenberg, P., Rademakers, J. & Uiters, E. 2013. The relationship between health, education, and health literacy: results from the Dutch adult literacy and life skills survey . *Journal of Health Communication*, 18(Suppl 1):172–184, December

Van Rensburg, B. & Meyers, A.M., 2015. Clinical aspects of chronic kidney disease. *South African Medical Journal*, 105(3):2-4, March

Vermaak, M., Nel, M., Botha, M., Conradie, A., Van Loggerenberg, M., Vermaak, L., Webb, E. & Wrench. J. 2018. "Dialysis completely controls your life.": The occupational performance and participation of chronic hemodialysis receivers in South Africa. *World Federation of Occupational Therapists*. Cape Town, South Africa: Abstract no:1954, May

Verseput, C. & Piccoli, G.B. 2017. Eating like a rainbow: The development of a visual aid for nutritional treatment of chronic kidney disease patients; a South African project. *Nutrients*, 9: http://www.mdpi.com/2072-6643/9/5/435/htm [20 Dec 2017]

Verseput, C. 2012. A full colour visual educating tool to improve renal diet compliance. *Kidney Research and Clinical Practice Journal*, 31(2):A82, June

Vogt, B.P., Ponce, D. & Caramori, J.C. 2016. Anthropometric indicators predict metabolic syndrome diagnosis in maintenance hemodialysis patients. *Nutrition in Clinical Practice*, 31(3):368-374, June.

Wang, Y., Xie, G., Huang, Y., Zhang, H., Yang, B. & Mao, Z. 2015. Calcium acetate or calcium carbonate for hyperphosphatemia of hemodialysis patients: a meta-analysis. *PLoS One*. https://www.ncbi.nlm.nih.gov/pubmed/25799184 [9 June 2018]

WHO Technical report series. 1995. Physical Status: The use and interpretation of anthropometry. WHO Expert Committee. Geneva, *World Health Organization*, 364

WHO Technical Report series. 2000. Obesity: Preventing and managing the global epidemic. report of a WHO consultation. Geneva, *World Health Organisation*, 9

Wickham, E. 2014. Phosphorus content in commonly consumed beverages. *Journal of Renal Nutrition*, 24 (1):e1-e4, January

Wilkens, K.G., Juneja, V. & Shanaman, E. 2012. Medical nutrition therapy for renal disorders. In Mahan, K.L., Escott-Stump, S. & Raymond, J.L. (eds). *Krause's Food and the Nutrition Care Process*. 13th ed., Philadelphia: W.B. Saunders Company: 818-823

Wilkens, K.G., Juneja, V. & Shanaman, E. 2017. Medical nutrition therapy for renal disorders. In Mahan, K.L. & Raymond, J.L. (eds). *Krause's Food and the Nutrition Care Process*. 14th ed., St. Louis, Missouri: Elsevier: 722

Wish, J.B. 2006. Assessing iron status: Beyond serum ferritin and transferrin saturation. *Clinical Journal of American Society of Nephrology*, 1:S4–S8

Yacoub, R., Habib, H., Lahdo, A., Ali, R.A., Varjabedian, L., Atalla, G., Akl, N.K., Aldakheel, S., Alahdab, S., Albitar, S. 2010. 4 Association between smoking and chronic kidney disease: A case control study. *Bio Med Central Public Health*, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3004836/ [accessed 5 June 2018]

Zimmerman, E. & Woolf, S.H. 2014. Understanding the relationship between education and health. Discussion paper, institute of medicine, Washington, DC: *National Academy of Sciences*:1

LIST OF APPENDICES

APPENDIX A: Information document for Participants

Information document for Participants

Study title: **Nutritional status, knowledge, attitudes and practices of patients receiving maintenance hemodialysis in Bloemfontein, South Africa.**

Research Institution: University of the Free State

Researcher: Ermi Spies

Dear Participant

I, Ermi Spies, a student at the University of the Free State (UFS), Department of Nutrition and Dietetics am studying for a Master's Degree in Nutrition and Dietetics, on the study title, stated above. The purpose of this study is to describe the living and medical conditions, nutritional status, knowledge, attitudes, practices as well as the role of a dietitian in persons receiving hemodialysis in Bloemfontein.

Research is the process to learn the answers to a question. In this study I want to learn about the living and medical profile, usual dietary intake, body measurements (body mass index, muscle area, fat percentage, and waist and wrist circumference), blood values, knowledge, attitudes, and practices concerning the following of prescribed eating patterns for persons with kidney failure on hemodialysis as well as the role of a dietitian. This is a descriptive research study and involves no routine care.

The researcher is kindly asking you to participate in this research study and to give permission to use the results.

For this study, the researcher needs men and women aged 18 years and older, presently on hemodialyis treatment for longer than 3 months. Participants that have been hospitalised in the three months before beginning of study and/or is not able to stand without assistance will be left out. The study will be performed during November 2016 – April 2017. Participants are required to read this information document, and if willing to participate, sign the consent form before the interviews. The research will require of you to answer questions, to the best of your ability, in three interviews based on questionnaires (information on your living and medical conditions, what you normally eat and your

knowledge, attitudes and practices concerning following a kidney eating pattern as well as the role of a dietitian) that will be filled-in by the researcher during one-to-one interviews. The interviews will take place at your chair with the curtains drawn, during dialysis sessions. The interviews will take approximately 60 minutes each time on two separate days. Your body measurements will also be measured directly after a dialysis session in a private room (if available at your dialysis unit) or with the curtains drawn at your chair. For the skinfold measurements a loose fitting shirt is needed and it may be a little uncomfortable when the measurement is taken. You will need to be barefoot for the weight and height measurements. These measurements will take approximately 20 minutes directly after a dialysis session. Blood results and medication lists will be obtained from your file and will include scheduled blood work; no extra blood will need to be drawn. The analysis of the results will be conducted by the Department of Biostatistics at UFS.

There are no foreseeable risks or harm being involved in the study. Participants may withdraw at any time from the study and confidentiality will be maintained at all times.

Benefits of being involved in the study is to provide additional information regarding the course or outcome of end-stage kidney disease where hemodialysis is needed; enable researchers to design and implement better treatment for end-stage kidney disease; and highlight gaps or problem areas that should be addressed by the multi-disciplinary team to enable them to manage end-stage kidney disease more effectively.

Participation is voluntary and refusal to participate will involve no penalty. You may stop participation at any time without penalty or loss of benefits.

Participants will not be rewarded financially for their participation, and it will also be at no personal cost to them.

Efforts will be made to keep personal information confidential (private). No names, but only numbers and codes will be written on the questionnaires. Absolute confidentiality cannot be guaranteed. Personal information may be disclosed if required by law. The laboratory may be contacted to verify blood results.

Results of the study may be published and presented at a meeting or congress but the participants will remain anonymous. Info will be given to participants after the study on the best eating patterns for persons with kidney failure on hemodialysis.

The study was approved by the Health Sciences Research Ethics Committee of the Faculty of Health Sciences, UFS as well as with the unit manager of your dialysis unit.

Your participation will be greatly appreciated. Thank you!

Kind regards,

Ermi Spies

Contact details:

Tel: 051 – 401 2894

Contact details of the Health Sciences Research Ethics Committee for reporting any problems or complaints:

Ms. M Marais, **Tel:** 051 401 7795, **E-mail:** EthicsFHS@ufs.ac.za

Inligtingsdokument vir deelnemers

Studie titel: Voedingstatus, kennis, houding en praktyke van pasiënte wat instandhoudings hemodialise ontvang in Bloemfontein, Suid-Afrika.

Navorsing Instituut: Universiteit van die Vrystaat

Navorser: Ermi Spies

Beste Deelnemer

Ek, Ermi Spies, is ’n meestersgraad student by die Universiteit van die Vrystaat (UVS), Departement Voeding en Dieetkunde, en ek doen navorsing oor die bogenoemde studie titel. Die doel van die studie is om die lewens- en medieseomstandighede, voedingstatus, kennis, houding en praktyke asook die rol van ’n dieetkundige in pasiënte wat instandhoudings hemodialise ontvang in Bloemfontein, Suid-Afrika, te beskryf.

Navorsing is die proses om ’n antwoord op ’n vraag te kry. In hierdie studie wil ek graag inligting bekom oor lewens- en medieseomstandighede, gewoontelike dieetinname, liggaamsmetings, (liggaamsmassa indeks, spier-area, vetpersentasie, middel- en polsomtrek), bloedwaardes, kennis, houding en praktyke rondom die volg van ’n voorgeskryfde eetpatroon vir mense met nierversaking op hemodialise asook die rol van ’n dieetkundige. Hierdie is ’n beskrywende studie en behels nie roetine sorg nie.

Die navorser vra u vriendelik om deel te neem aan die studie asook toestemming om die resultate te gebruik.

Hierdie studie benodig mans en vrouens, 18 jaar en ouer wat tans instandhoudings hemodialise ontvang vir ’n tydperk langer as 3 maande. Deelnemers wat gehospitaliseer is in die drie maande voor die aanvang van die studie en wat nie in staat is om alleen te staan nie sal uitgesluit word. Die studie sal uitgevoer word tydens November 2016 tot April 2017. Deelnemers moet asseblief hierdie inligtingsdokument lees en as hul gewillig is om deel te neem die toestemmingsvorm teken voor die onderhoude plaas vind. Die navorsing sal van u verwag om vrae te antwoord na die beste van u vermoë in drie onderhoude wat gebaseer is op vraelyste (inligting oor lewens- en medieseomstandighede-; wat u normaalweg eet-; en kennis, houding en praktyke rondom die volg van ’n nier eetpatroon asook die rol van ’n

dieetkundige vraelys) dit sal ingevul word deur die navorser tydens een-tot-een onderhoude. Die onderhoude sal by u stoel plaasvind met die gordyne toe getrek tydens ’n dialise sessie. Die onderhoude sal ongeveer 60 minute neem op twee afsonderlike dae. U liggaamsmetings sal ook direk na ’n dialise sessie in ’n privaatkamer (as beskikbaar by u eenheid is) geneem word of met die gordyne toegetrek by u stoel. Vir die velvou metings sal ’n los hemp nodig wees en dit kan moontlik effe ongemaklik wees as die meting geneem word. U sal kaalvoet moet wees vir die massa- en lengte metings. Hierdie metings sal ongeveer 20 minute neem direk na ’n dialise sessie. Bloedwaardes en medikasie lyste sal van u lêer verkry word en sluit skedule bloedtoetse in; geen ekstra bloed sal getrek word nie. Die analise van die studie sal gedoen word deur die Departement Biostatistiek van die UVS.

Daar is nie verwagte risiko of skade om betrokke te wees by die studie nie. Deelnemers mag enige tyd onttrek en konfidensialiteit sal te alle tye gehandhaaf word.

Voordele om betrokke te wees by die studie behels om addisionele inligting te voorsien rakende die verloop of uitkomste van eind-stadium niersiekte waar hemodialise benodig word; navorsers in staat te stel om beter behandeling vir eind-stadium niersiekte te ontwikkel en in werking te stel; en om moontlike probleemareas of tekortkominge uit te lig sodat die multidissiplinêre span dit kan oorbrug om die behandeling van eind-stadium niersiekte meer effektief te maak.

Deelneming is vrywillig en weiering om deel te neem sal nie nadelige gevolge inhou nie. U mag deelneming enige tyd stop sonder nadelige gevolge of verlies van voordele.

Deelnemers sal nie finansieel beloon word vir hul deelname nie en dit sal ook nie enige persoonlike koste van u vereis nie.

Daar sal gestreef word om persoonlike inligting konfidensieel (privaat) te hou. Geen name slegs kodes en nommers sal op vraelyste geskryf word. Absolute konfidensialiteit kan nie verseker word nie. Persoonlike inligting mag moontlik weergegee word as dit deur die wet vereis word. Die laboratorium mag moontlik gekontak word om bloedwaardes te bevestig.

Resultate van die studie mag moontlik gepubliseer word by ’n vergadering of kongres maar deelnemers sal anoniem bly. Inligting sal aan deelnemers na die studie gegee word oor die beste eetpatroon vir mense met nierversaking wat hemodialise ontvang.

Hierdie studie was goedgekeur deur die **Gesondheidswetenskappe Navorsingsetiekkomitee van die Universiteit van die Vrystaat** asook met die dialise eenheid bestuurder.

U deelname word opreg waardeer. Dankie!

Vriendelike groete,

Ermi Spies

Kontak besonderhede:

Tel: 051 – 401 2894

Kontak besonderhede van die Gesondheidswetenskappe Navorsingsetiekkomitee van die Universiteit van die Vrystaat om enige ongerymdhede of klagtes te rapporteer:

Me. M Marais, **Tel:** 051 401 7795, **E-pos:** EthicsFHS@ufs.ac.za

Information document for Participants (Sesotho)

Study title: **Nutritional status, knowledge, attitudes and practices of patients receiving maintenance hemodialysis in Bloemfontein, South Africa.**

Research Institution: University of the Free State

Researcher: Ermi Spies

Dear Participant

Monka karolo

Nna, Ermi Spies, moithuti Yunivesithing ya Foreisitata (UFS), ya ithutelang dithuto tse kgolo tsa Master's ya Phepo le Dietetics, ka sehloho sa dithuto se boletsweng ka hodimo. Sepheo sa dipatlisiso tsena ke ho hlalosa maemo a bophelo le boitekanelo, maemo a phepo, tsebo, maikutlo, le ditshebetso hammoho le karolo ya mma-phepo bathong ba fumantshwang hemodialysis mona Bloemfontein.

Dipatlisiso ke tsela eo ya ho ithuta karabo bakeng sa potso e itseng. Dipatlisisong tsena, ke rata ho ithuta ka maemo a ho phela, mafu le kalafi ya ona, mekgwa ya ho ja, ditekanyo tsa mmele (body mass index, muscle area, fat percentage, and waist and wrist circumference), boemo ba madi, tsebo, maikutlo, le ditshebetso tse lebisitsweng ho lateleng ha keletso yaho ja bathong bao dipheo tsa bona di seng di sa sebetse ba leng ho *hemodialysis* hammoho le karolo e bapalwang ke mmaphepo. Tsena ke dipatlisiso tse fanang ka tlhaloso feela, ha di ya kenya ditshebeletso tse ding tse tlwaelehileng.

Ke le mobatlisisi, ke o kopa ho nka karolo dipatlisisong tsena le ho fana ka tumello ya ho sebedisa diphetho tsa dipatlisiso tsena.

Bakeng sa dipatlisiso tsena, mobatlisisi o hloka bontate le bomme ba dilemo tse 18 ho ya hodimo, ba fumantshwang tlhwekiso ya diphio bakeng sa dikgwedi tse fetang tse 3. Batho ba kileng ba robatswa sepetlele bakeng sa dikgwedi tse 3 pele ho dipatlisiso kapa ba sa kgoneng ho ema ntle le thuso ba ke ke ba kenywa dipatlisisong. Dipatlisiso di tla etswa kgweding tsa November 2016 – April 2017. Batho ba nkang karolo ba tshwanetse ho bala tokomane ena, ebile, ha e be ba ikemiseditse ho nka karolo, ba tla saena ho fana ka tumello ya bona pele ba ka botswa dipotso. Dipatlisisong tsena ho lebelletswe hore o arabe dipotso,

ho ya ka moo o ka kgonang ka teng, ka ho botswa dipotso ho di-interview tse tharo tse sebedisang dipampitshana tsa dipotso (lesedi mabapi le mokgwa oo o phelang ka teng le maemo a hao a bophelo, hore na o ja eng, hammoho le tsebo, maikutlo le ditshebetso tse lebaneng le ho ja ka mokgwa oo motho ya nang le bohloko ba diphio a tshwanetseng ho ja ka teng hammo le karolo ya mmaphepo) tsena tsohle di tla tlatswa ke mobatlisisi nakong ya dipotso ka bonngwe. Di-interviews di tla etswa setulong sa hao ho kwetse digaretene, nakong eo o hlatsuwang diphio ka yona. Di-interview di tla nka bonyane metsotso e 60 nako e nngwe le e nngwe matsatsing a mabedi a fapaneng. Mmele wa hao o tla methwa hang feela ha o tloha motjhining kamoreng e ikgethileng (ha e be e le teng yuniting ya hao ya dialysis) kapa ho kwetswe digaretene setulong sa hao. Bakeng sa ho methwa ha memeno ya letlalo ho hlokahala hore o apare hempe e hlephileng ebile ho ka ba le ho se *comfort* nakong eo o methwang ka yona. O tla tlameha ho rola dieta bakeng sa ho methwa boima le botelele. Ho tla nka metsotso e 20 hang feela ka mora hore o tlohe motjhining hore o methwe. Diphetho tsa diteko tsa mading hammoho le lenane la meriana eo o e sebedisang di tla nkuwa faeleng ya hao mme ho tla kenngwa feela diphetho tsa diteko tse etswang ka mehla; o ke ke wa hulwa madi hape. Ditekolo tsena tsohle di tla etswa ke Lefapha la Distatistiki mona UFS.

Ha ho a lebellwa kotsi kapa ho utlwiswa bohloko ha o nka karolo dipatlisisong tsena. Batho ba nkang karolo ba ka tlohella ho nka karolo nako e nngwe le e nngwe dipatlisisong ebile ho tla sebetswa ka lekunutu ka nako tsohle.

Melemo ya ho nka karolo ke ho fana ka tlhahiso leseding bakeng sa tswellopele kapa ditlamorao tse ka lebellwang ho batho ba phelang ka bohloko ba diphio moo ho hlokehang tlhwekiso ya diphio; ho thusa babatlisisi ho hlahisa le ho kenya tshebetsong mekgwa e ntlafaditsweng ya pheko bakeng sa lefu la diphio; le ho totobatsa dikgeo kapa mathata ao a tshwanetseng ho lekolwa ke sehlopha sa ditsebi tse fapaneng tsa tsa bophelo ho thusa ho laola lefu la diphio hantle ka ho fetisisa.

O nka karolo ntle le ho qobellwa e bile ha o sa dumele ho nka karolo o ke ke wa fumantshwa kotlo. O ka emisa ho nka karolo nako enngwe le enngwe ntle ho kotlo kapa ho lahlehelwa ke melemo.

Batho ba nkang karolo ba ke ke ba fumantshwa moputso wa tjhelete bakeng sa ho nka karolo, mme ho ke ke ha eba le ditjeho le ho bona.

Ho tla lekwa ka hohle hore tlhahiso leseding ya hao e be lekunutu. Ha ho mabitso, empa ho tla sebediswa di-nomoro dipampitsaneng tse tlatswang tsa dipotso. Re ke ke ra tshepisa lekunutu ka hohle-hohle. Dintla tsa hao di ka phatlalatswa ha e be ho hlokeha hore ho etswe jwalo ka molao.

Diphetho tsa dipatlisiso tsena di ka phatlalatswa dingolweng kapa dikopanong hammoho le dibokeng, feela batho ba nkang karolo ba ke ke ba tsebahatswa. Ho tla fanwa ka tlhahiso leseding ho banka karolo ha ho qetuwe ka dipatlisiso mabapi le mekgwa e metle ya phepo bakeng sa batho ba nang le lefu la diphio ba fumantshwang *hemodialysis.*

Dipatlisiso tsena di dummeletswe ke Komiti ya Ethics Dipatlisisong Lefapheng le leholo la Disaense tsa Bophelo Yunivesithing ya Foreisitata, hammoho le motsamasi wa yuniti ya dialysis.

Re tla thabela ho nka karolo ha hao haholo feela. Ke ya leboha!

Ka diteboho

Ermi Spies

Contact details:

Tel: 051 – 401 2894

Contact details of the Health Sciences Research Ethics Committee for reporting any problems or complaints:

Ms. M Marais, **Tel:** 051 401 7795, **E-mail:** EthicsFHS@ufs.ac.za

APPENDIX B: Consent Form

CONSENT FORM for participation in the following research study:

Nutritional status, knowledge, attitudes and practices of patients receiving maintenance hemodialysis in Bloemfontein, South Africa.

You have been informed about the study by:

..... (Name of person)

		Please tick if you agree
1.	I confirm that I have read and understand the information sheet concerning the research study, and it has been clearly described to me.	
2.	I understand what my involvement requires and I had the opportunity to ask questions concerning the research study.	
3.	I understand my participation is voluntarily and that I am free to witHDRawn at any time, without giving a reason.	
4.	I agree to take part in the research study.	

_____ _____ _____

Name of participant (In print) Signature of participant Date

If you have any enquiries or questions please contact the researcher, Ermi Spies, Tel: 051 - 401 2894. You may contact the Secretariat of the Health Sciences Research Ethics Committee of the Faculty of Health Sciences, UFS at the telephone number, 051 401 7795 or e-mail address, EthicsFHS@ufs.ac.za if you have questions about your rights as a research participant.

<u>TOESTEMMINGSVORM vir deelname aan die volgende navorsing studie:</u>

Voedingstatus, kennis, houding en praktyke van pasiënte wat instandhoudings hemodialise ontvang in Bloemfontein, Suid-Afrika.

U was ingelig oor die studie deur:

..... (Naam van die persoon)

		Merk asb. as u toestemming gee
1.	Ek bevestig dat ek die inligtingsdokument gelees het en verstaan het rakende die navorsing studie en dit was duidelik aan my verduidelik.	
2.	Ek verstaan wat my deelname vereis en ek het kans gehad om vrae te vra oor die navorsing studie.	
3.	Ek verstaan my deelname is vrywillig en ek kan enige tyd onttrek sonder om ’n rede te verskaf.	
4.	Ek gee toestemming om deel te neem aan die navorsing studie.	

_____ _____ _____

Naam van deelnemer (in drukskrif) Handtekening van deelnemer Datum

As u enige navrae of vrae het kontak asseblief die navorser, Ermi Spies, Tel: 051 -401 2894. U kan ook die sekretariaat van die Gesondheidswetenskappe Navorsingsetiekkomitee van die Universiteit van die Vrystaat by die volgende telefoon nommer kontak, 051 401 7795 of e-pos, EthicsFHS@ufs.ac.za as u enige vrae oor u regte as ’n deelnemer het.

FOROMO YA TUMELO ho nka karolo dipatlisisong tsena tse latelang:

Maemo a phepo, tsebo, attitude le ditshebetso ho bakudi ba fumantshwang hemodialysis Bloemfontein, Aforika Borwa.

O tsebisitswe ka dipatlisiso ke:

..... (Lebiso)

		Tshwaya ha e be o dumela
1.	Ke netefatsa hore ke badile e bile ke utlwisisa pampiri ya tlhahiso leseding mabapi le dipatlisiso, ebile ke e hlaloseditswe ka botlalo.	
2.	Ke ya utliwisisa hore na ho hlokahala eng hore ke nke karolo ebile ke bile le monyetla wa ho botsa dipotso mabapi le dipatlisiso.	
3.	Ke utlwisisa hore ke nka karolo ka ho ithaopa ebile ke lokollohile ho ikgula dipatlisosong nako e nngwe le e nngwe ntle le ho fana ka lebaka.	
4.	Ke ya dumela ho nka karolo dipatlisisong tsena.	

_____ _____ _____

Lebitso la ya nkang karolo (In print) Signature ya ya nkang karolo Letsatsi

Ha e be o hloka tlhakisetso kapa o na le dipotso ikopanye le Ermi Spies, ho Tel: 051-4012894 ka kopo. O ka ikopantsha le mongodi Komiti ya Dipatlisiso le Ethics ho Disaense tsa Bophelo, Faculty ya tsa Bophelo, UFS mohaleng ona, 051 401 7795 kapa address ya email EthicsFHS@ufs.ac.za ha e be o na le dipotso ka ditokelo tsa hao jwalo ka motho ya nkang karolo dipatlisisong.

APPENDIX C: Letter to request permission

Permission to conduct a research study at the Dialysis Unit

Dear Mr R Mokoena

Manager of Dialysis Unit

I, Ermi Spies, am a student, currently registered for a Master's degree in Nutrition and Dietetics at the University of the Free State (UFS). I hereby apply for permission to include the Dialysis Unit as a site to obtain participants and information for my research study: Nutritional status, knowledge, attitudes and practices of patients receiving maintenance hemodialysis in Bloemfontein, South-Africa.

The study was approved by the Health Sciences Research Ethics Committee of the Faculty of Health Sciences at the UFS. For this study, men and women, aged 18 years and older, currently on hemodialyis treatment for longer than 3 months and diagnosed by a medical practitioner with end-stage renal disease (ESRD), are needed. Participants that have been hospitalised in the three months before commencing of study or are unable to stand unassisted will be excluded. The study will be executed during November 2016 – April 2017.

Participants are required to read the information document, and if willing to participate, sign the consent form prior to the conduction of the interviews. The information will be collected in two days' time with three semi-structured, one-to-one interviews where questionnaires will be completed by the researcher (socio-demographic and medical questionnaire [estimated time 20 minutes], dietary intake with a Quantified Food Frequency Questionnaire, and knowledge, attitudes, practices and the role of a dietitian questionnaire [estimated time 20 minutes]).

Weight, height, skinfold measurements, waist and wrist circumference and muscle mass will also be measured once; directly after a dialysis session. For the skinfold measurements a loose fitting shirt is needed by the participants. Blood results and medication lists will be obtained from the participant's medical file and will include scheduled blood work; no extra blood will need to be drawn. The release of files to obtain this information will be greatly appreciated. The interviews and anthropometric measurements will take place at each

dialysis unit in a private room or at the participants chair with the curtains drawn and your help with arrangements for these on allocated days would be greatly appreciated.

The unit will not carry any costs for participating in the study. The study may only have small impact on the daily running of the unit, but care would be taken to conduct interviews during dialysis and not when dialysis are commenced or ending. The staff would not be needed for interviews. In rare cases if an interpreter (from English to Sesotho) is needed it would be greatly appreciated if a registered nurse from the unit could be kindly asked, each participant will be asked before commencement of the questionnaires if he/she prefers an interpreter. If interpretation is needed from English to Afrikaans the researcher will manage it. The analysis of the results will be conducted by the Department of Biostatistics at UFS.

All information will be kept strictly confidential and no information will be used for purposes other than the research project. The participants' decision to participate is voluntary and they are allowed to witHDRaw from the study at any time.

Findings may be published, and or presented at a meeting/congress. In addition, participants will be given info after the study on the prescribed eating patterns for persons with kidney failure on hemodialysis.

Yours Sincerely,

Ermi Spies

M.Sc. Dietetics Student (Student Number: 2001017603)

Tel: 051-4012869; E-mail: ermi.spies@gmail.com

Contact details of the Health Sciences Research Ethics Committee of UFS, for reporting any problems or complaints:

Ms. M Marais; Tel**:** 051 401 7795, E-mail: EthicsFHS@ufs.ac.za

Contact Details of the Study Leader: Dr L van den Berg, Tel: 051 401 3316

APPENDIX D: Socio-Demographic and Medical Questionnaire

Socio-Demographic and Medical Questionnaire

Thank you for participating, remember there are no right or wrong answers and all information given to me will remain confidential. (The last section of the questionnaire will be obtained from the participant's medical file)

1. Participant Number _____
2. Date of interview _____/_____/_____(dd/mm/yy)
3. Date of birth (obtained from file) _____ (dd/mm/yy))
4. Gender

1. Male	2. Female

5. What language do you speak at home?

1. Eng	2. Afr	3. Sesotho	4. Other: _____

6. What is your second language that you can speak?

1. Eng	2. Afr	3. Sesotho	4. Other: _____

7. In what language did you receive most of your written nutrition (how you should eat) information in?

1. Eng	2. Afr	3. Sesotho	4. Other: _____

8. In what language did you receive most of your verbal (spoken) nutrition (how you should eat) information in?

1. Eng	2. Afr	3. Sesotho	4. Other: _____

9. What is the highest level of education you have achieved?

_____

10. What is your current marital status?

1. Single	2. Married	3. Divorced	4. Widow/Widower	5. Living with partner

11. What is your current employment status?

1. Unemployed	2. Employed: Full time	3. Employed: Part time / Piece jobs
4. Pensioner	5. Receive a social grant: _____	6. Other: _____

12. Please provide the number of children (ages 1- 10years), living in the home with you?

Please specify number? _____

13. Please provide the number of children (ages 11- 18years), living in the home with you?

Please specify number? _____

14. Please provide the number of adults (age 18 years and older), living in the home with you (excluding yourself)?

Please specify number? _____

15. Please provide the number of rooms that are used for sleeping in your home?

Please specify number? _____

16. How many people contribute to the monthly income in the household?

Please specify number: _____

17. What is the total monthly income in your household (in rands)?

_____

18. Of the montly total household income, how much money is available for food (in rands)?

_____

19. Please indicate your type of housing?

1. Shack/ Makuku	2. Brick home (one to two rooms)	3. Brick home (three or more rooms)	4. Apartment / Flat	5. Townhouse	6. Other: _____

20. Do you have running, tap water in your home?

1. Yes	2. No

21. Do you have electricity in your home?

1. Yes	2. No

22. With what means do you travel to and from the dialysis unit?

1.Own Car	2. Friend/ Family car	3. Taxi	4. Bus	5. Walking	6. Other: _____

23. How much time do you spend on travelling to the dialysis unit from your home (in minutes and/or hours)?

_____

24. Who mostly prepares home-cooked meals/food ?

_____

25. If the answer to the previous question is, Self, please also answer the following question: “How often do you feel tired when you have to prepare/cook food?”

1. Never	2. Sometimes	3. Always

26. How would you describe your appetite on dialysis days?

1. Very poor	2. Poor	3. Reasonable	4. Good	5. Very good

27. How long has your apetite been like your answer in the previous question on dialysis days (in days and/or months)?

_____

28. How would you describe your food intake on dialysis days?

1. Very poor	2. Poor	3. Reasonable	4. Good	5. Very good

29. How long has your food intake been like your answer in the previous question on dialysis days (in days and/or months)?

_____

30. How would you describe your appetite on non-dialysis days?

1. Very poor	2. Poor	3. Reasonable	4. Good	5. Very good

31. How long has your apetite been like your answer in the previous question on non-dialysis days (in days and/or months)?

_____

32. How would you describe your food intake on non-dialysis days?

1. Very poor	2. Poor	3. Reasonable	4. Good	5. Very good

33. How long has your food intake been like your answer in the previous question on non-dialysis days (in days and/or months)?

_____

34. How would you describe your current tobacco use?

1. I smoke tobacco (cigarettes / pipe / cigarres)	2. I snuff tobacco	3. I do not use tobacco

If participant answered that he/she is currently using tabacco, also answer the two following questions:

35. How many times per day do you use tabacco?

_____

36. For how many years have you been using tobacco as you currently do?

_____

37. How would you describe your tobacco use in the past?

1. I smoked tobacco (cigarettes / pipe / cigarres)	2. I snuffed tobacco	3. I did not use tobacco	4. Same as current use of tobacco

If participant answered that he/she used tobacco in the past, also answer the two following questions (do not repeat if it is the same as current use of tobacco):

38. How many times per day did you use tabacco?

_____

39. For how many years did you use tobacco?

_____

40. Did you receive peritoneal dialysis (PD) before receiving hemodialysis?

1. Yes	2. No

41. If yes, please provide the date of initiation/start of peritoneal dialysis (PD)?

_____ (dd/mm/yy)

INFORMATION TO BE OBTAINED FROM PARTICIPANTS FILE:

42. Date of initiation of hemodialysis :

_____(dd/mm/yy)

43. Dry weight (obtained in file); 3 months ago

_____kg _____(dd/mm/yy of dry weight)

44. Etiology of end stage renal disease:

1. Hypertension	2. Diabetes Mellitus	3. Glomerular Nephritis	4. TB	5. SLE	6. Other: _____

45. Co-morbidities present:

1. Hypertension	2. Diabetes Mellitus	3. Cardiovascular Disease	4. TB	5. Anemia
6. Renal Osteodystrophy	7. Gout	8. Pulmonary edema	9. SLE	10. Other: _____

46. Medications that participant are currently using:

	Medication	Dosage	Unit
1.			
2.			
3.			
4.			
5.			
6.			

7.			
8.			
9.			
10.			
11.			
12.			

Sosio-demografie en Mediese Vraelys

Dankie vir u deelname, onthou daar is nie regte of verkeerde antwoorde nie en alle inligting aan my verskaf sal konfidensieel bly. (Die laaste deel van die vraelys sal verkry word van die deelnemer se mediese lêer)

1. Deelnemer Nommer _____
2. Datum van onderhoud _____/_____/_____(dd/mm/jj)
3. Geboortedatum (verkry van lêer) _____ (dd/mm/jj)
4. Geslag

1. Manlik	2. Vroulik

5. Watter taal praat u by die huis?

1. Eng	2. Afr	3. Sesotho	4. Ander: _____

6. Watter tweede taal kan u praat?

1. Eng	2. Afr	3. Sesotho	4. Ander: _____

7. In watter taal het u meeste van u geskryfde voedings inligting (hoe u moet eet) ontvang?

1. Eng	2. Afr	3. Sesotho	4. Ander: _____

8. In watter taal het u meeste van u verbale (gesproke) voedingsinligting (hoe u moet eet) ontvang?

1. Eng	2. Afr	3. Sesotho	4. Ander: _____

9. Wat is die hoogste vlak van opleiding wat u bereik het?

_____

10. Wat is u huidige huwelikstatus?

1. Enkel	2. Getroud	3. Geskei	4.Wewenaar/Weduwee	5. Bly saam met maat

11. Wat is u huidige indiensmening status?

1. Werkloos	2. In diens: Voltyds	3. In diens: Deeltyds/ Los werkies
4. Pensionaris	5. Ontvang ’n sosiale toelaag: _____	6. Ander: _____

12. Verskaf asb. die getal kinders (ouderdom 1- 10jaar), wat saam met u in die huis bly?

Spesifiseer asseblief die getal ? _____

13. Verskaf asb. die getal kinders (ouderdom 11- 18jaar), wat saam met u in die huis bly?

Spesifiseer asseblief die getal? _____

14. Verskaf asb. die getal volwassenes (ouderdom 18 jaar en ouer), wat saam met u in die huis bly (uitsluitend uself)?

Spesifiseer asb. die getal? _____

15. Verskaf asb. die getal kamers wat in u huis gebruik word om in te slaap?

Spesifiseer asb. die getal? _____

16. Hoeveel mense dra by tot die maandelikse inkomste in u huishouding?

Spesifiseer asb. die getal? _____

17. Wat is die totale maandelikse inkomste in u huishouding (in rande)?

_____

18. Van die maandelikse huishoudelike inkomste, hoeveel geld is beskikbaar vir kos (in rande)?

_____

19. Watter tipe behuising het u?

1. Shack/ Makuku	2. Baksteenhuis (een tot twee kamers)	3. Baksteenhuis (drie of meer kamers)	4. Woonstel	5. Meenthuis	6. Ander: _____

20. Het u lopende, kraanwater in u huis?

1. Ja	2. Nee

21. Het u elektrisiteit in u huis?

1. Ja	2. Nee

22. Met wat reis u na-en-van die dialise eenheid?

1.Eie kar	2. Vriend/ Familie kar	3. Taxi	4. Bus	5. Stap	6. Ander: _____

23. Hoeveel tyd spandeer u aan reis na die dialise eenheid van u huis af (in minute en/of ure)?

_____

24. Wie berei die meeste tuisgekookte etes/kos voor?

_____

25. As die antwoord tot die vorige vraag, ekself, is antwoord ook asseblief die volgende vraag: Hoe gereeld voel u moeg as u etes/kos moet voorberei/kook?

1. Nooit	2. Somtyds	3. Altyd

26. Hoe sal u, u aptyt op dialise dae beskryf?

1. Baie sleg	2. Sleg	3. Redelik	4. Goed	5. Baie goed

27. Hoe lank was u aptyt soos u antwoord op die vorige vraag op dialise dae (in dae en/of maande)?

_____

28. Hoe sal u, u kos inname op dialise dae beskryf?

1. Baie sleg	2. Sleg	3. Redelik	4. Goed	5. Baie goed

29. Hoe lank was u kos inname soos u antwoord op die vorige vraag op dialise dae (in dae en/of maande)?

_____

30. Hoe sal u, u aptyt beskryf op nie-dialise dae?

1. Baie sleg	2. Sleg	3. Redelik	4. Goed	5. Baie goed

31. Hoe lank was u aptyt soos u antwoord op die vorige vraag op nie-dialise dae (in dae en/of maande)?

_____

32. Hoe sal u, u kos inname beskryf op nie-dialise dae?

1. Baie sleg	2. Sleg	3. Redelik	4. Goed	5. Baie goed

33. Hoe lank was u kos inname soos u antwoord op die vorige vraag op nie-dialise dae (in dae en/of maande)?

_____

34. Hoe sal u, u huidige tabak gebruik beskryf?

1. Ek rook tabak (sigarette/ pyp/ sigare)	2. Ek snuif tabak	3. Ek gebruik nie tabak nie

As die deelnemer geantwoord het dat hy/sy tabak tans gebruik, antwoord ook die volgende twee vrae:

35. Hoeveel keer per dag gebruik u tabak?

_____

36. Vir hoeveel jare gebruik u tabak soos u tans doen?

_____

37. Hoe sal u, u tabak gebruik in die verlede beskryf?

1. Ek het tabak gerook (sigarette/ pyp/ sigare)	2. Ek het tabak gesnuif	3. Ek het nie tabak gebruik nie	4. Dieselfde as huidige gebruik van tabak

As die deelnemer geantwoord het dat hy/sy tabak in die verlede gebruik het, antwoord ook die volgende twee vrae (moenie herhaal as dit dieselfde as huidige gebruik van tabak is nie):

38. Hoeveel keer per dag het u tabak gebruik?

_____

39. Vir hoeveel jare het u tabak gebruik?

_____

40. Het u peritoneale dialise (PD) ontvang voor hemodialise?

1. Ja	2. Nee

41. As u antwoord ja is, verskaf asb. die aanvangsdatum van PD.

_____ (dd/mm/jj)

IINLIGTING BEKOM VAN DIE DEELNEMER SE LêER:

42. Datum van die aanvang van hemodialise:

_____(dd/mm/jj)

43. Droë massa (bekom van lêer); 3 maande gelede:

_____kg _____(dd/mm/jj van droë massa)

44. Etiologie van eind-stadium nier siekte:

1. Hipertensie	2. Diabetes Mellitus	3. Glomerulêre Nefritis	4. TB	5. SLE	6. Ander: _____

45. Ko-morbiditeite teenwoordig:

1. Hipertensie	2. Diabetes Mellitus	3. Kardiovaskulêre Siekte	4. TB	5. Anemie
6. Renale Osteodistrofie	7. Jig	8. Pulmonêre edeem	9. SLE	10. Ander: _____

46. Medikasie wat die deelnemer tans gebruik:

	Medikasie	Dosis	Eenheid
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			

12.			

Socio-Demographic and Medical Questionnaire (Sesotho)

Ke ya leboha ha o dumetse ho nka karolo dipatlisisong tsena, hopola hore ha ho na karabo e nepahetseng kapa e fosahetseng mme ditlha tsohle tseo o fanang ka tsona di tla bolokwa e le lekunutu. (Karolo ya ho qetela foromong ena e fumanwa faeleng ya hao ya sepetlele).

1. Nomoro ya ya nkang karolo _____
2. Letsatsi _____/_____/_____(dd/mm/yy)
3. Letsatsi la tswalo (ho tswa faeleng) _____ (dd/mm/yy))
4. Bong

1. Monna	2. Mosadi

5. Na o bua puo e feng hae?

1. Eng	2. Afr	3. Sesotho	4. Enngwe: _____

6. Ke e feng hape puo eo o e buang?

1. Eng	2. Afr	3. Sesotho	4. Enngwe: _____

7. O fumantshitswe keletso ya phepo (hore o tshwanetse ho ja jwang) e ngotsweng fatshe ka puo e feng?

1. Eng	2. Afr	3. Sesotho	4. Enngwe: _____

8. O fumantshitswe keletso ya phepo (hore o tshwanetse ho jwang) e sa ngolwang fatshe ka puo e feng?

1. Eng	2. Afr	3. Sesotho	4. Enngwe: _____

9. O fihlelletse ho kae dithutong tsa hao?

_____

10. Maemo a hao a nyalo ha jwale ke a feng?

1. Ha wa nyalwa	2. O nyetswe	3. O hladile	4. O mohlolohadi/ widower	5. Le ya dulisana

11. Maemo a hao a tshebetso ke a feng?

1. Ha o sebetse	2. Employed: Full time	3. Employed: Part time / Piece jobs
4. Pensioner	5. Receive a social grant: _____	6. Other: _____

12. Fana ka palo ya bana (ba dilemo tse 1 – 10), ba dulang le wena hae .

Ba ba kae? _____

13. Fana ka palo ya bana (ba dilemo tse 11 – 18) ba dulang le wena ka tlung.

Ba ba kae? _____

14. Fana ka palo ya batho ba baholo (ba ka hodimo ho dilemo tse 18) ba dulang le wena ka tlung (ka ntle ho wena)?

Ba ba kae? _____

15. Fana ka nomoro ya dikamore tseo ho robalwang ka ho tsona

Di kae? _____

16. Ke batho ba ba kae ba nang le karolo lekenong la lelapa ka kgwedi?

Ba ba kae? _____

17. Lekeno la lelapa la hao ka kgwedi ke bokae kaofela ha lona (ka di ranta)?

_____

18. Tjheleteng ya lelapa, ke e kae e sebedisetswang dijo (ka di ranta)?

_____

19. Hlalosa mofuta wa ntlo ya hao ka kopo?

1. Mokhukhu	2. Ya stene (kamore e le nngwe kapa tse pedi)	3. Ya stene (dikamore tse tharo kapa tse fetang moo)	4. Apartment kapa Flat	5. Townhouse	6. E nngwe: _____

20. Na ho na le pompo ya metsi lelapeng la hao?

1. Ee	2. Tjhe

21. Na o na le motlakase lelapeng la hao?

1. Ee	2. Tjhe

22. O sebedisa sepalangwang se feng ho ya le ho kgutla dialysis yuniting?

1.Koloi ya ka	2. Koloi ya motswalle/lelapa	3. Taxi	4. Bese	5. Ka maout	6. E nngwe: _____

23. O nka nako e kae ho ya yuniting ya dialysis ho tloha lelapeng la hao (ka metsotso kapa ka dihora)?

_____

24. Ke mang a phehang dijo boholo ba nako lelapeng la hao?

_____

25. Ha e be karabo potsong e ka pele e le wena, araba le potso ena e latelang ka kopo: "O ikutlwa o kgathetse makgetlo a makae ha o tshwanetse ho lokisa/ho pheha dijo?

1. Ho hang	2. Nako tse ding	3. Ka mehla

26. O ka hlalosa takatso ya hao ya dijo jwang matsatsing a dialysis?

1. E tlase haholo	2. E tlase	3. Hantle hanyenyane	4. E hantle	5. E hantle haholo

27. Ke nako e kae takatso ya hao ya dijo e bileng jwalokaha o hlalositse ka hodimo ka matsatsi a hao a dialysis (ka matsatsi/dikgwedi)?

_____

28. O ka hlalosa ho ja ha hao jwang ka matsatsi a dialysis?

1. Ho hobe haholo	2. Ho ho be	3. Ho hantle ha nyenyane	4. Ho hantle	5. Ho hantle haholo

29. Ke nako e kae o ja jwalo ka ha o hlalositse potsong e ka hodimo ka matsatsi a dialysis (ka matsatsi/dikgwedi)?

_____

30. O ka hlalosa jwang takatso ya hao ya dijo ka matsatsi ao o senang dialysis?

1. E tlase haholo	2. E tlase	3. E hantle hanyenyane	4. E hantle	5. E hantle haholo

31. Ke nako e kae takatso ya hao ya dijo e le jwalokaha o e hlalositse matsatsing ao e seng a dialysis (ka matsatsi/ dikgwedi)?

_____

32. O ka hlalosa jwang ho ja ha hao ka matsatsi ao o senang dialysis ka ona?

1. Ho hobe haholo	2. Ho ho be	3. Ho hantle ha nyenyane	4. Ho hantle	5. Ho hantle haholo

33. Ke nako e kae o ja jwalo ka ha o hlalositse potsong e ka hodimo ka matsatsi ao e seng a dialysis (ka matsatsi/dikgwedi)?

_____

34. O ka hlalosa jwang tshebediso ya hao ya kwae?

1. Ke ya e tsuba kwae (cigarettes / pipe / cigarres)	2. Ke tsuba kwae ya senifi	3. Ha ke e sebedise kwae

Ha e be motho ya nkang karolo a arabile hore o sebedisa kwae, a arabe le potso 35 le 36:

35. O sebedisa kwae ha kae ka letsatsi?

_____

36. Ke nako e kae o sebedisa kwae jwalo ka ha o e sebedisa ha jwale?

_____

37. O hlalosa jwang tsebediso ya hao ya kwae nakong tsa ho feta?

1. Ke ne ke tsuba kwae (cigarettes / pipe / cigarres)	2. Ke ne ke tsuba sinifi	3. Ke ne ke sa tsube kwae	4. Jwalo ka ha ke e sebedisa ha jwale

Ha e be motho ya nkang karolo a arabile hore o ne a sebedisa kwae nakong ya ho feta, a arabe le potso 38 le 39 (se ke wa phetha dipotso ha e be a ne a e sebedisa jwalo ka hona jwale):

38. O sebedisa kwae ha kae ka letsatsi?

_____

39. O ne o sebediswa kwae dilemo tse kae?

_____

40. Na o ile wa fumana peritoneal dialysis (PD) pele o fumantshwa hemodialysis?

1.Ee	2. Tjhe

41. Ha e be karabo ya hao e le ee, o qadile ho fumana peritoneal dialysis (PD) neneng?

_____ (dd/mm/yy)

DINTLHA TSE TLAMEHANG HO FUMANWA FAELENG YA MOTHO YA NKANG KAROLO:

42. Letsatsi leo hemodialysis e qadileng ka lona:

_____(dd/mm/yy)

43. Boima (dry weight, ho tswa faeleng); dikgwedi tse 3 tse fetileng

_____kg _____(dd/mm/yy ya dry weight)

44. Sesosa sa ho hlokofala ha diphiyo:

1. Hypertension	2. Diabetes Mellitus	3. Glomerular Nephritis	4. TB	5. SLE	6. E nngwe: _____

45. Mafu a mang a teng:

1. Hypertension	2. Diabetes Mellitus	3. Cardiovascular Disease	4. TB	5. Anemia
6. Renal Osteodystrophy	7. Gout	8. Pulmonary edema	9. SLE	10. Le leng: _____

46. Meriana e sebediswang ke motho ya nkang karolo ha jwale:

	Medication	Dosage	Unit
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

APPENDIX E: FFQ

Food Frequency Questionnaire

1. Participant number _____
2. Date of interview _____/_____/_____ (dd/mm/yy)

Please think about the food and drinks that you have consumed during the past 6 months. I will now go through a list of foods and drinks with you and I would like you to tell me:

- If you eat these particular foods
- How the food is prepared
- How much of the food you eat at a time, and
- How many times a day you eat it and if you do not eat it every day, how many times a week or a month it is eaten? You can also choose "never" if you do not eat the food at all.

To help you to describe the **amount** of a food, I will show you pictures or models of different amounts of the food as small, medium or large. Please say which picture or model that is the closest to the amount eaten.

- **THERE ARE NO RIGHT OR WRONG ANSWERS**
- **EVERYTHING YOU TELL ME IS CONFIDENTIAL**
- **Is there anything that you want to ask me now?**
- **Are you willing to continue with the questions?**

INSTRUCTIONS: Circle the participant's answer. Fill in the amount and times eaten in the appropriate columns.

I shall now ask you about the type and the amount of food you have been eating in the LAST 6 MONTHS. Please tell if you eat the food, how much you eat and how often you eat it.

Food Frequency Questionnaire								
					Times eaten	2 columns to	be completed	
Food	**Description**	**Small**	**Medium**	**Large**	**Daily**	**Weekly**	**Monthly**	**Never**
Milk								
Milk (Fresh or Long Life)	Full cream	63ml	125ml	250ml				
	Medium Fat	63ml	125ml	250ml				
	Low fat	63ml	125ml	250ml				
	Skimmed	63ml	125ml	250ml				
Milk powder	Full cream	5g / 1 teaspoon	15g/ 1 heaped tablespoon	30g / 2 heaped tablespoons				
	Fat free	5g / 1 teaspoon	15g/ 1 heaped tablespoon	30g / 2 heaped tablespoons				
Coffee or tea creamers, specify type		2.5ml / ½ teaspoon	10ml/ 2teaspoons	30ml / 1 large spoon				
Condensed Milk		5g / 1 teaspoon	50g / 2level tablespoons	100g / 4 level tablespoons				
Yoghurt, specify type		63ml	125ml	250ml				
Custard, specify type (home-made or commercial)		63ml	125ml	250ml				
Inkomazi		63ml	125ml	250ml				
Mageu		63ml	125ml	250ml				
Ice cream, specify type		30ml / 2 level tablespoons	125ml /2 scoops	250ml / 4 scoops				
Other milk products								
Meat and meat alternatives								
Cottage Cheese		10ml / 2 teaspoons	60g / 2 heaped tablespoons	120g / 4 heaped tablespoons				
Cheese, specify type		15g / ½ matchbox size	30g / 1 matchbox size	60g / 2 matchbox sizes				

					Times eaten	2 columns to	be completed	
Food	**Description**	**Small**	**Medium**	**Large**	**Daily**	**Weekly**	**Monthly**	**Never**
Egg		1 egg	2 eggs	3 eggs				
Processed meats	Polony	1 slice	2 slices	4 slices				
	Vienna	1	2	4				
	Russians	1	2	4				
Soya Products (Toppers/ Imana)		24ml / 2 level tablespoons/	¾ cup	1 ½ cup				
Boerewors		5cm piece	15cm piece	30cm piece				
Bacon		1 strip	3 strips	5 strips				
Biltong		½ handful	handful	2 handfuls				
Dry sausage (wors)		5cm piece	15cm piece	30cm piece				
Organ meats, specify type		30g /1 small matchbox size	90g / hand palm size	150g / hand size				
Chicken heads/feet's		30g /1 small matchbox size	90g / hand palm size	150g / hand size				
Offal/ tripe/ Sotho word??		30g /1 small matchbox size	90g / hand palm size	150g / hand size				
Beef, specify cuts		30g /1 small matchbox size	90g / hand palm size	150g / hand size				
	Stew with vegetables	¼ cup	1 cup	2 cups				
Mutton/lamb, specify cuts		30g /1 small matchbox size	90g / hand palm size	150g / hand size				
	Stew with vegetables	¼ cup	1 cup	2 cups				
Pork, specify cuts		30g /1 small matchbox size	90g / hand palm size	150g / hand size				
Fish (fresh/ frozen), specify type		30g /1 small matchbox size	90g / hand palm size	150g / hand size				

					Times eaten	2 columns to	be completed	
Food	**Description**	**Small**	**Medium**	**Large**	**Daily**	**Weekly**	**Monthly**	**Never**
Tinned Fish	Pilchards	30g /1 small matchbox size	90g / hand palm size	150g / hand size				
	Tuna	30g /1 small matchbox size	90g / hand palm size	150g / hand size				
	Sardines	30g /1 small matchbox size	90g / hand palm size	150g / hand size				
Tinned Beef		30g /1 small matchbox size	90g / hand palm size	150g / hand size				
Tree Nuts, specify type	Salted	15g / ½ medium closed hand full	30g / 1 medium closed hand full	60g / 2 medium closed hand full				
	Unsalted	15g / ½ medium closed hand full	30g / 1 medium closed hand full	60g / 2 medium closed hand full				
Ground nuts (peanuts)	Salted	15g / ½ medium closed hand full	30g / 1 medium closed hand full	60g / 2 medium closed hand full				
	Unsalted	15g / ½ medium closed hand full	30g / 1 medium closed hand full	60g / 2 medium closed hand full				
Legumes	Dried beans	30g / ¼ cup	90g / ¾ cup	180g / 1 ½ cup				
	Dried split peas/ lentils	30g / ¼ cup	90g / ¾ cup	180g / 1 ½ cup				
	Lentils, whole	45g / ¼ cup	90g / ⅔ cup	180g / 1 ⅓ cup				
	Chickpeas	45g / ¼ cup	90g / ⅔ cup	180g / 1 ⅓ cup				
Baked beans, tinned		45g / 2 heaped tablespoons	90g / 2 heaped tablespoons	180g / 4 heaped tablespoons				
Peanut butter, specify type		10g / 2 teaspoons	30g / 2 level dessert spoons	60g / 4 level dessert spoons				
Other meat and meat alternatives, specify type								

					Times eaten	2 columns to	be completed	
Food	**Description**	**Small**	**Medium**	**Large**	**Daily**	**Weekly**	**Monthly**	**Never**
Bread and grains								
Bread, specify type		½ slice	2 slices	4 slices				
Cereals, specify type		¼ cup	½ cup	1 ½ cup				
Maize porridge, stiff		¼ cup	½ cup	1 ½ cup				
Maize Porridge, soft		¼ cup	½ cup	1 ½ cup				
Motoho		¼ cup	½ cup	1 ½ cup				
Other cooked porridge, specify type		¼ cup	½ cup	1 ½ cup				
Other breads and grains, specify type								
Snack Products								
Cake, specify type		25g / ½ slice	50g / 1 thin slice	100g / 2 slices				
Tart, specify type		25g / ½ slice	50g / 1 thin slice	100g / 2 slices				
Puddings, specify type		½ heaped large spoons	2 heaped large spoons	4 heaped large spoons				
Jelly		63ml	125ml	250ml				
Biscuits, specify types		15g / 1	30g / 2	60g / 4				
Sweets, jelly or hard boiled		5g / 1 small sweet	10g / 2 small sweets	20g / 4 small sweets				
Chocolates		25g / ¼ slab	50g / ½ slab	100g / 1 slab				
Toffees		5g / 1 small sweet	10g / 2 small sweets	20g / 4 small sweets				
Liquorice		5g / 1 small sweet	10g / 2 small sweets	20g / 4 small sweets				
Chips (crisps), specify type		1 closed hand full	Small packet	Large packet				
Other snacks, specify type								
Vegetables								
Spinach, specify type	With potato and onion	30ml / 1 large spoon	½ cup	1 ½ cup				

					Times eaten	2 columns to	be completed	
Food	**Description**	**Small**	**Medium**	**Large**	**Daily**	**Weekly**	**Monthly**	**Never**
Spinach, specify type	Without potato and onion	30ml / 1 large spoon	½ cup	1 ½ cup				
Morogo	With potato and onion	30ml / 1 large spoon	½ cup	1 ½ cup				
	Without potato and onion	30ml / 1 large spoon	½ cup	1 ½ cup				
Butternut		30ml / 1 large spoon	½ cup	1 ½ cup				
Gem squash		30ml / 1 large spoon	½ cup	1 ½ cup				
Tomatoes, specify		30ml / 1 large spoon	½ cup	1 ½ cup				
Onion		30ml / 1 large spoon	½ cup	1 ½ cup				
Cabbage, specify cooking method		30ml / 1 large spoon	½ cup	1 ½ cup				
Potato		½ medium	1 medium	2 medium				
Other vegetables, specify type								
Fruits								
Banana		½	1 small	2 small				
Grapes		50g / ½ small bunch	100g / 1 small bunch	200g / 2 small bunches				
Orange		½	1 small	2 small				
Watermelon		50g / ¼ wedge	100g / ½ wedge	200g / 1 wedge				
Paw-paw		50g / 2 heaped tablespoons	100g / 4 heaped tablespoons	200g / 8 heaped tablespoons				
Peach		½	1 small	2 small				
Apple		½	1 small	2 small				

					Times eaten	2 columns to	be completed	
Food	**Description**	**Small**	**Medium**	**Large**	**Daily**	**Weekly**	**Monthly**	**Never**
Pear		½	1 small	2 small				
Fruit other, specify								
Fruit juice 100%, specify		63ml	125ml	250ml				
Dried fruit, specify type								
Tinned peaches		2 thin wedges	½ large peach	2 x ½ large peach				
Tinned Guavas		2 thin wedges	½ large peach	2 x ½ large peach				
Other fruits, specify type								
Fats								
Oil	Sunflower	1 teaspoon	5 teaspoons	4 tablespoons				
	Olive	1 teaspoon	5 teaspoons	4 tablespoons				
	Canola	1 teaspoon	5 teaspoons	4 tablespoons				
	Other, specify type	1 teaspoon	5 teaspoons	4 tablespoons				
Margarine	Light	1 teaspoon	5 teaspoons	4 tablespoons				
	Med Fat (PUFA)	1 teaspoon	5 teaspoons	4 tablespoons				
	Brick	1 teaspoon	5 teaspoons	4 tablespoons				
Butter		1 teaspoon	5 teaspoons	4 tablespoons				
Mayonnaise		1 teaspoon	5 teaspoons	4 tablespoons				
Other spread/fat, specify type								
Condiments								
Salt		½ teaspoon	1 teaspoon	3 teaspoons				
Aromat/ Fondor		½ teaspoon	1 teaspoon	3 teaspoons				
Steak and chops spice		1 shake	4 shakes	7 shakes				

					Times eaten	2 columns to	be completed	
Food	**Description**	**Small**	**Medium**	**Large**	**Daily**	**Weekly**	**Monthly**	**Never**
Stock cubes		½	1	2				
Soup powder / gravy powder		5ml / 1 teaspoon	12ml / 1 level tablespoon	24ml / 2 level tablespoons				
Herbs, specify type								
Miscellaneous								
Coffee, specify type		90ml / ½ tea cup	180ml / 1 tea cup	360ml / 2 tea cups				
Tea, specify type		90ml / ½ tea cup	180ml / 1 tea cup	360ml / 2 tea cups				
Cold drinks	Cola	125ml / ½ medium glass	250ml / 1 medium glass	500ml / 2 medium glasses				
	Sprite	125ml / ½ medium glass	250ml / 1 medium glass	500ml / 2 medium glasses				
	Other:							
Alcohol	Wine	63ml	125ml	250ml				
	Beer	165ml / ½ can	330ml / 1 can	660ml / 2 cans				
	Cider	165ml / ½ bottle	330ml / 1 bottle	660ml / 2 bottles				
	Spirits	25g / ½ tot	50g / 1 tot	100g / 2 tots				
	Sherry	25ml / ½ small glass	50ml / 1 small glass	100ml / 2 small glasses				
	Other:							

					Times eaten	2 columns to	be completed	
Food	**Description**	**Small**	**Medium**	**Large**	**Daily**	**Weekly**	**Monthly**	**Never**
Take-a-way's	Pizza	½ slice	2 slices	4 slices				
	Burgers	½	1	2				
	Pies	½	1	3				
Take-a-ways	Boerewors roll	½	1	2				
	Fish and chips							
	Other:							
Other food eaten often, not mentioned before								

Voedsel Frekwensie Vraelys - 2016

1. Deelnemer nommer _____
2. Datum van onderhoud _____/_____/_____ (dd/mm/jj)

Dink asseblief aan die kos en dranke wat u gedurende die vorige 6 maande geëet het. Ek gaan nou ’n lys van kosse en dranke opnoem en ek wil graag hê u moet die volgende vir my sê:

- Of u hierdie spesifieke kosse eet
- Hoe die kos voorberei is
- Hoeveel van die kos u eet op ’n slag, en
- Hoeveel keer per dag u dit eet en as u dit nie elke dag eet nie hoeveel keer per week of in ’n maand? U kan ook “nooit” kies as u die kos glad nie eet nie.

Om u te help om die **hoeveelheid** kos te beskryf, sal ek aan u prente of modelle van verskillende hoeveelhede kos as klein, medium of groot wys. Sê asseblief watter prent of model is die naaste aan die hoeveelheid wat u eet.

- **DAAR IS NIE REGTE OF VERKEERDE ANTWOORDE NIE**
- **ALLES WAT U MY VERTEL IS KONFIDENSIEEL**
- **Is daar enige iets wat u my nou wil vra?**
- **Is u gewillig om met die vrae voort te gaan?**

INSTRUKSIES: Omkring die deelnemer se antwoord. Voltooi die hoeveelhede en tye geëet in die betrokke kolomme.

Ek sal nou vir u vra oor die tipe en hoeveelheid kos wat u in die LAASTE 6 MAANDE geëet het. Noem asseblief of u die kos eet, hoeveel u eet en hoe gereeld u dit eet.

Voedsel Frekwensie Vraelys								
					Tye geëet	2 kolomme	om in te vul	
Voedsel	**Beskrywing**	**Klein**	**Medium**	**Groot**	**Daagliks**	**Weekliks**	**Maandeliks**	**Nooit**
Melk								
Melk (Vars of langlewe)	Volroom	63ml	125ml	250ml				
	Medium Vet	63ml	125ml	250ml				
	Lae-vet	63ml	125ml	250ml				
	Afgeroom	63ml	125ml	250ml				
Melk poeier	Volroom	5g / 1 teelepel	15g/ 1 opgehoopte eetlepel	30g / 2 opgehoopte eetlepels				
	Vet vry	5g / 1 teelepel	15g/ 1 opgehoopte eetlepel	30g / 2 opgehoopte eetlepels				
Koffie of tee verromers, spesifiseer tipe		2.5ml / ½ teelepel	10ml/ 2 teelepels	30ml / 1 groot lepel				
Kondensmelk		5g / 1 teelepel	50g / 2gelyke eetlepels	100g / 4 gelyke eetlepels				
Joghurt, spesifiseer tipe		63ml	125ml	250ml				
Vla, spesifiseer tipe (tuisgemaak of gekoop)		63ml	125ml	250ml				
Inkomazi		63ml	125ml	250ml				
Mageu		63ml	125ml	250ml				
Roomys, spesifiseer tipe		30ml / 2 gelyke eetlepels	125ml /2 skeppe	250ml / 4 skeppe				
Ander melk produkte								
Vleis en vleis alternatiewe								
Maaskaas (Cottage Cheese)		10ml / 2 teelepels	60g / 2 opgehoopte eetlepels	120g / 4 opgehoopte eetlepels				

					Tye geëet	2 kolomme	om in te vul	
Voedsel	**Beskrywing**	**Klein**	**Medium**	**Groot**	**Daagliks**	**Weekliks**	**Maandeliks**	**Nooit**
Kaas, spesifiseer tipe		15g / ½ vuurhoutjieboks grootte	30g / 1 vuurhoutjieboks grootte	60g / 2 vuurhoutjieboks groottes				
Eier		1 eier	2 eiers	3 eiers				
Geprosesseerde vleis	Polonie	1 sny	2 snye	4 snye				
	Vienna	1	2	4				
	Russians	1	2	4				
Soja Produkte (Toppers/ Imana)		24ml / 2 gelyke eetlepels/	¾ koppie	1 ½ koppie				
Boerewors		5cm stuk	15cm stuk	30cm stuk				
Spek		1 repie	3 repies	5 repies				
Biltong		½ handvol	handvol	2 handevol				
Droëwors (wors)		5cm stuk	15cm stuk	30cm stuk				
Orgaan vleis, spesifiseer tipe		30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
Hoender kop/pote		30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
Affval / tripe/ Sotho word		30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
Bees, spesifiseer snye		30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
	Bredie met groente	¼ koppie	1 koppie	2 koppies				
Skaap/lam, spesifiseer snye		30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				

					Tye geëet	2 kolomme	om in te vul	
Voedsel	**Beskrywing**	**Klein**	**Medium**	**Groot**	**Daagliks**	**Weekliks**	**Maandeliks**	**Nooit**
Skaap/lam, spesifiseer snye	Bredie met groente	¼ koppie	1 koppie	2 koppies				
Vark, spesifiseer snye		30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
Vis (vars/gevries), spesifiseer tipe		30g /1 klein vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
Geblikte vis	Sardyne/ Pilchards	30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
	Tuna	30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
	Sardiens	30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
Geblikte Bees		30g /1 vuurhoutjieboks grootte	90g / handpalm grootte	150g / handgrootte				
Boom neute, spesifiseer tipe	Gesout	15g / ½ medium grootte handvol	30g / 1 medium grootte handvol	60g / 2 medium grootte handvol				
	Ongesout	15g / ½ medium grootte handvol	30g / 1 medium grootte handvol	60g / 2 medium grootte handvol				
Grond neute (peanuts)	Gesout	15g / ½ medium grootte handvol	30g / 1 medium grootte handvol	60g / 2 medium grootte handvol				
	Ongesout	15g / ½ medium grootte handvol	30g / 1 medium grootte handvol	60g / 2 medium grootte handvol				

					Tye geëet	2 kolomme	om in te vul	
Voedsel	**Beskrywing**	**Klein**	**Medium**	**Groot**	**Daagliks**	**Weekliks**	**Maandeliks**	**Nooit**
Peulgroente	Droë bone	30g / ¼ koppie	90g / ¾ koppie	180g / 1 ½ koppie				
	Droë gesplete ertjies/ lensies	30g / ¼ koppie	90g / ¾ koppie	180g / 1 ½ koppie				
	Lensies, heel	45g / ¼ koppie	90g / ⅔ koppie	180g / 1 ⅓ koppie				
	Kekerertjies/ Chickpeas	45g / ¼ koppie	90g / ⅔ koppie	180g / 1 ⅓ koppie				
Baked beans, geblik		45g / 2 opgehoopte eetlepels	90g / 2 opgehoopte eetlepels	180g / 4 opgehoopte eetlepels				
Grondbonebotter, spesifiseer tipe		10g / 2 teelepels	30g / 2 gelyke nagereg lepels	60g / 4 gelyke nagereg lepels				
Ander vleis en vleis alternatiewe, spesifiseer tipe								
Brood en grane								
Brood, spesifiseer tipe		½ sny	2 snye	4 snye				
Ontbytgrane, spesifiseer tipe		¼ koppie	½ koppie	1 ½ koppie				
Mieliepap, styf		¼ koppie	½ koppie	1 ½ koppie				
Mieliepap, sag		¼ koppie	½ koppie	1 ½ koppie				
Suurpap/ Motoho		¼ koppie	½ koppie	1 ½ koppie				
Ander gekookte pap, spesifiseer tipe		¼ koppie	½ koppie	1 ½ koppie				
Ander brood en grane, spesifiseer tipe								
Peusel produkte								
Koek, spesifiseer tipe		25g / ½ sny	50g / 1 dun sny	100g / 2 snye				
Tert, spesifiseer tipe		25g / ½ sny	50g / 1 dun sny	100g / 2 snye				
Poeding, spesifiseer tipe		½ opgehoopte groot lepels	2 opgehoopte groot lepels	4 opgehoopte groot lepels				

					Tye geëet	2 kolomme	om in te vul	
Voedsel	**Beskrywing**	**Klein**	**Medium**	**Groot**	**Daagliks**	**Weekliks**	**Maandeliks**	**Nooit**
Jellie		63ml	125ml	250ml				
Koekies, spesifiseer tipes		15g / 1	30g / 2	60g / 4				
Lekkers, jellie of hard gekook		5g / 1 klein lekker	10g / 2 klein lekkers	20g / 4 klein lekkers				
Sjokolade		25g / ¼ blok	50g / ½ blok	100g / 1 blok				
Toffies		5g / 1 klein lekker	10g / 2 klein lekkers	20g / 4 klein lekkers				
Liqourice		5g / 1 klein lekker	10g / 2 klein lekkers	20g / 4 klein lekkers				
Skyfies (crisps), spesifiseer tipe		1 toe hand vol	Klein pakkie	Groot pak				
Ander peuselhappies, spesifiseer tipe								
Groente								
Spinasie, spesifiseer tipe	Met aartappel en uie	30ml / 1 groot lepel	½ koppie	1 ½ koppie				
	Sonder aartappel en uie	30ml / 1 groot lepel	½ koppie	1 ½ koppie				
Morogo	Met aartappel en uie	30ml / 1 groot lepel	½ koppie	1 ½ koppie				
	Sonder aartappel en uie	30ml / 1 groot lepel	½ koppie	1 ½ koppie				
Botterskorsie		30ml / 1 groot lepel	½ koppie	1 ½ koppie				
Lemoenpampoen		30ml / 1 groot lepel	½ koppie	1 ½ koppie				
Tamaties, spesifiseer		30ml / 1 groot lepel	½ koppie	1 ½ koppie				
Uie		30ml / 1 groot lepel	½ koppie	1 ½ koppie				
Kool, spesifiseer bereidingsmetode		30ml / 1 groot lepel	½ koppie	1 ½ koppie				
Aartappel		½ medium	1 medium	2 medium				
Ander groente, spesifiseer tipe								

					Tye geëet	2 kolomme	om in te vul	
Voedsel	**Beskrywing**	**Klein**	**Medium**	**Groot**	**Daagliks**	**Weekliks**	**Maandeliks**	**Nooit**
Vrugte								
Piesang		½	1 klein	2 klein				
Druiwe		50g / ½ klein tros	100g / 1 klein tros	200g / 2 klein tros				
Lemoen		½	1 klein	2 klein				
Waatlemoen		50g / ¼ skyf	100g / ½ skyf	200g / 1 skyf				
Papaja		50g / 2 opgehoopte eetlepels	100g / 4 opgehoopte eetlepels	200g / 8 opgehoopte eetlepels				
Perske		½	1 klein	2 klein				
Appel		½	1 klein	2 klein				
Peer		½	1 klein	2 klein				
Ander vrugte , spesifiseer								
Vrugtesap 100%, spesifiseer		63ml	125ml	250ml				
Droë vrugte, spesifiseer tipe								
Geblikte perskes		2 dun Skywe	½ groot	2 x ½ groot				
Geblikte koejawels		2 dun skywe	½ groot	2 x ½ groot				
Ander vrugte, spesifiseer tipe								
Vette								
Olie	Sonneblom	1 teelepel	5 teelepels	4 eetlepels				
	Olyf	1 teelepel	5 teelepels	4 eetlepels				
	Kanola	1 teelepel	5 teelepels	4 eetlepels				
	Ander, spesifiseer tipe	1 teelepel	5 teelepels	4 eetlepels				
Margarien	Light	1 teelepel	5 teelepels	4 eetlepels				
	Med Vet (PUFA)	1 teelepel	5 teelepels	4 eetlepels				
	Hard	1 teelepel	5 teelepels	4 eetlepels				

					Tye geëet	2 kolomme	om in te vul	
Voedsel	**Beskrywing**	**Klein**	**Medium**	**Groot**	**Daagliks**	**Weekliks**	**Maandeliks**	**Nooit**
Botter		1 teelepel	5 teelepels	4 eetlepels				
Mayonnaise		1 teelepel	5 teelepels	4 eetlepels				
Ander smere/vet, spesifiseer tipe								
Byvoegings								
Sout		½ teelepel	1 teelepel	3 teelepels				
Aromat/ Fondor		½ teelepel	1 teelepel	3 teelepels				
Steak and chops, speserye		1 skud	4 skutte	7 skutte				
Aftreksel blokkies		½	1	2				
Souspoeier		5ml / 1 teelepel	12ml / 1 gelyke eetlepel	24ml / 2 gelyke eetlepels				
Kruie, spesifiseer tipe								
Verskeidenheid								
Koffie, spesifiseer tipe		90ml / ½ tee koppie	180ml / 1 tee koppie	360ml / 2 tee koppies				
Tee, spesifiseer tipe		90ml / ½ tee koppie	180ml / 1 tee koppie	360ml / 2 tee koppies				
Koeldrank	Kola	125ml / ½ medium glas	250ml / 1 medium glas	500ml / 2 medium glase				
	Sprite	125ml / ½ medium glas	250ml / 1 medium glas	500ml / 2 medium glase				
	Ander:							
Alkohol	Wyn	63ml	125ml	250ml				
	Bier	165ml / ½ blik	330ml / 1 blik	660ml / 2 blikke				
	Cider	165ml / ½ bottel	330ml / 1 bottel	660ml / 2 bottels				

					Tye geëet	2 kolomme	om in te vul	
Voedsel	**Beskrywing**	**Klein**	**Medium**	**Groot**	**Daagliks**	**Weekliks**	**Maandeliks**	**Nooit**
Alkohol	Spirits	25g / ½ tot	50g / 1 tot	100g / 2 tot's				
	Sherry	25ml / ½ klein glas	50ml / 1 klein glas	100ml / 2 klein glase				
	Ander:							
Wegneem etes	Pizza	½ sny	2 snye	4 snye				
	Burgers	½	1	2				
	Pasteie	½	1	3				
	Boerewors rol	½	1	2				
	Vis en tjips							
	Ander:							
Ander kos wat gereeld geëet word; wat nie voorheen genoem is nie								

<u>Lethathama la Dipotso la Bokgafetsa ba Dijo - 2016</u>

1. Nomoro ya monkakarolo _____
2. Letsatsi la puisano _____/_____/_____ (ll/kk/ss)

Ka kopo nahana mabapi le dijo le dino tseo o di jeleng nakong ya dikgwedi tse 6 tse fetileng. Jwale ke tla lekodisa lenane la dijo le dino le wena mme ke batla hore o mpolelle:

- Haeba o ja dijo tsena
- Ka moo dijo tseo di lokiswang ka teng
- Ke tse kae tsa dijo tsee tseo o di jang ka nako, mme
- Ke makgetlo a makae ka letsatsi o di jang haeba o sa di je letsatsi le leng le le leng, ke makgetlo a makae ka beke kapa ka kgwedi di jewang? Hape o ka kgetha "ho hang" haeba o sa je dijo tsena ho hang.

Ho o thusa ho hlalosa **bongata** ba dijo, ke tlo o bontsha ditshwantsho tsa dimmotlolo tsa bongata bo fapaneng ba dijo e le tse nyane, tse mahareng kapa tse ngata. Ka kopo bolela hore ke setshwantsho kapa mmotlolo ofe o atametseng ka ho fetisisa ho bongata bo jewang.

- **HA HO DIKARABO TSE NEPAHETSENG KAPA TSE FOSAHETSENG**
- **DINTHO TSOHLE TSEO O MPOLELLANG TSONA KE SEPHIRI**
- **Na ho na le eng kapa eng eo o lakatsang ho mpotsa yona hona jwale?**
- **Na o ikemiseditse ho tswela pele ka dipotso?**

DITAELO: Dikanyetsa karabo ya monkakarolo. Tlatsa bongata le dinako tseo di jelweng dikholomong tse lokelang.

Jwale ke tla o botsa mabapi le mofuta le bongata ba dijo le dino tseo o di jeleng <u>DIKGWEDING TSE 6 TSE FETILENG</u>. Ka kopo bolela haeba o ja dijo tsena, hore o jele tse kae le hore o di ja hangata hakae.

Lethathama la Dipotso la Bokgafetsa ba Dijo								
					Makgetlo ao di jeweng	Dikholomo tse 2	di lokela ho tlatswa	
Dijo	**Tlhaloso**	**Tse nyane**	**Tse mahareng**	**Ngata**	**Letsatsi le letsatsi**	**Beke le Beke**	**Kgwedi le Kgwedi**	**Ho hang**
Lebese								
Lebese (Le foreshe kapa Long Life)	Lebese la Romo	63ml	125ml	250ml				
	Mafura a Mahareng	63ml	125ml	250ml				
	Mafura a tlase	63ml	125ml	250ml				
	Lebese le Okotsweng Mafura	63ml	125ml	250ml				
Lebese la phoofshwana	Lebese la romo	5g / thispune e 1	15g/ kgaba e 1 e mohlohlo	30g / kgaba e 2 e mohlohlo				
	Lebese le se nang mafura	5g / thispune e 1	15g/ kgaba e 1 e mohlohlo	30g / dikgaba tse 2 tse mohlohlo				
Lebejana la kofi kapa teye, hlakisa mofuta		2.5ml / ½ ya thispune	10ml/ dithispune tse 2	30ml / kgaba e 1 e kgolo				
Lebese la Khondense		5g / thispune e 1	50g / dikgaba tse 2 tse tletseng ho lekana	100g / dikgaba tse 4 tse tletseng ho lekana				
Yokate, hlakisa mofuta		63ml	125ml	250ml				
Khastate, hlakisa mofuta (e entsweng lapeng kapa femeng)		63ml	125ml	250ml				
Inkomazi		63ml	125ml	250ml				
Mageu		63ml	125ml	250ml				
Aesekerime, hlakisa mofuta		30g / dikgaba tse 2 tse tletseng ho lekana	125ml /dikgabana tse 2	250ml /dikgabana tse 4				

					Makgetlo ao di jeweng	Dikholomo tse 2	di lokela ho tlatswa	
Dijo	**Tlhaloso**	**E nyane**	**Mahareng**	**Ngata**	**Letsatsi le letsatsi**	**Beke le Beke**	**Kgwedi le kgwedi**	**Ho hang**
Dihlahiswa tse ding tsa lebese								
Bana le mefuta e meng ya nama								
Tjhisi ya Khotheje		10ml / dithispune tse 2	60g / dikgaba 2 tse mohlohlo	120g / dikgaba 4 tse mohlohlo				
Tjhisi, hlakisa mofuta		15g / ½ ya saese ya lebokose la mollo	30g / saese ya lebokose la mollo le 1	60g / saese ya mabokose a mollo a 2				
Lehe		Lehe le 1	Mahe a 2	Mahe a 3				
Nama e rekwang e se e hlophisitswe	Polone	Selae se 1	Diselae tse 2	Diselae tse 4				
	Vienna	1	2	4				
	Di-russian	1	2	4				
Dihlahiswa tsa soya (Di-toppers/ Imana)		24g / dikgaba tse 2 tse tletseng ho lekana	¾ ya kopi	Dikopi tse 1 ½				
Boroso		Sekotwana sa 5cm	Sekotwana sa 15cm	Sekotwana sa 30cm				
Beikhone		Leqa le 1	Maqa a 3	Maqa a 5				
Sehwapa		½ ya seatla	seatla	diatla tse 2				
Soseje e ommeng (boroso)		Sekotwana sa 5cm	Sekotwana sa 15cm	Sekotwana sa 30cm				
Dinama tsa ditho tsa phoofolo, hlakisa mofuta		30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				
Dihlooho/maotwana a kgoho		30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				

					Makgetlo ao di jeweng	Dikholomo tse 2	di lokela ho tlatswa	
Dijo	**Tlhaloso**	**E nyane**	**Mahareng**	**Ngata**	**Letsatsi le letsatsi**	**Beke le Beke**	**Kgwedi le kgwedi**	**Ho hang**
Dikahare/ mohodu?		30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				
Nama ya kgomo, hlalosa dikarolo		30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				
	Setjhu le meroho	¼ ya kopi	Kopi e 1	Dikopi tse 2				
Nama ya nku/konyana, hlakisa dinama		30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				
	Setjhu le meroho	¼ ya kopi	Kopi e 1	Dikopi tse 2				
Nama ya kolobe, hlalosa dikarolo		30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				
Tlhapi (e foreshe/ e hwammeng), hlakisa mofuta		30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				
Tlhapi e Kotikoting	Di-pilchard	30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				
	Tuna	30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				
	Di-sardine	30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				
Kgomo e Kotikoting		30g / saese e nyane ya lebokose la mollo le 1	90g / saese ya seatla sa letsoho	150g / saese ya letsoho				

					Makgetlo ao di jewang	Dikholomo tse 2	di lokela ho tlatswa	
Dijo	**Tlhaloso**	**E nyane**	**Mahareng**	**Ngata**	**Letsatsi le letsatsi**	**Beke le Beke**	**Kgwedi le Kgwedi**	**Ho hang**
Dinatsho tsa Sefate, hlakisa mofuta	Tse letswai	15g / ½ ya seatla se fupereng se tletseng se mahareng	30g / seatla se fupereng se tletseng se mahareng se 1	60g / seatla se fupereng se tletseng se mahareng se 2				
	Tse seng letswai	15g / ½ ya seatla se fupereng se tletseng se mahareng	30g / seatla se fupereng se tletseng se mahareng se 1	60g / seatla se fupereng se tletseng se mahareng se 2				
Dinatsho tse sitsweng (matokomane)	Tse letswai	15g / ½ ya seatla se fupereng se tletseng se mahareng	30g / seatla se fupereng se tletseng se mahareng se 1	60g / seatla se fupereng se tletseng se mahareng se 2				
	Tse seng letswai	15g / ½ ya seatla se fupereng se tletseng se mahareng	30g / seatla se fupereng se tletseng se mahareng se 1	60g / seatla se fupereng se tletseng se mahareng se 2				
Dithotse	Dinawa tse omisitsweng	30g / ¼ ya kopi	90g / ¾ ya kopi	180g / kopi e 1 ½				
	Dierekisi/di-lentil tse petsotsweng	30g / ¼ ya kopi	90g / ¾ ya kopi	180g / kopi e 1 ½				
	Di-lentil, tse feletseng	45g / ¼ ya kopi	90g / ⅔ ya kopi	180g / kopi tse 1 ⅔				
	Dierekisi tse nyane	45g / ¼ ya kopi	90g / ⅔ ya kopi	180g / kopi tse 1 ⅔				
Dinawa tse bakilweng, tse kotikoting		45g / dikgaba 2 tse mohlohlo	90g / dikgaba 2 tse mohlohlo	180g / dikgaba 4 tse mohlohlo				
Pinabatha, hlakisa mofuta		10g / dithispune tse 2	30g / dikgaba tse 2 tse tletseng ho lekana tsa dessert	60g / dikgaba tse 4 tse tletseng ho lekana tsa dessert				

					Makgetlo ao di jewang	Dikholomo tse 2	di lokela ho tlatswa	
Dijo	**Tlhaloso**	**Tse nyane**	**Tse mahareng**	**Tse ngata**	**Letsatsi le letsatsi**	**Beke le Beke**	**Kgwedi le Kgwedi**	**Ho hang**
Nama e nngwe le dijo tse nkang sebaka sa nama, hlakisa mofuta								
Borotho le dijothollo								
Borotho, hlakisa mofuta		½ ya selae	Diselae tse 2	Diselae tse 4				
Dijothollo, hlakisa mofuta		¼ ya kopi	½ ya kopi	Dikopi tse 1 ½				
Lesheleshele la poone, le tiileng		¼ ya kopi	½ ya kopi	Dikopi tse 1 ½				
Lesheleshele la poone, le bonolo		¼ ya kopi	½ ya kopi	Dikopi tse 1 ½				
Motoho		¼ ya kopi	½ ya kopi	Dikopi tse 1 ½				
Lesheleshele le leng le phehilweng, hlakisa mofuta		¼ ya kopi	½ ya kopi	Dikopi tse 1 ½				
Marotho a mang le dijothollo, hlakisa mofuta								
Dihlahiswa tsa Diseneke								
Kuku, hlakisa mofuta		25g / ½ ya selae	50g / selae se 1 se sesesane	100g / diselae tse 2				
Tart, hlakisa mofuta		25g / ½ ya selae	50g / selae se 1 se sesesane	100g / diselae tse 2				
Di-pudding, hlakisa mofuta		½ ya dikgaba tse mohlohlo	Dikgaba tse 2 tse mohlohlo	Dikgaba tse 4 tse mohlohlo				
Jeli		63ml	125ml	250ml				
Dibiskiti, hlakisa mefuta		15g / 1	30g / 2	60g / 4				
Dipongpong, tsa jeli kapa tse bedisitsweng ho ba thata		5g / pongpong e 1 e nyane	10g / dipongpong tse 2 tse nyane	20g / dipongpong tse 4 tse nyane				
Ditjhokolete		25g / ¼ ya setene	50g / ½ ya setene	100g / setene se 1				
Mathofi		5g / pongpong e 1 e nyane	10g / dipongpong tse 2 tse nyane	20g / dipongpong tse 4 tse nyane				

					Makgetlo ao di jewang	Dikholomo tse 2	di lokela ho tlatswa	
Dijo	**Tlhaloso**	**Tse nyane**	**Tse mahareng**	**Tse ngata**	**Letsatsi le letsatsi**	**Beke le Beke**	**Kgwedi le Kgwedi**	**Ho hang**
Liquorice		5g / pongpong e 1 e nyane	10g / dipongpong tse 2 tse nyane	20g / dipongpong tse 4 tse nyane				
Ditjhipisi (tse ramutsehang), hlakisa mofuta		Seatla se 1 se fupereng	Pakana e nyane	Pakana e kgolo				
Diseneke tse ding, hlakisa mofuta								
Meroho								
Sepinatjhe, hlakisa mofuta	Ka tapole le anyanese	30ml / kgaba e 1 e kgolo	½ ya kopi	Dikopi tse 1 ½				
	Ntle le tapole le anyanese	30ml / kgaba e 1 e kgolo	½ ya kopi	Dikopi tse 1 ½				
Moroho	Ka tapole le anyanese	30ml / kgaba e 1 e kgolo	½ ya kopi	Dikopi tse 1 ½				
	Ntle le tapole le anyanese	30ml / kgaba e 1 e kgolo	½ ya kopi	Dikopi tse 1 ½				
Bathanate (mokopu)		30ml / kgaba e 1 e kgolo	½ ya kopi	Dikopi tse 1 ½				
Gem squash		30ml / kgaba e 1 e kgolo	½ ya kopi	Dikopi tse 1 ½				
Tamati, hlakisa		30ml / kgaba e 1 e kgolo	½ ya kopi	Dikopi tse 1 ½				
Anyanese		30ml / kgaba e 1 e kgolo	½ ya kopi	Dikopi tse 1 ½				
Khabetjhe, hlakisa mokgwa wa ho phetha		30ml / kgaba e 1 e kgolo	½ ya kopi	Dikopi tse 1 ½				
Tapole		½ e mahareng	1 e mahareng	2 tse mahareng				
Meroho e meng, hlakisa mofuta								

					Makgetlo ao di jewang	Dikholomo tse 2	di lokela ho tlatswa	
Dijo	**Tlhaloso**	**Tse nyane**	**Tse mahareng**	**Tse ngata**	**Letsatsi le Letsatsi**	**Beke le Beke**	**Kgwedi le Kgwedi**	**Ho hang**
Ditholwana								
Banana		½	1 e nyane	2 tse nyane				
Morara		50g / ½ ya lefupe le lenyane	100g / lefupe le lenyane le 1	200g / mafupe a manyane a 2				
Lamunu		½	1 tse nyane	2 tse nyane				
Lehapu		50g / ¼ ya selae	100g / ½ ya selae	200g / selae se 1				
Paw-paw		50g / dikgaba 2 tse mohlohlo	100g / dikgaba 4 tse mohlohlo	200g / dikgaba 8 tse mohlohlo				
Perekisi		½	1 tse nyane	2 tse nyane				
Apole		½	1 tse nyane	2 tse nyane				
Pere		½	1 tse nyane	2 tse nyane				
Tholwana e nngwe, hlakisa								
Lero la ditholwana la 100%, hlakisa		63ml	125ml	250ml				
Mangangajane, hlakisa mofuta								
Diperekisi tse kotikoting		Diselae tse 2 tse tshesane	½ ya perekisi e kgolo	½ ya perekisi e kgolo tse 2				
Di-guava tse kotikoting		Diselae tse 2 tse tshesane	½ ya perekisi e kgolo	½ ya perekisi e kgolo tse 2				
Ditholwana tse ding, hlakisa mofuta								
Mafura								
Oli	Sonobolomo	Thispune e 1	Dithispune tse 5	Dikgaba tse 4				
	Olive	Thispune e 1	Dithispune tse 5	Dikgaba tse 4				
	Canola	Thispune e 1	Dithispune tse 5	Dikgaba tse 4				

					Makgetlo ao di jewang	Dikholomo tse 2	di lokela ho tlatswa	
Dijo	**Tlhaloso**	**Tse nyane**	**Tse mahareng**	**Tse ngata**	**Letsatsi le Letsatsi**	**Beke le Beke**	**Kgwedi le Kgwedi**	**Ho hang**
Oli	E sele, hlakisa mofuta	Thispune e 1	Dithispune tse 5	Dikgaba tse 4				
Majarine	E bobebe	Thispune e 1	Dithispune tse 5	Dikgaba tse 4				
	Mafura a Mahareng (PUFA)	Thispune e 1	Dithispune tse 5	Dikgaba tse 4				
	Setene	Thispune e 1	Dithispune tse 5	Dikgaba tse 4				
Botoro		Thispune e 1	Dithispune tse 5	Dikgaba tse 4				
Mayoneise		Thispune e 1	Dithispune tse 5	Dikgaba tse 4				
Setlotsi/mafura amang, hlakisa mofuta								
Donoko								
Letswai		½ ya thispune	Thispune e 1	Dithispune tse 3				
Aromat/ Fondor		½ ya thispune	Thispune e 1	Dithispune tse 3				
Senoko sa seteike le ditjhopse		Shake e 1	Di-shake tse 4	Di-shake tse 7				
Dikhiubu tsa setoko		½	1	2				
Phoofshwana ya sopho / phoofshwana ya moro		5ml / thispune e 1	12ml / kgaba e 1 e tletseng ho lekana	24ml / dikgaba tse 2 tse tletseng ho lekana				
Ditlama, hlakisa mofuta								
Tsa tlatsetso								
Kofi, hlakisa mofuta		90ml / ½ ya kopi ya teye	180ml / kopi e 1 ya teye	360ml / dikopi tse 2 tsa teye				
Teye, hlakisa mofuta		90ml / ½ ya kopi ya teye	180ml / kopi e 1 ya teye	360ml / dikopi tse 2 tsa teye				

					Makgetlo ao di jewang	Dikholomo tse 2	di lokela ho tlatswa	
Dijo	**Tlhaloso**	**Tse nyane**	**Tse mahareng**	**Tse ngata**	**Letsatsi le Letsatsi**	**Beke le Beke**	**Kgwedi le Kgwedi**	**Ho hang**
Dinomaphodi	Cola	125ml / ½ ya galase e mahareng	250ml / galase a 1 e mahareng	500ml / digalase tse 2 tse mahareng				
	Sprite	125ml / ½ ya galase e mahareng	250ml / galase a 1 e mahareng	500ml / digalase tse 2 tse mahareng				
	Di sele:							
Tahi	Veine	63ml	125ml	250ml				
	Biri	165ml / ½ ya kotikoti	330ml / kotikoti e 1	660ml / dikotikoti tse 2				
	Cider	165ml / ½ ya botlolo	330ml / botlolo e 1	660ml / dibotlolo tse 2				
	Jwala bo thata	25g / ½ ya tot	50g / tot e 1	100g / di-tot tse 2				
	Sherry	25ml / ½ ya galase e nyane	50ml / galase a 1 e nyane	100ml / digalase tse 2 tse nyane				
	Di sele:							
Di-take-a-way	Pizza	½ ya selae	Diselae tse 2	Diselae tse 4				
	Di-burger	½	1	2				
	Diphae	½	1	3				
Di-take-a-way	Boerewors roll	½	1	2				
	Tlhapi le ditjhipisi							
	Di sele:							
Dijo tse ding tse jelweng hangata, tse sa bolelwang pele ho mona								

APPENDIX F: Anthropometry Data Form

Anthropometry Data Form

1. Participant number _____
2. Date of interview _____/_____/_____(dd/mm/yy)
3. Weight (kg)

1.	2.

4. Height (cm)

1.	2.

5. Mid Upper Arm Circumference (cm)

1.	2.

6. Skinfold Measurements

	mm	mm	mm
Triceps Skinfold			
Biceps Skinfold			
Sub-scapula Skinfold			
Ileac crest Skinfold			

7. Wrist Circumference (cm)

1.	2.

8. Waist Circumference (cm)

1.	2.

APPENDIX G: Biochemistry Results

Biochemistry Data Form

1. Participant Number _____
2. Date of interview _____/_____/_____ (dd/mm/yy)

If a certain biochemical value is not available, indicate with not available (NA). Indicate most recent values as far as 6 months ago.

Biochemical Marker	Biochemical Value	Date of test (dd/mm/yy)	Test performed pre-dialysis	Test performed post dialysis
3. Serum Albumin (g /L)				
4. Serum Urea (mmol/L)				
5. Serum Creatinine (µmol/L)				
6. CRP (mg/L)				
7. Serum Cholesterol (mmol/L)				
8. Kt/V				
9. Serum Phosphate (mmol/L)				
10. Serum Potassium (mmol/L)				
11. Serum Sodium (mmol/L)				
12. HbA1c (% / mmol/mol)				
13. Hemoglobin (g/dL)				
14. Ferritin (ng/ml)				
15. TSAT (%)				
16. WBC (10^9/L)				

17. How often is CRP tested (answer obtained from unit manager)?

1. Monthly	2. Every 2nd month	3. Every 3rd month	4. Other_____

18. Name of Laboratory? _____

APPENDIX H: KAP and role of a dietitian questionnaire

Questionnaire: KAP and the role of a dietitian

1. Participant Number _____
2. Date of interview _____/_____/_____ (dd/mm/yy)

3. **Knowledge about eating patterns for kidney failure treated with hemodialysis**

Please look at the food picture and tell me if you are allowed to eat without restriction or limit or if you must restrict/limit the amount that you eat. You may also answer, that you do not know, if you must restrict it or not. Also identify if the food shown to you is high in phosphate, potassium, salt or not high in any of the minerals or if you do not know. Please remember this is not a test, you will not be penalised or rewarded for your answers, only answer truthfully to the best of your ability. Please choose only one of the options that will be provided.

If you have diabetes mellitus (High blood sugar disease), only consider the following food in terms of minerals (phosphate, potassium and salt) that need to be restricted/limited in kidney failure on hemodialysis and not according to carbohydrate or sugar amount.

3.1 Milk picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.2 Does milk contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.3 Potato picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.4 Does a baked potato in skin contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.5 Vienna picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.6 Does a vienna contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.7 Chilli pepper powder picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.8 Does chilli pepper powder contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.9 Organ meat (liver) picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.10 Does organ meat contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.11 Instant soup powder picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.12 Does instant soup powder contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.13 Butternut pumpkin picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.14 Does butternut pumpkin contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.15 Cooked chicken breast picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.16 Does cooked chicken breast contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.17 Cola cool drink picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.18 Does a cola cool drink contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.19 Orange picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.20 Does an orange contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.21 Corn flakes cereal (without milk) picture

1. I may eat it without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.22 Do corn flakes cereal (without milk) contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.23 Apple picture

1. I may eat without restriction/limit	2. I must restrict/limit the amount I eat	3. Do not know

3.24 Does an apple contain a lot of (please choose one of the following options):

1. Phosphate	2. Potassium	3. Salt	4. None of these minerals	5. Do not know

3.25 What is the name of your phosphate binder medication?

_____

3.26 When should you take your phosphate binder medication?

_____

4. **Attitude towards dietary adherence**

With the following 5 questions you can describe your feelings regarding the eating pattern for persons with kidney failure on hemodialysis.

4.1 How do you feel towards the prescribed eating pattern (kidney diet) for persons with kidney failure on hemodialysis?

1. Positive	2. Negative	3. Neutral

4.2 Please explain your answer:

_____

_____

_____

4.3 Describe your feelings towards the cost of the eating pattern for persons with kidney failure on hemodialysis:

1. Cheaper	2. Expensive	3. Same cost as the rest of my family	4. Other:

4.4 Please explain your answer:

_____

_____

_____

4.5 Describe your feelings towards the food that you can eat with the prescribed eating pattern for persons with kidney failure on hemodialysis:

1. I like it	2. I do not like it	3. Neutral feeling	4. Other:

4.6 Please explain your answer:

_____

_____

_____

5. **Practices regarding diet adherence**

With the following 5 questions you can describe your actions regarding the eating pattern for persons with kidney failure on hemodialysis.

5.1 Are you able to eat the correct amounts of restricted food?

1. Always	2. Sometimes	3. Never

5.2 Does your family support you to follow the correct diet?

1. Always	2. Sometimes	3. Never

5.3 Do you measure your food using scales, different size spoons and cups?

1. Always	2. Sometimes	3. Never

5.4 How many times do you eat take-a way's per week?

_____ (times)

5.5 For how many days last week did you follow the prescribed eating pattern for persons with kidney failure on hemodialysis?

_____ (days)

6. **Role of a dietitian in renal nutrition care**

The following 5 questions are about the dietitian's role in the prescribed eating pattern for persons with kidney failure on hemodialysis .

6.1 Who (all) taught you about the kidney eating pattern (kidney diet)?

_____

_____

6.2 Have you ever seen a dietitian and talked about what foods you should eat more or less of since being on hemodialysis?

1.Yes	2. No	3. Do not know

If your answer was yes, please answer the rest of the questions.

6.3 How often did you see/consulted the dietitian since you were on dialysis and talked about what foods you should eat more or less of?

_____ (times)

6.4 Did you understand what the dietitian taught you about the kidney eating pattern (kidney diet)?

1.Always	2. Some of it, but not everything	3. Never

6.5 If your answer in the previous question was never or some of it, why did you not understand?

_____

_____

_____

_____

Vraelys: Kennis, houding en praktyke asook die rol van ’n dieetkundige

1. Deelnemer nommer _____
2. Datum van onderhoud _____/_____/_____ (dd/mm/jj)
3. **Kennis oor eetpatrone vir nierversaking behandel met hemodialise**

Kyk asseblief na die volgende kos prente en sê vir my of u dit mag eet sonder beperking of moet u die hoeveelheid beperk wat u eet. U mag ook antwoord dat u nie weet of u dit moet beperk of nie. Identifiseer ook of die kos hoog in fosfaat, kalium, sout of nie hoog in enige van die minerale is nie of dat u nie weet nie. Onthou asseblief hierdie is nie ’n toets nie en u sal nie gestraf of beloon word vir u antwoorde nie, antwoord eerlik en na die beste van u vermoë. Kies net een van die moontlikhede wat gegee word.

As u diabetes mellitus (Hoë bloedsuiker siekte) het, oorweeg die volgende kosse in terme van minerale (fosfate, kalium en sout) wat beperk moet word in nierversaking op hemodialise behandeling en nie volgens koolhidraat of suiker hoeveelheid nie.

3.1 Melk prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.2 Bevat melk baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.3 Aartappel prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.4 Bevat ’n gebakte aartappel in die skil baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.5 Vienna prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.6 Bevat ’n vienna baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.7 Rissie poeier prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.8 Bevat rissie poeier baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.9 Orgaan vleis (lewer) prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.10 Bevat orgaanvleis baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.11 Kits soppoeier prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.12 Bevat soppoeier baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.13 Botterskorsie prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.14 Bevat botterskorsie baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.15 Gekookte hoenderborsie prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.16 Bevat gekookte hoenderborsie baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.17 Kola koeldrank prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.18 Bevat kola koeldrank baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.19 Lemoen prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.20 Bevat ’n lemoen baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.21 Graanvlokkies ontbytgraan (sonder melk) prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.22 Bevat graanvlokkies (sonder melk) baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.23 Appel prent

1. Ek mag dit eet sonder beperking	2. Ek moet die hoeveelheid beperk wat ek eet	3. Ek weet nie

3.24 Bevat ’n appel baie van (kies asb. een van die opsies):

1. Fosfaat	2. Kalium	3. Sout	4. Nie een van die minerale nie	5. Ek weet nie

3.25 Wat is die naam van u fosfaatbinder medikasie?

_____

3.26 Wanneer moet u, u fosfaatbinder medikasie neem?

_____

4. **Houding rakende nakoming van eetplan**

Met die volgende 5 vrae kan u asb. u gevoelens beskryf rakende die eetpatroon vir mense met nierversaking op hemodialise.

4.1 Hoe voel u oor die voorgeskryfde eetpatroon (nierdieet) vir persone met nierversaking op hemodialise?

1. Positief	2. Negatief	3. Neutraal

4.2 Verduidelik asb. u antwoord:

_____
_____
_____
_____

4.3 Beskryf u gevoelens rondom die koste van 'n eetpatroon vir persone met nierversaking op hemodialise:

1. Goedkoper	2. Duurder	3. Dieselfde koste as die res van my gesin	4. Ander:

4.4 Verduidelik asb. u antwoord:

_____
_____
_____
_____

4.5 Beskryf u gevoelens rondom die kos wat u kan eet met die voorgeskryfde eetpatroon vir persone met nierversaking op hemodialise:

1. Ek hou daarvan	2. Ek hou nie daarvan nie	3. Neutrale gevoel	4. Ander

4.6 Verduidelik asb. u antwoord:

_____
_____
_____
_____

5. **Praktyke rondom nakoming van eetplan**

Met die volgende 5 vrae kan u, u praktyke/aksies beskryf rakende die eetpatroon vir persone met nierversaking op hemodialise.

5.1 Is u in staat om die korrekte hoeveelhede beperkte kos te eet?

1. Altyd	2. Somtyds	3. Nooit

5.2 Ondersteun u familie u om die korrekte dieet te volg?

1. Altyd	2. Somtyds	3. Nooit

5.3 Meet u, u kos met skale, verskillende groottes lepels en koppies?

1. Altyd	2. Somtyds	3. Nooit

5.4 Hoeveel keer per week eet u wegneem etes?

_____ (kere)

5.5 Vir hoeveel dae verlede week het u die voorgeskryfde eetpatroon vir persone met nierversaking op hemodialise gevolg

_____ (dae)

6. **Rol van ’n dieetkundige in voedingsorg vir niere**

Die volgende 5 vrae handel oor die dieetkundige se rol in die voorgeskryfde eetpatroon vir persone met nierversaking op hemodialise.

6.1 Wie almal het u geleer oor die nier eetpatroon (nierdieet)?

_____
_____
_____

6.2 Het u al ooit ’n dieetkundige gesien en gepraat oor die kosse wat u meer of minder van moet eet vandat u op hemodialise is?

1.Ja	2. Nee	3. Ek weet nie

As u antwoord ja was; antwoord ook asb. die res van die vrae.

6.3 Hoe gereeld het u ’n dieetkundige gesien/gekonsulteer oor die kosse wat u meer of minder van moet eet?

_____ (kere)

6.4 Het u verstaan wat die dieetkundige vir u geleer het oor die nier eetpatroon (nierdieet)?

1.Altyd	2. Van dit, maar nie alles nie	3. Nooit

6.5 As die antwoord in die vorige vraag nooit of van dit, maar nie alles nie, was; hoekom het u nie verstaan nie?

_____
_____
_____
_____

Questionnaire: KAP and the role of a dietitian (Sesotho)

1. Participant Number _____
2. Date of interview _____/_____/_____ (dd/mm/yy)
3. **Knowledge about eating patterns for kidney failure treated with hemodialysis**

Sheba ka kopo setshwantsho sa dijo e be o mpolella hore na o dumelletswe ho dija ntle le thibelo kapa o tshwanetse ho di fokotsa/ho fokotsa bongata boo o bo jang. O ka fana ka karabo ya hore ha o tsebe hore na o tswanetse ho di fokotsa ka tjhe. Hlalosa hape hore na dijo tse bontswang di hodimo ka *phosphate, potassium,* letswai kapa diminerale tse ding kapa hore na ha o tsebe. Hopola hore ena ha se hlahlobo, o ke ke wa lahlehelwa ke matshwao kapa ya fuwa moputso bakeng sa dikarabo tsa hao, araba feela ho ya ka moo o kgonang ka teng. Kgetha feela karabo e le nngwe ho tseo o tla beng o di fuweng.

Ha e be o na le lefu la tswekere, sheba feela dijo tse latelang ho ya ka dimenerale (*phosphate, potassium, salt)* tse hlokang hore di fokotswe nakong eo dipheo di seng di sa sebetse ha o fumantshwa *hemodialysis* e seng ho ya ka diCarbohydrates kapa tswekere eo di nang le yona.

3.1 Milk picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.2 Lebese le na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.3 Potato picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.4 Na tapole e bakuweng ka letlalo la yona e na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.5 Vienna picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.6 Na vienna e na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.7 Chilli pepper powder picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.8 Na chilli pepper e na le (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.9 Organ meat (liver) picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.10 Na nama ya dikahare e na le (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.11 Instant soup powder picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.12 Na poiri ya shopho e na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.13 Butternut pumpkin picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.14 Na mokopu wa butternut o na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.15 Cooked chicken breast picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.16 Na nama ya kgoho e sefubeng e na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.17 Cola cool drink picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.18 Na seno sa cola se na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.19 Orange picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.20 Na lamunu e na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.21 Setshwantsho sa Corn flakes (ntle le lebese)

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.22 Na di-corn flakes (ntle le lebese) di na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.23 Apple picture

1. Nka le ja ntle le thibelo/ ho fokotsa	2. Ha ke a tshwanela ho di sebedisa/ ke tshwanetse ke di fokotse	3. Ha ke tsebe

3.24 Na apole e na le dikotla tsena tse ngata (etsa kgetho e le nngwe ho tse latelang):

1. Phosphate	2. Potassium	3. Salt	4. Ha di yo kaofela dikotla tsena	5. Ha ke tsebe

3.25 Lebitso la moriana wa hao wa *phosphate binder* ke mang?

_____

3.26 O tshwanetse ho sebedisa moriana wa hao wa *phosphate binder* neneng?

_____

4. **Maikutlo ka ho tshwarella phepong e lokileng**

Ka dipotso tsena tse 5 tse latelang o ka hlalosa maikutlo a hao mabapi le paterone ya ho ja bakeng sa batho ba nang le lefu la diphio ba ho *hemodialysis*.

4.1 O ikutlwa jwang ka patrone ya ho ja (kidney diet) eo o e fuweng e sebedisetswang batho ba nang le lefu la diphio ba ho hemodialysis?

1. Ha ntle	2. Ha mpe	3. Mahareng

4.2 Hlalosa karabo ya hao ka kopo:

_____
_____
_____
_____

4.3 Hlalosa maikutlo a hao mabapi le ditjeho tsa ho ja ho ya ka patrone ya ho ja bakeng sa batho ba nang le lefu la diphio ba ho hemodialysis:

1. Di theko e tlase	2. Di theko e hodimo	3. Di theko e tshwanang le ya lelapa kaofela	4. Ho hong:

4.4 Hlalosa karabo ya hao

_____
_____
_____
_____

4.5 Hlalosa maikutlo a hao mabapi le dijo tseo o kgonang ho di ja ho ya ka patrone bakeng sa batho ba nang le lefu la pelo ba ho hemodialysis:

1. Ke ya di rata	2. Ha ke di rate	3. Ke maikutlo a mahareng	4. Ho hong

4.6 Hlalosa karabo ya hao:

_____
_____
_____

5. **Ditshebetso tse tlwaelehileng tsa ho latela meralo ya phepo**

Ka dipotso tsena tse latelang o ka hlalosa dikgato mabapi le patrone ya ho ja bakeng sa batho ba nang le lefu la pelo ba ho hemodialysis.

5.1 Na o kgona ho ja dijo tse thibetsweng ka bongata bo lokileng?

1. Ka mehla	2. Nako tse ding	3. Ho hang

5.2 Na ba lelapa la hao ba o tshehetsa ho ja ho ya ka mokgwa oo o tshwanetseng ka teng?

1. Ka mehla	2. Nako tse ding	3. Ho hang

5.3 O metha dijo tsa hao ka ho sebedisa sekala, le dikgaba le dikopi tsa boholo bo fapaneng?

1. Ka mehla	2. Nako tse ding	3. Ho hang

5.4 Na o ja dijo tsa *take away* ha kae ka beke?

(makgetlo)_____

5.5 O sebedisitse patrone ya ho ja ya batho ba nang le lefu la diphio ha kae bekeng e fetileng?

(matsatsi)_____

6. **Karolo e phethwang ke mmaphepo kalafong ya lefu la diphio ka phepo**

Dipotso tsena tse latelang di mabapi le karolo e phethwang ke mmaphepo ho patrone ya dijo e etseditsweng batho ba nang le lefu la diphio ba ho hemodialysis.

6.1 Ke mang (kaofela) ya o rutileng ka patrone ya dijo bakeng sa lefu la diphio?

_____
_____
_____

6.2 Na o se o ile wa bona mmaphepo la bua dijo tseo o tshwanetseng ho di ja le tseo o tshwanetseng ho di fokotsa haesale o le ho *hemodialysis?*

1.Ee	2. Tjhe	3. Ha ke tsebe

Ha e be karabo ya hao e le ee, araba dipotso tse latelang ka kopo.

6.3 Na o se o kile wa kopana le mmaphepo ha kae ha e sale o le ho dialysis ho bua ka dijo tseo o tshwanetseng ho di ja le tseo o tshwanetseng ho di fokotsa?

(makgetlo)_____

6.4 O ile wa utlwisisa seo mmaphepo a o hlaloseditseng sona ka patrone ya ho ja bakeng sa batho ba nang le lefu la diphio?

1.Ka mehla	2. Tse ding tsa tsona, empa e seng kaofela	3. Ho hang

6.5 Ha e be karabo ya hao ke hohang, kapa tse ding tsa tsona, ke hobane eng o sa utlwisisa?

_____
_____
_____
_____
_____

APPENDIX I: Usual daily intake of a non-dialysis day

1. Participant number _____
2. Date of interview _____ (dd/mm/yy)

Please tell me what you normally eat and drink on a non-dialysis day:

Time	Food item	Portion size	Cooking method

Anything else that you eat or drink, not mentioned before?

_____

Control with food frequency questionnaire; and ask about food and drinks eaten daily not mentioned here and include.

Gewoontelike inname vir nie-dialise dae

1. Deelnemer nommer _____
2. Datum van onderhoud _____ (dd/mm/jj)

Vertel my asb. wat u normaalweg eet en drink op ’n nie-dialise dag:

Tyd	Voedsel item	Porsie grootte	Bereidingsmetode

Enige iets anders wat u eet of drink, nie voorheen genoem nie?

_____

Kontroleer met voedsel frekwensie vraelys en vra oor kos en dranke wat daagliks geëet word wat nie hier genoem is nie en voeg by.

Usual daily intake of a non-dialysis day (Sesotho)

1. Participant number _____
2. Date of interview _____ (dd/mm/yy)

Ke kopa o mpolelle hore na o ja eng le hore o nwa eng ka matsatsi ao e seng a dialysis:

Nako	Sejo/seno	Bongata	Mokgwa wa ho pheha

Na ho na le hohong hoo o ho jang, hoo o sa o bitsang?

_____

Control with food frequency questionnaire; and ask about food and drinks eaten daily not mentioned here and include.

APPENDIX J: Letters of approval

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS·UV
HEALTH SCIENCES

IRB nr 00006240
REC Reference nr 230408-011
IORG0005187
FWA00012784

17 November 2016

MS HC SPIES
DEPT OF NUTRITION AND DIETETICS
FACULTY OF HEALTH SCIENCES
UFS

Dear Ms HC Spies

HSREC 142/2016
PROJECT TITLE: NUTRITIONAL STATUS, KNOWLEDGE, ATTITUDE AND PRACTISES OF PATIENTS RECEIVING MAINTENANCE HEMODIALYSIS IN BLOEMFONTEIN, SOUTH AFRICA

1. You are hereby kindly informed that the Health Sciences Research Ethics Committee (HSREC) approved this protocol after all conditions were met. This decision will be ratified at the next meeting to be held on 29 November 2016.
2. The Committee must be informed of any serious adverse event and/or termination of the study.
3. Any amendment, extension or other modifications to the protocol must be submitted to the HSREC for approval.
4. A progress report should be submitted within one year of approval and annually for long term studies.
5. A final report should be submitted at the completion of the study.
6. Kindly use the **HSREC NR** as reference in correspondence to the HSREC Secretariat.
7. The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act. No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.

Yours faithfully

DR SM LE GRANGE
CHAIR: HEALTH SCIENCES RESEARCH ETHICS COMMITTEE

Health Sciences Research Ethics Committee
Office of the Dean: Health Sciences
T: +27 (0)51 401 7985/7991 | F: +27 (0)51 444 4359 | E: ethicsfhs@ufs.ac.za
Block D, Dean's Division, Room D104 | P.O. Box/Posbus 339 (Internal Post Box 540) | Bloemfontein 9300 | South Africa
www.ufs.ac.za

health
Department of Health
FREE STATE PROVINCE

22 November 2016

Ms. HC Spies
Dept. of Nutrition and Dietetics
CR De Wet Building
Faculty of Health Science
UFS

Dear Ms. HC Spies

Subject: Nutritional status, knowledge, attitude and practices of patients receiving maintenance hemodialysis in Bloemfontein, South Africa.

- Permission is hereby granted for the above – mentioned research on the following conditions
- Participation in the study must be voluntary
- A written consent by each participants must be obtained
- Serious adverse events to be reported and/or termination of the study.
- Ascertain that your data collection exercise neither interferes with the day to day running of Pelonomi and Universitas Hospital nor the performance of duties by the respondents or health care workers.
- Confidentiality of information will be ensured and no names will be used.
- Research results and a complete report should be made available to the Free State Department of Health on completion of the study (a hard copy plus a soft copy).
- Progress report must be presented not later than one year after approval of the project to the Ethics Committee of the University of Free State and to Free State Department of Health.
- Any amendments, extension or other modifications to the protocol or investigators must be submitted to the Ethics Committee of the University of Free State and to Free State Department of Health.
- **Conditions stated in your Ethical Approval letter should be adhered to and a final copy of the Ethics Clearance Certificate should be submitted to khusemj@fshealth.gov.za or sibeelab@fshealth.gov.za before you commence with the study**
- No financial liability will be placed on the Free State Department of Health
- Please discuss your study with the institution managers/CEOs on commencement for logistical arrangements
- Department of Health to be fully indemnified from any harm that participants and staff experiences in the study
- Researchers will be required to enter in to a formal agreement with the Free State department of health regulating and formalizing the research relationship (document will follow)
- You are encouraged to present your study findings/results at the Free State Provincial health research day
- Future research will only be granted permission if correct procedures are followed see http://nhrd.hst.org.za

Trust you find the above in order.

Kind Regards

Dr D Motau
HEAD: HEALTH
Date: 09/12/2016