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ASSESSING RISK OF MALNUTRITION IN ADULT PATIENTS ON HEMODIALYSIS IN PORT ELIZABETH

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DECLARATION

"I, Angelique Botha, declare that the mini-dissertation is hereby submitted by me for the Magister Scientiae (Dietetics) degree at the University of the Free State, is my own independent work and has not previously been submitted by me at another university/faculty. I furthermore cede copyright of the dissertation in favour of the University of the Free State."

SUMMARY

There are currently 737 patients on renal replacement therapy (RRT) in the Eastern Cape (EC) of South Africa (SA) alone. Diseases of lifestyle are major risk factors for the development and/or progression of chronic kidney disease (CKD). CKD is a growing problem in SA, as diseases of lifestyle are becoming more prevalent.

The kidneys play a vital role in the body. The kidneys' functions include: waste removal through the urine; reabsorption of water, glucose and amino-acids; production of hormones such as calcitriol and erythropoietin; production of the enzyme renin; regulation of homeostasis by regulating electrolytes, the acid-base balance and blood pressure.

CKD is present when there are abnormalities in the kidneys prevent these functions. The reduced ability of the kidneys to carry out these functions, leads to the need for renal replacement therapy (RRT), such as hemodialysis (HD).

The main objective of this study was to determine the risk for malnutrition amongst adults with CKD receiving HD in Port Elizabeth (PE). A total of 68 patients took part in the study. Only 68, 7% (n = 44) patients were from the National Renal Care Dialysis unit, 20.6% (n = 14) patients from the Mercantile Life Dialysis unit and 14.7% (n = 10) from Fresenius Medical Care dialysis unit. These three centres were included for logistical reasons as well as familiarity with the staff and patients.

A structured researcher-administered questionnaire was presented to the HD patients. The information collected included socio-demographics, a short-form mini nutrition assessment (SF-MNA) and anthropometrical data.

There were 57.4% (n=39) male patients and 42.7% (n= 29) female patients. The majority of patients were married (58.8%); 47.1% had finished high school and an equal percentage of patients had a tertiary education. The largest percentage of patients (63.2%) was older than 50 years with a median age of 54.5 years. Half of

the patients were black (n=34), 22.1% (n=15) were coloured, 4.4% (n=3) were Asian/ Indian and 22.1% (n=15) were white. Most patients spoke isiXhosa (41.3%) while only 23.5% spoke English.

Just under a third (29.4%) of the patients was unemployed, while just over a quarter (26.5%) was employed on a full time basis. Pensioners made up 32.4% of the sample and only 2 patients were students.

Most patients (94.1%) attend the unit 3 times per week and 5.9% (n= 4) attend the unit only twice per week. The majority of patients have been on HD for more than a year, half (48.9%) had been on HD for 1 to 5 years, and 26.5% had been on HD for more than 5 years.

Patients who came from areas outside PE, were from Somerset East, Alexandria, Cradock, Port Alfred or Grahamstown. Most of the patients live within PE. Five patients (7.4%) live within 5 km of their dialysis unit, 39.7% within 5 – 10 km from the unit, and six 8.8% (n= 6) more than 50 km from the unit.

Patients were classified as at risk for malnutrition if their SF-MNA scores were ≤ 11, and a score of ≥ 12 was considered acceptable. Of the 68 patients, 52.9% (n = 36) were identified as at risk for malnutrition.

Significant associations between the risk of malnutrition, and HD duration, loss of appetite (p-value < 0.0001), weight loss (p-value < 0.0001) and psychological stress and/or acute disease (p-value < 0.0001) were found.

In conclusion, a large number (52.9%) of patients that were receiving HD in PE at the time of the study, were at risk for malnutrition. Ongoing monitoring of such at-risk patients is therefore important. Detection of loss of appetite, weight loss and psychological stress and/or acute disease should be reason to suspect a risk for malnutrition. Early dietary and psychosocial intervention may improve the nutritional status and thus improve the patient's quality of life.

Psychological, nutritional and medical support during the first few months after HD is started, is important, as a higher risk for malnutrition is seen amongst patients on HD for 0 – 6 months. It is recommended that appropriate supplementation becomes standard practice and form part of the National Therapeutic Programme (NTP) during the first 6 months of HD.

OPSOMMING

Daar is 737 pasiente in die Oostelike provinsie van Suid-Afrika alleen wat huidig niervervangingsterapie ondergaan. Kroniese nierversaking is ’n toenemende probleem in Suid-Afrika. Soos die voorkoms van diabetes, hipertensie, vetsugtigheid en kardiovaskulêre siekte toeneem, neem die voorkoms van kroniese nierversaking linieêr toe.

Die niere handhaaf n verskeidenheid funksies in die liggaam. Die niere help om afval produkte vanuit die liggaam in die uriene uit te skei, absorbeer water, glukose en aminosure, vervaardig hormone soos kalsitrol en erythropoietin, en vervaardig die ensiem renin. Die niere help ook om n toestand van homeostase in die liggaam te handhaaf deur die regulering van elektroliete, suur-basisbalans en bloeddruk.

Kroniese nierversaking kom voor wanneer abnormaliteite in die niere voorkom dat die niere sy funksies uitvoer. Die ingekorte funksie van die niere noodsaak niervervangingsterapie soos hemodialise.

Die hoofdoel van die studie was om die risiko vir wanvoeding onder volwassenes wat hemodialise in Port Elizabeth (PE) ontvang, te bepaal. n Totaal van 68 deelnemers is in die studie ingesluit. Onder die 68 pasiente was 68.7% (n = 44) van die National Renal Care dialise-eenheid. 20.6% (n = 14) pasiente van die Mercantile dialise-eenheid en 14.7% (n = 10) van die Fresenius Medical Care dialise-eenheid. Die dialise-eenhede was gekies op gronde van hul ligging asook die bestaande goeie verhouding met die personeel en pasiente.

´n Gestruktureerde vraelys is deur die navorser aan die pasient voorgelê. Die inligting wat versamel is, sluit sosiodemografiese inligting, sowel as´n kort mini-voedingsassessering en antropometriese data in.

Die deelnemers het uit 57.35% (n = 39) manlike en 42.65% (n = 29) vroulike deelnemers bestaan. Die meerderhid van die pasiente was getroud (58.8%); 47.1% het skool voltooi en ´n gelyke persentasie pasiente het tersiêre onderrig. Die grootste deel (63.2%) van die pasiente was ouer as 50 jaar, met n gemiddelde ouderdom van 54.5 jaar. Die helfte van die pasiente (n = 34) was swart, 22.06% (n = 15) kleurling, 22.06% (n = 15) blank en 5.9% (n – 4) Asiaat/ Indier of ander. Die meeste pasiente was isiXhosa-sprekend (41.3%) terwyl net 23.5% Engels-sprekend was.

Net onder ´n derde van die pasiente (29.4%) was werkloos, terwyl net ´n kwart (26.5%) ´n voltydse werk gehad het. Pensioenarisse het ´n derde van die pasiente uitgemaak (32.4%), terwyl twee pasiente studente was.

Die meerderheid van die pasiente (94.1%) het die dialise eenheid drie keer per week bygewoon, terwyl net 5.9% (n = 4) twee keer per week dialise ontvang het. Die meerderheid van die pasiente het meer as een jaar lank dialise ontvang, waarvan 48.9% tussen 1-5 jaar op dialise was en 26.5% vir meer as vyf jaar.

Pasiente wat van buite PE woonagtig was sluit Somerset Oos, Alexandria, Cradock, Port Alfred en Grahamstad in. Die meeste van die pasiente was in PE woonagtig. Vyf pasiente (7.4%) woon binne 5 km vanaf die dialise eenheid, 39.7% is binne 5-10 km vanaf die eenheid en 8.8% (n = 6) meer as 50 km.

Deelnemers is as ´n risiko vir wanvoeding beskou as hul SF-MNA telling ≤ 11 was, en n telling van ≥ 12 was as aanvaarbaar aanskou. Van die 68 deelnemers, was 52.9% (n = 36) geidentifiseer as pasiente wat ´n risiko vir wanvoeding het.

Statisties betekenisvolle assosiasies is waargeneem tussen die periode wat deelnemersreeds op dialise was, en die verlies van eetlus (p-value <0.0001), massaverlies (p-waarde <0.0001) en psigologiese stres of akute siekte (p-waarde <0.0001).

Die studie het gevind dat meer as die helfte (52.9%) van pasiente wat ten tye van die studie dialise in PE ontvang het, ´n risiko vir wanvoeding gehad het. Deurlopende monitering van sodanige pasiente is belangrik. n Moontlike risiko vir wanvoeding moet oorweeg word wanneer n verlies van eetlus, massaverlies en psigologiese stres waargeneem word. Ondersteuning van die pasient tydens die eerste paar maande na die aanvang van dialise, is belangrik, aangesien die risiko vir wanvoeding dan groter is. Dieet- en psigo-sosiale intervensie mag die voedingstatus en dus die lewenskwaliteit van pasiente verbeter.

Sielkundige-, voedings- en mediese ondersteuning tydens die eerste 6 maande na aanvang van dialise is veral belangrik, aangesien ´n groter risiko vir wanvoeding dan bestaan. Dit word aanbeveel dat dieet aanvullings n standaard behandeling word en deel vorm van die Nasionale Terapeutiese Program (NTP) tydens die eerste 6 maande van hemodialise.

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LIST OF ABBREVIATIONS

%	Percent
ACR	Albumin-creatinine ratio
ACEI	Angiotensin-converting enzyme inhibitors
AER	Albumin excretion rate
AKD	Acute kidney disease
ASF-MNA	Adjusted short-form mini-nutrition assessment
BMI	Body mass index
CKD	Chronic kidney disease
CVD	Cardiovascular disease
DKD	Diabetic kidney disease
DM	Diabetes mellitus
EC	Eastern Cape
ESRD	End-stage renal disease
GFR	Glomerular filtration rate
HB	Hemoglobin
HD	Hemodialysis
HGS	Hand-grip strength
HIV	Human immunodeficiency virus
HPT	Hypertension

KDIGO	Kidney disease Improving global outcomes
MIS	Malnutrition inflammation score
MNA	Mini-nutrition assessment
MNA-T1	Mini-nutrition assessment- Taiwan version 1
MUST	Malnutrition universal screening tool
NKF KDOQI	National Kidney Foundation Kidney disease outcomes quality initiative
NRC	National renal care
NTP	National Therapeutic Programme
PD	Peritoneal dialysis
PEM	Protein-energy malnutrition
PG-SGA	Patient generated subjective global assessment
RRT	Renal replacement therapy
SA	South Africa
SAS	Statistical Analysis Software
SF-MNA	Short-form mini-nutrition assessment
SGA	Subjective global assessment
TB	Tuberculosis
TIBC	Total iron binding capacity
UK	United Kingdom

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CHAPTER 1:
INTRODUCTION

1.1. INTRODUCTION AND PROBLEM STATEMENT

The kidneys play a vital role in the body and help the body to maintain homeostasis by regulating electrolytes, the acid-base balance and blood pressure. The kidneys also act as a filter by removing waste products, such as urea and ammonia, through the urine. The kidneys reabsorb water, glucose and amino-acids and also produce hormones including calcitriol and erythropoietin, and the enzyme renin (Weiner, 2007:1).

Chronic kidney disease (CKD) is defined as abnormalities of the kidney's structure or function for duration of three months or more (Stevens & Levins, 2013:829; Levey *et al.,* 2011:17). A decrease kidney function is defined as a glomerular filtration rate (GFR) below 60mL/min/1.7m² (Weiner, 2007:2). The most common manifestation of kidney damage, is the presence of protein in the urine.

The impact of CKD and end-stage renal disease (ESRD) is increasing in developing countries (Okpechi *et al.,* 2012:254). Possible reasons for this include the high prevalence of non-communicable diseases, high prevalence of infectious diseases, such as HIV/AIDS and tuberculosis (TB), limited health care funding and resource constraints, as well as a low number of nephrologists, trained renal nurses, social workers and technologists.

The etiology of CKD is complicated and several risk factors have been identified. Major risk factors for the development of CKD include obesity, hypertension (HPT), diabetes mellitus (DM), and older age (Weiner, 2007:2). Other less likely causes of CKD include primary glomerular nephritis, lupus and polycystic kidney disease (Weiner, 2007:2).

Patients with CKD should be assessed annually (Stevens & Levins, 2013:827) to monitor the severity and the progression of disease. Disease progression is influenced by a number of factors, including the cause of the CKD, the level of the GFR and albuminurea, age, sex, race or ethnicity, HPT, high blood glucose, lipid

disorders, smoking, obesity, cardiovascular disease (CVD) and the use of nephrotoxic agents (Stevens & Levins, 2013:827). Angiotensin-converting enzyme inhibitors (ACEI'S), angiotensin receptor blockers, management of high blood glucose and HPT, smoking cessation, statins to control dyslipidemia, and the effective management of anemia, can help slow the progression of CKD (Weiner, 2007:4).

Hemodialysis (HD) is renal replacement therapy (RRT), which becomes necessary in stage 5 CKD, and is a method for the artificial replacement of the kidney function (Naylor *et al.,* 2013:316). The blood is circulated outside of the body and excess urea, creatinine and electrolytes is removed via diffusion, using a membrane in an external filter. Excess fluid can also be removed via ultrafiltration.

Malnutrition is often associated with CKD (Roy *et al.*, 2013:45), mainly due to inadequate dietary intake, associated with physical and financial limitations, loss of nutrients during dialysis, illness and protein catabolism. Physical limitations might be present as a result of amputation or any lack of mobility due to illness or otherwise. Protein catabolism occurs as a result of inflammation, higher energy requirements and expenditure, acidosis and endocrine disorders associated with renal failure. The protein catabolism, in turn, causes an increase in metabolism and ultimately leads to the catabolism of protein stores in patients with CKD (Carrero *et al.,* 2013:79).

Malnutrition may also assume the form of over-nutrition recognised as overweight or obesity. Over- and undernourishment affects the quality of life and survival rate in patients with CKD (Pasticci *et al.*, 2012:50).

During HD, amino-acids and protein losses occur (Carrero *et al.,* 2013:84). Patients on HD have higher protein and energy needs in order to prevent protein and fat catabolism. Adequate nutritional intake to meet the increased needs is sometimes not possible due to a loss of appetite and the taste changes that occur in HD patients. Loss of appetite is reported in 30%-40% of patients receiving dialysis and is associated with worse outcomes regarding dietary intake, inflammatory markers,

malnutrition, reduced quality of life, increased hospitalisation, and increases the risk of death fourfold (Zabel *et al.,* 2009:343).

Other causes for undernutrition found in HD stage 5 CKD patients, include dental problems, disturbances in taste, early satiety, a low energy restrictive diet, a low protein diet, tiredness, loneliness and a lack of support from family and friends (Bovio *et al.,* 2013:52).

In HD patients, it is important to assess nutritional status and intervene as soon as possible, to slow the progression of CKD and improve patient outcomes. Tools for assessing malnutrition in patients undergoing HD have been widely investigated. The Renal Association, as described in Fisher *et al.* (2011:282), recommend the Subjective Global Assessment (SGA) as a screening tool for detecting malnutrition in patients on HD (Fisher *et al.*, 2011:282). The SGA has, however, been criticised for being time consuming and lacking sensitivity to identify the risk for malnutrition.

The Patient Generated Subjective Global Assessment (PG-SGA) requires the patient to complete a portion of the assessment tool. This reduces the time that a dietitian needs to be spending conducting the assessment. The PG-SGA has also shown better construct validity in a pilot project on patients receiving HD (Fisher *et al.*, 2011:282).

Fisher *et al.* (2011:282) conducted a study to determine which tool was the bestto identify the risk of malnutrition in patients undergoing HD. A total of 65 patients from two dialysis units, St. Georges and Canterbury, in the United Kingdom (UK), were assessed. The patients found the PG-SGA too difficult to complete and the tool was less sensitive to the nutritional status of patients on HD, than the SGA. The malnutrition universal screening tool (MUST) was not a sensitive method for assessing the risk of malnutrition in this sample group. The SGA appeared to be more sensitive to the nutritional status of patients on HD.

The MNA is a highly sensitive tool in diagnosing malnutrition (Cereda, 2012:37). The full Mini-Nutritional Assessment (MNA) and the short-form Mini-Nutritional Assessment (SF-MNA) have been used to evaluate malnutrition in patients receiving HD and was found to be useful screening tools to routinely assess for malnutrition in HD (Tsai *et al.,* 2013; Lu, 2008). The full MNA consists of 18 components and evaluates four aspects of a person's nutritional status e.g. diet, anthropometrics, global and self-rated status (Tsai *et al.*, 2013:2831). The full MNA can be seen as a two-part assessment: patients are first assessed with the SF-MNA and if they are rated as being at risk for malnutrition, they are assessed with the full MNA.

Tsai *et al.* (2013: 2831) found that the SF-MNA rates a smaller portion of patients in HD as at risk for malnutrition. This is not acceptable, as the patients who are not picked up on the SF-MNA as a risk for malnutrition, will be presumed to be "not at risk". These patients will then miss the opportunity for early nutritional intervention. Tsai *et al.* (2013) proceeded to make a few changes to the SF-MNA to improve the predictive ability of this assessment tool. They compiled an adjusted SF-MNA (ASF-MNA) that was the most appropriate in screening for malnutrition in patients with HD. The MNA was tested on patients undergoing peritoneal dialysis (PD) by Brzosko *et al.,* (2013), and found that the MNA is a valuable, clinically suitable tool for assessing the nutritional status in patients receiving PD.

The number of patients on RRT in the Eastern Cape (EC) is 737. This includes patients receiving RRT from 3 public hospitals and 12 private dialysis units in the province. Of the 12 private dialysis units in Port Elizabeth (PE), Life Mercantile Dialysis Unit's statistics was not included in the South African Renal Registry Report. Mercantile Life Dialysis Unit at the time of the study had 62 patients receiving HD and none receiving PD. Five patients were using arranged transport, i.e. one patient from Alexandria, one patient from Uitenhage and three patients were transported from Grahamstown.

Only a few studies have been conducted in South Africa (SA) to determine malnutrition in patients with CKD, receiving dialysis. Herselman *et al.* (2000:5)

investigated the role of protein energy malnutrition (PEM) as a risk factor for morbidity in 37 patients receiving long term dialysis at Tygerberg Hospital in Cape Town for a period of 24 months. PEM was found to be one of the important contributing factors to morbidity in this particular study, possibly via an effect on the immune system and infection.

Of the 84 PD patients from a dialysis center in Durban, 76.2% of patients were classified as being malnourished (Naicker, 2002:757). Naicker concluded that strategies to optimise dialysis dose and to improve nutritional intake with the help of a renal dietitian, could assist in improving the nutritional status of patients with chronic renal failure.

All patients, especially patients on HD, should be screened for risk of malnutrition, as this population is at an increased risk of PEM (Tsai *et al.*, 2013). Nutritional intervention should be initiated as early as possible to improve patient outcomes. According to the Guidelines for the Optimal Care of Patients on Chronic Dialysis in SA (Moosa *et al.*, 2006:12) a dietitian should be involved to individualise the meal plan for the patient. Ongoing basic monitoring should be done by means of a global clinical assessment. How frequently assessments are done, and whether they are being done at all the units, remains unknown.

1.2. AIMS AND OBJECTIVES

The aim of this study is to determine the risk of malnutrition among adult patients with chronic kidney disease undergoing HD at three dialysis units in PE.

In order for the study aim to be achieved, the following objectives is determined:

- The socio-demographics of patients on HD (i.e. age, gender, race, etc.); and
- The risk for malnutrition as determined by the mini nutrition assessment (MNA).

1.3 LAYOUT OF THE DISSERTATION

Following this introductory chapter, a review of the literature is presented in Chapter 2. Detailed information on the definition of CKD, etiology, prevalence, risk factors of CKD and malnutrition screening tools is discussed.

In Chapter 3, the methodology of the study is described. The study design is discussed here, as well as the method of sampling used; including the inclusion criteria and the sample size. The questionnaire and its sub-divisions is described, as well as the methods in which the data was presented to participants and the measuring of weight and height. This chapter also includes a description on the ethics and limitations of the study.

The results are presented in Chapter 4. This is done using tables. The results give an indication of the socio-demographics of the patients on HD, as well as indicate the results of the SF-MNA tool. The association between socio-demographics and the MNA variables is also indicated by use of a table. Tables include percentages and compare the group at risk of malnutrition with the group found not to be at risk of malnutrition.

Chapter 5 is the discussion chapter where the results that are reported in Chapter 4 is discussed in detail. The characteristics of the study population are discussed. The association between these characteristics, MNA variables and anthropometric data is discussed. The results that have been obtained in this study is then be compared to those found in available literature to assess whether there are similarities or differences, especially in terms of socio-demographics and the MNA variables. Significant associations found are discussed in more detail.

Following the discussion of the results, conclusions and recommendations will be made in Chapter 6. The results and discussion given in the previous chapters will be used to draw conclusions regarding the study. Recommendations on improving

current practice, identifying malnutrition earlier, supplementation and further research will be discussed.

CHAPTER 2: LITERATURE REVIEW

2.1. CKD IN SOUTH AFRICA

Worldwide it is believed that CKD effects up to 10% of the population. SA has a high prevalence of DM, HPT and human immunodeficiency virus (HIV) that put patients at risk for developing CKD (Gernholtz *et al.*, 2015:1). In SA, it is very important to diagnose kidney disease early and slow the progression to ESRD, as the resources available are limited. In the SA public sector, receiving HD depends on whether the patient is a suitable candidate for a transplant.

2.2. THE ROLE OF KIDNEYS IN THE BODY

The kidneys play a vital role in the body and it helps the body to maintain homeostasis by regulating electrolytes, the acid-base balance and our blood pressure. The kidneys also act as a filter by removing waste products, such as urea and ammonia in our urine. The kidneys reabsorb water, glucose and amino-acids and also produce hormones including calcitriol and erythropoietin, and the enzyme renin (Weiner, 2007:1). CKD is defined as abnormalities of the kidney's structure or function for a duration of three months or more.

2.3. PATHOPHYSIOLOGY OF CKD

Table 1 summarises the criteria used to determine kidney damage.

Table 1: Markers of kidney damage (Stevens & Levin, 2013:826)

Albuminurea [albumin excretion rate (AER) >30 mg/d; albumin-creatinine ratio (ACR) >30 mg/g]
Urinary sediment abnormalities
Electrolyte and other abnormalities due to tubular disorders
Abnormalities detected by histology
Structural abnormalities detected by imaging
History of kidney transplantation
Decreased GFR (for >3 months)
GFR <60 mL/min per 1.73 m² (GFR categories C3a-G5)

Urinary sediment abnormalities, as indicated in Table 1, includes the measuring of ACR's in urine to evaluate proteinuria. Electrolyte abnormalities occur mostly in patients with a GFR <10ml/min (Alcazar, 2008:87). As the GFR decreases, the osmolality of the urine reaches plasma osmolality and becomes isostenuric. This lead to water balance disorders, and nocturia and polyuria are symptoms of this occurrence (Alcazar, 2008:87). Fluid overload occurs, which usually leads to hyponatremia. As the GFR decreases, the kidneys' ability to excrete potassium also decreases. Increased potassium increase the risk for elevated calcium-phosphorus products which may predispose a person to developing arteriosclerosis (Weiner, 2007:1). Metabolic acidosis usually also occurs when the GFR is <20 ml/min. Metabolic acidosis favour bone demineralisation due to the release of calcium and phosphates from the bones and may lead to renal bone disease (Alcazar, 2008:87).

If these markers for kidney damage, shown in Table 1, are present, other implications to the patient's health may exist (Stevens & Levins, 2013:826). These implications can include the developing and/or progression of CVD, anemia and bone disease, as well as the need for replacement therapy (Weiner, 2007:3). Without quick intervention, the disease can progress to ESRD and even death. This makes screening and early detection and intervention for managing CKD progression extremely important.

2.4. CKD CAUSES AND RISK FACTORS

Major risk factors for the development of CKD include obesity, HPT, DM, and older age (Weiner, 2007:2). Obesity causes CKD and CVD through a number of mechanisms that include hyperglycaemia, dyslipidaemia, inflammation and artherosclerosis (Hall *et al*. 2014:75). These mechanisms are frequently all present and are referred to as "metabolic syndrome".

According to Hall and colleagues (2014; 7:75) obesity raises blood pressure by increasing the amount of sodium that is reabsorbed from the tubules of the kidneys into the bloodstream, impairing sodium excretion in the urine, and thus increasing the amount of fluid present in the body by activating the sympathetic nervous system and renin-angiotensin-aldosterone system. The increased pressure from visceral adipose tissue also causes the blood pressure to rise. Inflammation, oxidative stress and lipotoxicity also contribute to the HPT seen in obese patients. Due to the increase in the amount of sodium reabsorbed into the bloodstream from the tubules of the kidney, renal vasodilatation and glomerular hyperfiltration try to keep the sodium balance. These mechanisms, in conjunction with increased arterial pressure and metabolic abnormalities, lead to further glomerular injury and progression of CKD. Hypertensive nephropathy is second to DM as the leading cause of progression to CKD (Hart & Bakris, 2010:2675).

DM can cause diabetic nephropathy, which will affect the function of the kidneys. Diabetic Kidney disease (DKD) is defined as kidney disease caused by DM. DKD is the most frequent complication of DM. Approximately 50% of all ESRD cases are caused by DM (Tuttle *et al.,* 2014:511).

The dysregulation of metabolism plays a key role in the development of diabetic nephropathy (Reidy *et al.,* 2014). When hyperglycemia is present, cells experience an increase in intracellular glucose concentration. This leads to an increase in glucose oxidation by a number of pathways described by Reidy and colleagues (2014). Other metabolic factors such as an increase in fatty acids, changes in adiponectin, insulin levels and resistance, contribute to the progression of diabetic nephropathy.

Age-associated glomerular filtration rate (GFR) decline is a common occurrence amongst elderly patients. The GFR quantifies the function of the kidney (Weiner, 2007:1). The lower the GFR, the more progressed the kidney disease become. Decreased kidney function is defined as a GFR below <60 mL/min per 1.73 m^2. There is no clarity yet on whether a low GFR and a high albumin-creatinine ratio

(ACR) shows a progression of CKD, or should be considered "normal aging". The older population presents with other conditions that might need to be treated with medication. The use of medication may also contribute to the GFR decline and presence of albuminurea (Stevens & Levins, 2013:829).

The abnormalities summarised in Table 1 helps to identify the cause and focus on cause-specific treatment (Stevens & Levin, 2013:826). KDIGO recommends that CKD be classified based on the cause, GFR and albuminurea. In 2002, KDOQI first introduced the model used for classification and definition of CKD, as summarised in Table 2. Since 2002, limitations to this model have become evident and KDIGO sponsored a collaborative meta-analysis, and this model was reviewed at the Controversies Conference in 2009 (Stevens & Levin, 2013:826). The current model lacked coherence, as some patients at earlier stages of disease are at a higher risk for an adverse outcome. It was thus, important that a new model for CKD classification should reflect patient prognosis. Levey *et al.* (2011) found that in the range of GFR 30-59 ml/ min per 1.73^2 there was a steep rise in the risk for adverse outcomes with lower GFR, which supported the suggestion to subdivide category 3 into G3a and G3b. The classification of CKD based on the level of albuminurea, are summarised in Table 3.

A "heat map" (Figure 1) combines the GFR and the levels of microalbuminuria, and highlights the prognosis associated with each GFR stage. The colours indicate a low to higher risk for adverse outcomes for the 28 GFR and albuminurea categories in these population groups (Levey *et al*., 2011:25). The difference between G3a and G3b can be seen by examining the risk profiles for these groups.

Table 2: Staging of CKD *(Table 2 adapted from Stevens & Levin, 2013:826)*

Categories	**GFR values (mL/min/1.73m²**	**Kidney function**
G1	≥ 90	Normal to high
G2	60 – 89	Mildly decreased
G3a	45 – 59	Mildly to moderately decreased
G3b	30 – 44	Moderately to severely decreased
G4	15 – 29	Severely decreased
G5	< 15	Kidney failure

Table 3: Staging of albuminurea *(Table 3 adapted from Stevens & Levin, 2013:827)*

Stage	**AER(mg/d)**	**ACR (mg/d)**	**Description**
A1	<30	<30	Normal to mildly increased
A2	30-300	30-300	Moderately increased
A3	>300	>300	Severely increased

Composite ranking for relative risks by GFR and albuminurea (KDIGO 2009)				Albuminurea stages, description and range (mg/g)				
				A1		A2	A3	
				Optimal and high-normal		High	Very high and nephrotic	
				<10	10-29	30-299	300-1999	≥2000
GFR stages, description and range (ml/min per 1.73m²)	G1	High and optimal	>105					
			90-104					
	G2	Mild	75-89					
			60-74					
	G3a	Mild-Moderate	45-59					
	G3b	Moderate-Severe	30-44					
	G4	Severe	15-29					
	G5	Kidney failure	<15					

Figure 1: Heat map ***(Adapted from Levey et al. 2011:25.*** The categories with mean rank numbers 1-8 are green, mean rank numbers 9-14 are yellow, mean rank numbers 15-21 are orange, mean rank numbers 22-28 are red and the additional 12 cells is extrapolated based on results from the meta-analysis of CKD cohorts.

2.5. PREVENTION OF CKD

The National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF KDOQI) made a number of recommendations regarding these risk factors to prevent and treat CKD. NKF KDOQI's primary function is to provide individuals with evidence based guidelines on the management of all stages of CKD since 1997 (NKF KDOQI Clinical Practice Guideline for Diabetes and CKD: 2012; 60(5):858). In addition to developing guidelines, KDOQI also collaborates with other education programs to

improve clinical practice amongst health care providers. One of these programmes is the Kidney Disease: Improving Global Outcomes (KDIGO). KDIGO is a non-profit organisation which aims to improve international participation in the development, sharing and implementation of the guidelines.

Due to the risk factors described, recommendations made by NKF KDOQI include lifestyle changes namely, 1) achieving and maintaining a healthy weight [body mass index (BMI) 20-25]; 2) lowering salt intake to <2g per day; 3) thirty minutes of cardiovascular and tolerance training, five times per week and 4) limiting alcohol intake to two standard drinks per day for men and one standard drink per day for women (Taler, 2013:203). These recommendations are linked to the reduction of proteinuria (Stevens & Levin, 2013:829).

2.6. MANAGEMENT OF CKD

Patients with CKD should be assessed annually (Stevens & Levin, 2013:827) to monitor the severity and the progression of disease. Disease progression is influenced by a number of factors, including the cause of the CKD, the level of the GFR and albuminurea, age, sex, race or ethnicity, HPT, high blood glucose, lipid disorders, smoking, obesity, CVD and the use of nephrotoxic agents. Weiner (2007:4) stated that angiotensin-converting enzyme inhibitors (ACEI'S), angiotensin receptor blockers, management of high blood glucose and high blood pressure, cessation of smoking, the use of statins to control dyslipidemia, and the effective management of anemia, can help slow down the progression of CKD.

Renal replacement therapy (RRT) are treatment methods used in stage 5 CKD that mimic the function of the kidneys and these methods include HD, PD and kidney transplants (Naylor *et al.,* 2013:316).

These methods are described by Naylor and colleagues (2013). In HD the blood is circulated outside of the body and excess urea, creatinine and electrolytes are removed via diffusion using a membrane in an external filter. Excess fluid can also

be removed via ultrafiltration. In PD, the by-products and fluid is removed from the blood from inside the body, through a dialysate solution inserted in the abdominal cavity of the patient. In contrast to HD, the PD patient's peritoneum serves as a natural membrane. HD is the most common RRT used.

2.7. MALNUTRITION IN HD

Reasons for the malnutrition can include inadequate dietary intake due to physical and financial limitations, loss of nutrients during dialysis, illness and protein catabolism (Roy *et al.*, 2013:45). During dialysis amino-acids and protein losses occur. Together with a low nutrient intake there are not enough nutrients available for protein synthesis (Carrero *et al.*, 2013:84). Dialysis thus has a catabolic effect. Not only does protein catabolism occur when the dietary intake of protein is adequate, but also due to uremia-induced alterations such as inflammation, higher energy requirements and expenditure, acidosis and endocrine disorders which causes, hypermetabolism. This all leads to the catabolism of protein stores in patients with CKD (Carrero *et al.,* 2013:79).

Albumin is the most important protein lost in CKD (Stevens & Levin, 2013:827). Albumin is synthesised in the liver and plays a vital role in the body by transporting various circulating molecules and maintaining osmotic pressure (Friedman & Fadem, 2010: 223). The serum albumin level is considered to be a useful indicator of malnutrition (Foster & Leonard, 2004: 806). Studies have shown (Kaminski *et al.,* 1991; Lowrie & Lew, 1990) an association between low albumin levels and increased mortality, which offer potential clinical value. Reasons for low serum albumin levels, in CKD patients especially, include fluid overload, metabolic acidosis and inflammation (Friedman & Fadem, 2010:224).

The ubiquitin proteasome system is a pathway that describes how CKD-related complications can lead to protein catabolism. These complications include metabolic acidosis, reduced insulin action, higher angiotensin II levels and inflammation. It is important for the clinician to determine what leads to the albumin level decline. It is

not only the nutritional intake that influences albumin levels (Freidman & Fadem, 2010: 227). Even though the serum albumin is a useful indicator of malnutrition, a low albumin level by itself, however, is not a reliable. It should be used in conjunction with other objective data to help identify malnutrition as stated by The Council on Renal Nutrition (Friedman & Fadem, 2010: 227).

Bovio and co-workers (2012:52) investigated the reasons for malnutrition in HD stage 5 CKD patients and additional causes found, included dental problems, disturbances in taste, early satiety, a low energy restrictive diet, a low protein diet, tiredness, loneliness and a lack of support from family and friends. Patients on HD need a higher protein and energy intake to prevent protein and fat catabolism. Due to a loss of appetite and taste changes that occur, adequate nutritional intake is not possible.

Loss of appetite, as established, is one of the many possible reasons why undernutrition is prevalent in patients with CKD. This makes investigating appetite an important research area. Loss of appetite is reported in 30%-40% of patients receiving dialysis and is associated with worse outcomes regarding dietary intake, inflammatory markers, malnutrition, reduced quality of life, increased hospitalisation and increases the risk of death, fourfold (Zabel *et al.,* 2009:343).

Malnutrition may also assume the form of over-nutrition (Pasticci *et al.,* 2012:50). A study (LeClercq B,2015), to investigate the effect of protein supplementation on the nutritional status of patients receiving continuous ambulatory peritoneal dialysis (CAPD) in the Eastern Cape if South Africa, found that most participants had a BMI within normal range, a normal to above average muscle mass, and were well-nourished based on the SGA nutrition assessment tool.

2.8. TOOLS FOR ASSESSING MALNUTRITION

Tools for assessing malnutrition in patients undergoing HD have been widely investigated. The UK Renal Association recommends the Subjective Global Assessment (SGA) as a screening tool for detecting malnutrition in patients on HD (Fisher *et al.*, 2011:282). It also recommended by the United States Kidney Foundation and the Taiwan Society of Nephrology. It has been criticised for being time consuming and lacking sensitivity to identify the risk for malnutrition.

The Patient Generated Subjective Global Assessment (PG-SGA) has also been investigated (Fisher *et al.,* 2011). This tool requires the patient to complete a portion of the assessment tool. This reduces the time that a dietitian needs to spend conducting the assessment. The PG-SGA has also shown better construct validity in recent studies.

Hand grip strength (HGS), anthropometric measures, dietary intake, malnutrition inflammation score (MIS) and biochemical parameters also indicate malnutrition (Roy *et al.,* 2013:39). MIS has many components including eight change, dietary intake, gastro-intestinal symptoms, functional capacity, years on dialysis, subcutaneous fat, muscle wasting, BMI, serum albumin and total iron binding capacity (TIBC) (Roy *et al.*, 2013:39). HGS has been described as a useful tool to assess muscle mass related to the patient's nutritional status. However, no standardised protocol has been developed for its use (Leal *et al.*, 2011:1359).

Fisher *et al.* (2011) conducted a study to determine which tool was the best to use to identify the risk of malnutrition in patients undergoing HD. The Malnutrition Universal Screening Tool (MUST) did not identify the risk of malnutrition in patients undergoing HD (Fisher *et al.*, 2011:283). In contrast to previous studies, the patients found the PG-SGA too difficult to complete and the tool was less sensitive to the nutritional status of patients on HD than the SGA. It was found that the MUST tool was not a sensitive method for assessing the risk of malnutrition in this sample

group. The SGA appeared to be more sensitive to the nutritional status of patients on HD.

Other tools used to assess the nutritional status of patients on HD, are the full Mini-Nutritional Assessment (MNA) and the short-form Mini-Nutritional Assessment (SF-MNA). The MNA is a highly sensitive tool in diagnosing malnutrition (Cereda, 2012:37). The full scale MNA consists of 18 components and evaluates four aspects of a person's nutritional status e.g. diet, anthropometrics, global and self-rated status (Tsai *et al.*, 2013:2831). The full MNA can be seen as two-part assessment. Patients are first assessed with the SF-MNA and if they are rated as a risk for malnutrition they are assessed with the full MNA. Tsai *et al.* (2013: 2831) has found that the SF-MNA rates a smaller portion of patients in HD as at risk for malnutrition. This is not acceptable as the patients who are not picked up on the SF-MNA as a risk for malnutrition, will be presumed "normal". These patients will then miss the opportunity for early nutritional intervention. Tsai and colleagues (2013: 2831) made a few changes to the SF-MNA to improve the predictive ability of this assessment tool. They compiled an adjusted SF-MNA (ASF-MNA) that was the most appropriate in screening for malnutrition in patients with HD. This tool was tested in a non-westernised population. The MNA has been tested on a PD population by Brzosko and colleagues (2013) and they found that the MNA is a valuable, clinically suitable tool for assessing the nutritional status in patients receiving PD.

There are some limitations as the MNA has been developed based on the clinical data of Western populations. There is a variation of the MNA that was especially developed for the Taiwanese population e.g. MNA-Taiwan version 1 (MNA-T1). Tsai *et al.* (2013: 2834) found that the MNA performed well against the SGA. Their results suggest that the MNA is as effective as the SGA in identifying patients at risk for malnutrition.

2.9. SUMMARY

Malnutrition affects a large percentage of patients receiving HD and the nutritional management is widely recognised as an important part of treatment for patients receiving HD (Naylor *et al.*, 2013:316).

Adequate and renal specific supplementation may improve nutritional status amongst HD patients (Roy *et al.,* 2013:39) and is a possible intervention. Roy and colleagues (2013:39) studied 15 HD patients for three months in which these patients received a low cost nutrient supplement. Various nutrition parameters were evaluated and it was concluded that nutritional supplementation, designed for patients on HD, improved their nutritional status.

According to the researcher's knowledge, there is no literature available on the risk of malnutrition in the HD population in the EC of SA. Malnutrition affects the quality of life and survival rate in patients with CKD (Pasticci *et al.*, 2012:50). This is why it is important to assess patients' nutritional status and intervene as soon as possible to slow the progression of CKD and improve patient outcomes.

CHAPTER 3:

METHODOLOGY

3.1 INTRODUCTION

A descriptive study was conducted to determine the risk of malnutrition among adult patients with CKD undergoing HD at three dialysis units in PE. This chapter gives details on the study population, operational definitions and the detailed data collection procedures followed.

3.2 SAMPLING

3.2.1 Study population

The study population consisted of adult patients with CKD receiving HD in dialysis units in PE. Approximately 10-20 patients spend three to four hours on dialysis, per shift, per day, at each unit.

3.2.2 Sample selection

The study population was chosen using a non-random sampling method. The sample included adult patients with CKD undergoing HD at the following dialysis units in PE: the Mercantile Life dialysis unit, Greenacres National Renal Care (NRC), and the Fresenius Medical Care dialysis unit. The three units were included due to a good relationship that exists between the researcher, dialysis unit staff, unit managers and the patients. The other reasons included logistics. The chosen units are close to each other, which made transport to and from the units more convenient for the researcher. This also assisted in staying within a budget on fuel expenditure during the collection of data.

HD patients attend the dialysis unit three times per week. The different days are referred to as schedules. The 1st schedule is on a Tuesday, Thursday and Saturday and the 2nd schedule on a Monday, Wednesday and Friday. There are three different shifts on the 2nd schedule; a morning (7am – 11am), afternoon (11am – 3pm) and an evening (3pm – 7pm) shift. There is also a nocturnal shift from 6pm to 10pm on the first schedule that was also included in this study. Transport is arranged for patients travelling from areas such as Humansdorp, Jeffreysbay,

Grahamstowm, Alexandria, Uitenhage, Dispatch and informal settlements surrounding PE, but the majority of the patients reside within PE.

Data was collected during September and October 2015.

3.2.3 Sample size

A total of 68 patients met the inclusion criteria and were included in the study.

Patients were included in the study if they were:

- on HD at the specified units;
- receiving dialysis at least two times per week;
- over 18 years of age; and
- gave informed consent.

Patients were excluded from this study if they:

- had acute kidney disease (AKD); and
- were under 18 years of age.

3.3 OPERATIONAL DEFINITIONS

The following are the variables that were measured for the study.

3.3.1 Socio-demographics

Socio-demographic information referred to the patients' background, their gender, and their level of education, as well as their medical background.

3.3.2 Nutritional status

The nutritional status of an individual is reflected by the balance between the individual's nutrient intake and their nutritional requirements (Hammond, 2012: 129). Nutritional status therefore mirrors the degree to which the body's physiologic

need for nutrients has been met. Assessment of nutritional status can involve the use of nutrition histories, anthropometry, biochemical tests and physical examinations (Hammond, 2012: 129). For the purposes of this study, BMI was used to determine nutritional status. The BMI is calculated by dividing weight in kilograms (kg) by height in m^2 (Fererra, 2005:168).

3.3.3 Risk of malnutrition

Malnutrition can present as either a state of under or over nutrition. Risk of undernutrition can be defined as either the possibility of an inadequate nutrient intake, or inadequate nutrient absorption to meet an individual's metabolic needs (Hammond, 2012:131). Over nutrition results from excess energy and manifests as obesity, DM, CVD, HPT and metabolic syndrome (Hammond, 2012:131).

Determination of risk of malnutrition is useful in identifying those patients who require nutrition intervention. For the purposes of this study, the SF-MNA was used to assess risk of malnutrition. The following variables make up the SF-MNA tool and were used to determine risk of malnutrition:

3.3.3.1 Appetite

Appetite is subjective and encompasses a variety of sensations including hunger, fullness and the desire to eat (Zabel *et al.,* 2009:344).

Appetite is defined as the desire to eat (Stolerman, 2010:142). An individual will partake in activities that will ensure the procurement of food. The rate and duration at which the food is consumed, as well as the quantity of the food consumed, is also an indication of the degree of an individuals' appetite, according to Stolerman (2010).

3.3.3.2 Weight loss

Unintentional weight loss refers to a loss of >10 % of usual body weight during a period of 3 - 6 months (Fouque *et al.,* 2007:ii53). Unintentional weight loss often leads to a reduction in body fat (Bechard & Duggan, 2008:55) and may be caused by inadequate food intake; inefficient nutrient absorption and metabolism; disease which increases the metabolic rate, thus, leading to wasting; or by psychological or emotional stress, amongst others (Lysen & Israel, 2012: 484).

3.3.3.3 Mobility

The ability of an individual to independently perform physical tasks and activities of daily living, as well as the ability to move either by walking or movement of joints without the use of mobility aids such as wheelchairs, canes, etc., is referred to as mobility (Doran, 2012:35). Patients who are able to walk independently, are regarded as mobile, while immobile patients are those who rely on mobility aids to move around.

3.3.3.4 Psychological stress

Situations in which the challenges or threats facing people exceed their coping resources, are referred to as psychological stress (Goldberger & Breznits, 2010). The inability of patients to cope with these psychological and physiological responses may place them at risk for disease (Bruce *et al*., 2009:586).

3.3.3.5 Acute disease

Acute disease conditions are illnesses or injuries lasting less than three months, but are serious enough to cause the individual to cut down on their activities for at least one-half of a day, and/or lead them to consult a physician (Larson, 1991:69).

3.3.3.6 Self-view of nutritional status

For the purpose of this study, self-view of nutritional status refers to how the patient perceived his or her body status. In other words, it refers to whether the patient sees themselves as having a normal nutritional status or whether they see themselves as over- or undernourished.

3.4 DATA COLLECTION TECHNIQUES

A questionnaire was used by the researcher in an interview to collect socio-demographic data, as well as the SF-MNA assessments of the patients (Appendix E). Anthropometric measurements were also taken by the researcher or the nursing staff.

3.4.1 Questionnaire and SF-MNA

The questionnaire used in this study has three sections. Section A is socio-demographic data. Section B consists of the 6 MNA questions on appetite, weight loss, mobility, BMI, self-view of nutritional status, psychological stress and/or acute disease. The SF-MNA is a practical tool for identifying the risk of malnutrition. Section C was used to record anthropometric measurements of weight and height for the calculation of BMI.

In order to determine the distance from the unit included in the questionnaire, a number was allocated to each of the units in: 1= Fresenius Medical Care; 2=Life Mercantile Dialysis Unit and 3= National Renal Care unit. Google maps was used to allocate a number to the suburb (Question 12) according to the distance from the unit (i.e. 1= 1-5km; 2= 5-10km; 3= 10-20km; 4= 20-50km and 5= >50km from the unit).

3.4.2 Determining BMI

The BMI was calculated by the researcher by dividing the participant's weight in kilograms (kg) by height in m^2.

The height of the patients was available from their file, as height is recorded when the patient is admitted to the dialysis unit. The weight was taken by the nursing staff if the patient arrived at the dialysis unit before the researcher arrived to take the pre-dialysis weight. The same was done if patients left after the researcher left to attend another unit. Patients were on the dialysis machine for at least 3-4 hours and due to time constraints it was not possible for the researcher to be at the unit at the arrival and departure for the same patient on the same day. Any outstanding weight measurements were taken from the file as recorded by the nursing staff.

For the purposes of this study, the following score was allocated for each BMI cut-off point according to the MNA tool: e.g. 0 = <17 kg/m²; 1 = 17-18.9 kg/m²; 2 = 18.9-20.9 kg/m² and 3 = ≥21 kg/m² (Tsai *et al.*, 2013:2833).

3.4.2.1. Weight measurement

Weight was measured in the dialysis unit by either the researcher or the nursing staff. Weight was measured on a digital or chair scale (Scalemaster: model PF-1 Micro or model Micro T3). Weight on both types of scales was measured with the patients wearing minimal clothing (jacket, shoes and jewelry removed). For mobile patients, weight was measured with the patients standing still in the middle of the scale's platform without touching anything and the body weight was equally distributed on both feet as described in Lee & Nieman (2013:168). The same was done when patients were weighed on the chair scale with feet lifted up on the foot rest. If a chair scale was not available in the unit, a chair was placed on the platform scale and the patient was weighed with their feet lifted from the ground. The weight of the chair was subtracted from the total weight measured. Weight is taken before and after dialysis and recorded to the nearest 100g.

3.4.2.2. Height measurement

Height was measured by means of a vertical scale of 2 meters with a sliding head-piece, to the nearest 0.5 cm. The patients stood without shoes, with their heels together, arms to the side, legs straight, shoulders relaxed and head in the Frankfort

horizontal plane (looking straight ahead). Heels, buttocks, scapulae (shoulder blades), and the back of the head were against the vertical surface of the vertical scale. Just before the measurements were taken, the patients inhaled deeply, held their breath and maintained an erect position while the sliding-headpiece was lowered on the highest point of the head with enough pressure to compress the hair (Lee & Nieman, 2013:167).

3.4.3 Pilot study

The pilot study was conducted on 21 September 2015 before the main study, in order to test the questionnaire, techniques, sampling procedures and the data input Excel spreadsheet. The purpose of this pilot study was to identify any problems with the questionnaire, its layout and wording, as well as possible problems with the measuring techniques.

Using convenience sampling, the researcher selected four patients in the Fresenius Medical Care dialysis unit to take part in the pilot study. After the pilot study, the necessary changes were made to the final questionnaire and data input Excel spreadsheet.
The results of the pilot study were not included in the main study.

3.4.4 Data collection process

The following process as followed during the data collection process.

- Data was collected by the researcher over a period of a week from 28 September to 2 October 2015.
- Three dialysis units were visited in the PE area by the researcher every day during the data collection period.
- Patients that were in the unit at the time of the researcher's unit, were approached and asked to participate in the study.
- Upon agreeing to participate, they were asked to sign an informed consent in a language of their preference (i.e. English, Afrikaans or isiXhosa).

- The researcher then completed the questionnaire in an interview and where necessary a translator was available to assist in isiXhosa.
- Anthropometrical data was collected for all the patients.

3.4.5 Statistical analysis

Data sheets were prepared in Microsoft Excel. On the top row the question numbers were allocated and on the far left column the patient number.

No names were visible on the sheet. Each participant had a number allocated to their questionnaire.

The answers given by the participant was used to complete the coding section next to the questions on the questionnaire.

A biostatistician at the Faculty of Health Sciences, University of the Free State, performed the statistical analysis.

Descriptive statistics such as frequency tables, means, standard deviations and medians were used. The Statistical Analysis Software (SAS) Program version 9.4 was used. P-values were calculated using the chi-square or the Fischer exact test.

3.4.6 Ethical aspects

A protocol for the proposed study was submitted to, and subsequently approved by the Committee for Human Research, Faculty of Health Sciences, University of the Free State (ECUFS NR: 171/2015) (Appendix A).

A letter was presented to the unit managers (Appendix B) requesting permission to perform the study at the specific unit. The request was taken further by the

managers to their relevant head offices and permission was obtained within two months from date of request.

Patients from Fresenius Medical Centre, Life Mercantile Dialysis Unit and National Renal Care gave informed consent in the language of their choice (Appendix C). Patients received a copy of the study information sheet (Appendix D) upon signing the consent form.

It was explained to each participant that signing of the form would imply the following:

- Participation was entirely voluntary.
- Participants were allowed to withdraw from the study at any time.
- Participation involved no risk or adverse events.
- Participation involved answering a questionnaire.
- All information would remain confidential.

Personal identification information was omitted from the questionnaire to ensure confidentiality. Upon entering the study, each participant received a unique identification number that was used on all study-related material. The patients were ensured of confidentiality via the consent form. Data was also captured blind, using the unique identification number.

3.4.7 Problems experienced during data collection

The main problems encountered were as follows:

- Time constraints: The questionnaire and MNA took longer than anticipated to complete and thus a smaller number of patients could be seen by the researcher per day.

- Translator: It was not possible to make use of one translator during the collection process. Nursing staff that were able to speak isiXhosa and were available during that specific shift, assisted when needed.

3.5 VALIDITY AND REPRODUCIBILITY OF THE TOOL

The test-retest reliability of the SF-MNA has not been previously determined in the available literature. The test-retest reliability was considered beyond the scope of this study with many factors that could influence the accuracy of such a reproducibility study. Difficulties in reproducing the exact conditions in which testing occurred include medication that may affect appetite, daily weight changes, patient health and mood. The tool has been validated by Brzosko *et al.* (2013) and Lu (2008).

CHAPTER 4: RESULTS

4.1 INTRODUCTION

This chapter discusses the results of the socio-demographic factors and the SF-MNA results for the 68 patients from all three dialysis units in PE that met the inclusion criteria and participated in the study.

4.2 SOCIO-DEMOGRAPHICS

A total of 68 patients gave consent to participate in the study. Of these participants 44 (68, 7%) were from the National Renal Care Dialysis unit, 14 (20.6%) participants from the Mercantile Life Dialysis unit and ten (14.7%) from Fresenius Medical Care dialysis unit.

Table 4 depicts the results of the socio demographic data for all the participants.

Table 4: Socio-demographic data of participants (n = 68)

	Category	**n**	**%**
Age	18-29 years	9	13.2%
	30-39 years	5	7.4%
	40-49 years	11	16.2%
	≥ 50 years	43	63.2%
Race	Black	34	50.0%
	Coloured	15	22.1%
	Asian/ Indian	3	4.4%
	White	15	22.1%
	Other	1	1.5%
Gender	Male	39	57.4%
	Female	29	42.6%

Marital status	Never married	15	22.1%
	Married	40	58.8%
	Separated/ divorced	4	5.9%
	Widowed	9	13.2%
Highest level of education	None	0	0.0%
	Primary school	4	5.9%
	High school	32	47.1%
	Tertiary education	32	47.1%
Employment status	Unemployed	21	30.9%
	Self-employed	5	7.4%
	Part-time employed	1	1.5%
	Full time employed	18	26.5%
	Pensioner	22	32.4%
	Student	2	2.9%

The median age of the participants was 54.5 years. The largest percentage of participants, (63.2%) was older than 50 years of age. Half of the participants were black (50.0%), and 15 (22.1%) were coloured. Most participants spoke isiXhosa (41.3%),only 23.5% spoke English and the rest spoke Afrikaans.

There were 39 (57.4%) male participants and 29 (42.7%) were female. The majority of participants were married (58.8%); 47.1% finished high school and an equal number (47.1%) of participants had a tertiary education.

Just under a third (29.4%) of the participants was unemployed, while just over a quarter of them (26.5%) were employed on a full time basis. Pensioners made up 32.4% of the study population and only 2 participants were students.

The number of months or years on HD as well as the number of dialysis sessions attended by the participants per week is summarised in Table 5. The majority of participants have been on dialysis for more than a year, with half (48.9%) having been on dialysis for 1 to 5 years, and 26.5% being on dialysis for more than 5 years.

Most participants (94.1%) attended the unit 3 times per week and 4 participants (5.9%) attended the unit only twice per week.

Table 5: Duration on HD and number of sessions per week

Months/years on HD	**n**	**%**
0-6 months	10	14.7%
6<12 months	7	10.3%
1<5 years	33	48.5%
>5 years	18	26.5%
Number of sessions per week		
Two sessions per week	4	5.9%
Three sessions per week	64	94.1%

HPT was the most prevalent illness amongst the participants (41.2%), followed by a combination of Type 1 DM and HPT (20.6%) as indicated in Table 6 below.

Table 6: Illness of participants (n = 68)

Illness	N	%
T1DM	1	1.5%
T2DM	2	2.9%
T1DM & HPT &CVD	2	2.9%
T2DM & HPT &CVD	2	2.9%
HPT	28	41.2%
T1DM & HPT	14	20.6%
T2DM & HPT	6	8.9%
HPT & CVD	5	7.4%
No illnesses	8	11.8%

Eight participants had no other illnesses, one participant had Type 1 DM with no other conditions and two participants (2.9%) were diagnosed with Type 2 DM. Almost half of the participants had more than one illness (42.6%).

The source of transport and distance of residence from the dialysis units are summarised in Table 7. The majority of participants (70.6%) had their own transport to and from the dialysis units. Sixteen participants (23.5%) used public transport with four participants (5.9%) making use of the units' transport for their dialysis sessions.

Table 7: Transportation and residence of participants (n = 68)

Transportation to dialysis unit	n	%
Own transport	48	70.6%

Public transport	16	23.5%
Unit's transport	4	5.9%
Distance from dialysis unit		
<5km	5	7.5%
5-10km	27	39.7%
10-20km	20	29.4%
20-50km	10	14.7%
>50km	6	8.8%

Participants who came from area outside PE came from Somerset East, Alexandria, Cradock, Port Alfred and Grahamstown. Most of the participants stay within PE. Five participants (7.4%) reside within 5km of their dialysis unit, 39.7% live 5 - 10km from the unit and six 8.8% live more than 50km form the unit.

4.3 SF-MNA RESULTS

Results obtained from the SF-MNA form are indicated below. Overall, 52.9% had an SF-MNA score of ≤11 and were classified as being at risk of malnutrition as shown in Figure 2.

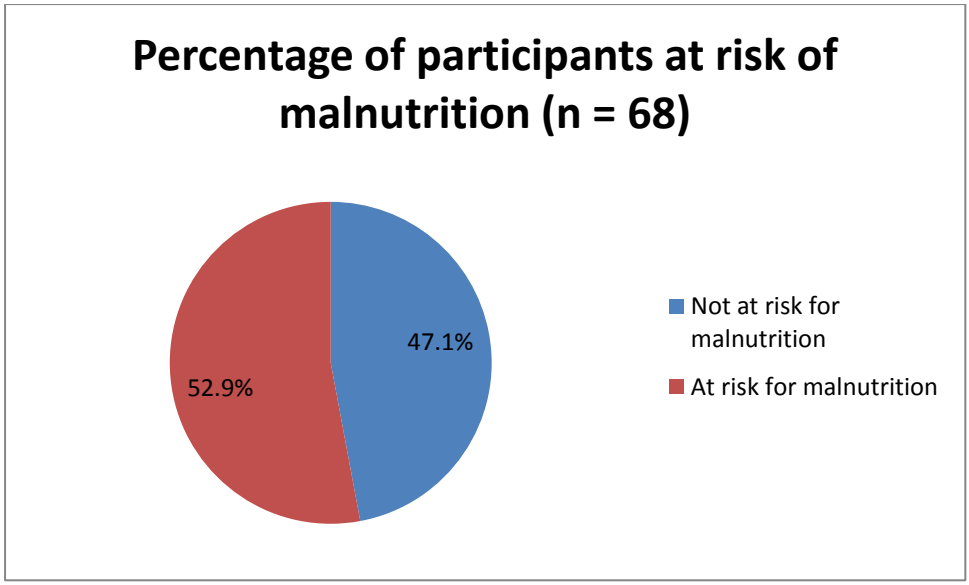

Figure 2: Percentage of participants at risk for malnutrition

Results for the individual variables for the MNA are as follows:

Table 8 - 13 compares the results of the variables e.g. appetite, weight loss, mobility, psychological stress and/ or acute disease, BMI and self-view of the nutritional status amongst participants at risk and not at risk of malnutrition.

Statistically significant differences between the group identified as at risk of malnutrition, and the group not at risk of malnutrition, were only found with the following variables: appetite, weight loss and psychological stress. The rest of the MNA variables did not show any statistically significant difference between the group of patients who were at risk and not at risk for malnutrition.

4.3.1 Appetite:

Of all the participants, 5.9% reported that they experienced a severe loss of appetite. These four participants were identified as being at risk for malnutrition. The majority, 66.2%, of participants reported that they have not experienced any loss of appetite in the past three months. No loss of appetite was reported by the majority (93.8%) of participants that were not at risk of malnutrition. More than half

of the participants at risk for malnutrition (58.3%) reported some degree of loss of appetite. This result with regards to loss of appetite was statistically significant (p-value < 0.0001).

Table 8: Appetite amongst participants (n = 68)

Appetite	**Total n (%)**	**Not at risk n (%)**	**At risk n (%)**
Severe loss of appetite	4 (5.9)	0 (0.0)	4 (11.1)
Moderate loss of appetite	19 (27.9)	2 (6.3)	17 (47.2)
No loss of appetite	45 (66.2)	30 (93.8)	15 (41.7)

4.3.2 Weight loss

Over half of the participants (54.4%) reported no loss of weight experienced over the past three months. Significantly more participants that were at risk of malnutrition, (87.5%) compared to those who are at risk (25.0%), experienced no weight loss in the previous three months (p-value < 0.0001).

Table 9: Weight-loss past 3 months amongst participants (n = 68)

Weight loss	**Total n (%)**	**Not at risk n (%)**	**At risk n (%)**
>3kg	21 (30.9)	0 (0)	21 (58.3)
Don't know	5 (7.4)	2 (6.3)	3 (8.3)
<3kg	5 (7.4)	2 (6.3)	3 (8.3)
No weight loss	37 (54.4)	28 (87.5)	9 (25.0)

4.3.3 Mobility

The majority (82.4%) of participants were mobile and active. Only one participant was chair bound and this participant was classified as not at risk for malnutrition. The majority of the participants at risk for malnutrition, 77.8%, were mobile and active.

Table 10: Mobility amongst participants (n = 68)

Mobility	**Total n (%)**	**Not at risk n (%)**	**At risk n (%)**
Bed/chair bound	1 (1.5)	1 (3.1)	0 (0)
Able to get out of bed/chair but does not go out	11 (16.2)	3 (9.4)	8 (22.2)
Able to go out	56 (82.4)	28 (87.5)	28 (77.8)

4.3.4 Psychological stress and/ or acute disease

A little over two thirds (67.6%) of the participants reported that they had not experienced any psychological stress or acute illness in the past three months. Significantly more participants at risk for malnutrition (55.6%) experienced psychological stress or acute illness compared to the participants not at risk (6.3%) (p-value <0.0001).

Table 11: Psychological stress or acute illness experienced amongst participants (n = 68)

Psychological stress/ acute illness	**Total n (%)**	**Not at risk n (%)**	**At risk n (%)**

Yes	22 (32.4)	2 (6.3)	20 (55.6)
No	46 (67.6)	30 (93.8)	16 (44.4)

4.3.5 BMI

Almost all participants who were not at risk of malnutrition, had a BMI of more than or equal to 21kg/m^2. Similarly, most participants who are at risk for malnutrition also had a high BMI.

Table 12: BMI amongst participants (n = 68)

BMI	**Total n (%)**	**Not at risk n (%)**	**At risk n (%)**
<17	1 (1.5)	0 (0)	1 (2.8)
17 – 18.9	3 (4.4)	0 (0)	3 (8.3)
19 – 20.9	6 (8.8)	2 (6.3)	4 (11.1)
≥ 21	58 (85.3)	30 (93.8)	28 (77.8)

4.3.6 Self-view of nutritional status

The majority of the participants (67.6%), viewed themselves as having no nutritional problem. Of the 36 participants identified as at risk for malnutrition, 58.3% also viewed themselves as having no nutritional problem.

Table 13: Self-view of nutritional status amongst participants (n = 68)

Self-view of nutritional status	**Total n (%)**	**Not at risk n (%)**	**At risk n (%)**
View self as being	7 (10.3)	1 (3.1)	6 (16.7)

malnourished			
Uncertain	15 (22.1)	6 (18.8)	9 (25.0)
View self as having no nutritional problem	46 (67.6)	25 (78.1)	21 (58.3)

4.4. COMPARISON OF NUTRITIONAL RISK AND SOCIO-DEMOGRAPHICS

A significant association was found between the risk for malnutrition and the duration of HD treatment. Overall, there were a greater percentage of participants in the dialysis units that have been receiving dialysis for between 1 to 5 years or more (48.5%). Significantly more participants who were receiving HD for under 6 months (90%), were at risk for malnutrition and significantly more participants who were receiving HD for 1 to 5 years, were not at risk for malnutrition.

Table 14: HD duration of participants at risk and not at risk for malnutrition (n = 68)

		Not at risk n (%)	**At risk n (%)**	**Confidence intervals**
	Category	**n (%)**	**n (%)**	
HD Duration	0-6 months	1 (10.0)	9 (90.0)	*0.0385
	6<12 months	3 (42.9)	4 (57.1)	
	1<5 years	20 (60.6)	13 (39.4)	
	>5 years	8 (44.4)	10 (55.6)	

4.5. SUMMARY

There was no significant association found between age, gender, ethnicity and the risk for malnutrition. The illness that was most prevalent was HPT with a large

number of participants also diagnosed with DM and CVD. These illnesses are risk factors for the development and progression of CKD.

No association was found between BMI and the risk of malnutrition. Anthropometrical data indicated that the participants were more likely to be overweight (BMI > 24.9kg/m²). Weight loss, however, was significantly associated with the risk of malnutrition. More than half of the participants at risk of malnutrition reported a weight loss greater than 3kg over the past three months.

The only other significant associations were found with the duration of HD, loss of appetite, and psychological stress or acute disease. The risk of malnutrition was higher in the group that was receiving HD for 0-6 months and the group that had been receiving HD for between one to five years, were the least at risk of malnutrition.

The effect of psychological stress and acute disease during the previous three months, was also found to be a significant factor in increasing the risk of malnutrition in the HD population.

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION

A study was conducted on patients attending three dialysis units in the PE area to better understand the risk of malnutrition within this population. The aims of the present study were to determine the socio-demographics of this population, as well as their risk of malnutrition by using the SF-MNA tool.

5.2 SOCIO-DEMOGRAPHICS

Socio-demographic data was included in the present study to identify any possible association between the characteristics of the HD population and their risk for malnutrition. The majority of the participants was receiving HD three times per week and has been attending the unit for more than one year.

Most of the participants live in and around PE, whilst three quarters live within twenty kilometers form the unit. Areas from outside PE, more than 50km from the dialysis unit, where the participants travelled from, included Somerset East, Alexandria, Cradock, Port Alfred and Grahamstown. Transport to and from the dialysis unit was not a hindrance, as most participants had their own transport to and from the dialysis unit, and transport was arranged by the unit for participants who required it and for all the participants living outside PE.

It is a well-known fact that race or ethnicity, sex, age, HPT, high blood glucose, lipid disorders, smoking, obesity, CVD and the use of nephrotoxic agents are risk factors for CKD (Stevens & Levin, 2013:827).

A greater percentage of the participants were black and male. The incidence of CKD has been found to be 6-10 times higher in patients older than 70 years of age in comparison to patients between 30 and 50 years of age (Alebusio & Ayodele, 2005:418). This is due to an age-associated decline in the GFR, meaning the higher a person's age, the more likely a decrease in kidney function become. This is possibly the reason why most of the participants in this study were over 50 years of age.

An association between ethnicity and malnutrition in HD patients has also been described by Alebiosu & Ayodele (2005:420). They noted that African Americans, American Indians or Alaska Natives and Hispanics had a higher prevalence of CKD, with a 4.8-fold greater risk for CKD in Blacks compared to Whites.

Half of the participants in this study were married. This may have a positive impact on treatment adherence (Cicolini *et al.*, 2012:2410). In this study, a total of 72 subjects with ESRD participated. The subjects that were assisted by a family carer, were identified as a case and subjects without a family carer were identified as the control. Cigolini and colleagues then proceeded to follow-up these subjects for 4 months and evaluated their interdialytic weight gain, phosphate and potassium levels. They concluded that the presence of a family carer did improve the HD patient's adherence to treatment.

Just under half of the participants finished high school and an equal number of participants finished a tertiary education. Even with this high level of schooling, there were still a high percentage of participants that were unemployed. Progression of CKD often affects patients' ability to be economically active and work. It is for this reason that some of them become medically boarded. Medically boarded participants were included under "unemployed" and thus the percentage of unemployed participants was expected to be high. Also as expected, due to the older age of the participants, a large percentage were on pension.

Being unemployed and being on pension may have financial implications that may affect treatment compliance. Most patients on HD may not have the finances to be able to follow a strict renal diet which requires a variety of food. In SA, healthier food options are often found to be unaffordable, particularly in peri-urban areas (Temple *et al.,* 2009:58). In the absence of a variety of foods, nutritional supplementation becomes the next option. However, this also poses a problem in terms of affordability. Added to this, patients travel to and from the dialysis unit two to three times per week. The cost of transport is an extra expense that may have an effect on the patient's finances.

A quarter (25%) of South African adults is currently diagnosed with HPT, and HPT accounts for 21% of patients receiving RRT (Okpechi *et al.*, 2012:254). It therefore, comes as no surprise that the most prevalent illness amongst the participants was HPT. More than three quarters (82%) of the participants at risk for malnutrition in the current study had HPT, either by itself or in conjunction with DM or CVD. Noo significant association was found between HPT and an increased risk for malnutrition.

5.3 RISK FOR MALNUTRITION

Malnutrition in this study refers to undernutrition. HD has a catabolic effect and during HD amino-acids and protein losses occur (Carrero *et al.,* 2013:84). Together with a low nutrient intake, uremia-induced alterations such as inflammation, higher energy requirements and expenditure, acidosis and endocrine disorders which cause an increased metabolism, there are not enough nutrients available for protein synthesis, and this all leads to malnutrition in the form of undernutrition. Many other studies have discussed malnutrition in HD patients (Bovio *et al*., 2012; Pasticci *et al*., 2012; Roy *et al.,* 2013; Tsai *et al*., 2013).

Half of this study's participants were classified as being at risk for malnutrition according to the SF-MNA. This was expected due to the catabolic effect of dialysis. In SA, of the 84 patients on PD at a dialysis center in Durban, 76.2% were classified as being malnourished (Naicker *et al.,* 2002:757). Another study done in the Eastern Cape of South Africa by LeClercq (2015), found that 61.5% and 83.3% of the experimental and control group on CAPD, respectively, was found to be well-nourished by the SGA nutrition assessment tool. This finding is in contrast to the findings in Durban. Even though a different tool was used, this confirms the increased risk of malnutrition for patients on HD even in the South African setting.

A closer look at the components making up the MNA tool revealed a significant association between the, loss of appetite, weight loss and psychological stress or

acute disease. The questionnaire also revealed a significant association between the risk of malnutrition and the number of years on HD.

5.3.1 HD duration

For the participants in this study, being on dialysis for six months or less meant that the risk for malnutrition was high. On the other hand, being on dialysis for 1 to 5 years meant a reduced risk for malnutrition for this study population. Thus, the longer a participant received HD, the better the outcomes.

Similar results were found in a study by Kaufmann *et al.* (1994:754) where 96 patients with ESRF were assessed to evaluate the impact that HD duration had on their nutritional status. The patients were divided into four groups e.g. onset HD (<1 month); early-stage HD (1-8 months); mid-stage HD (6-69 months) and advanced-stage HD (70-207 months). The early-stage and mid-stage HD groups were found to have serum protein and total lymphocyte counts within normal and range. This was significantly higher than in the onset HD group. This study thus showed similar results as found in the current study with regards to a higher risk for malnutrition during the early stages of HD.

Uremic toxicity, which is common in the early stages of HD, may cause symptoms such as anorexia, referred to in this study as a loss of appetite, nausea and vomiting (Quresh *et al.*, 1998:773). These symptoms may lead to a reduction in food intake in the early stages of HD that may increase the participants' risk for malnutrition. Successful dialysis will decrease the symptoms experienced due to uremia (Quresh *et al.*, 1998:773) and may help explain the improvement in the participants' nutritional status after 6 months of dialysis.

5.3.2 Appetite

A build-up of toxins in the body due to insufficient renal function, will cause a patient to experience many symptoms, including nausea and a loss of appetite as described by Quresh *et al.* (1998). If the patient's nutritional intake is poor, the likelihood of

weight loss will also increase. Poor nutritional intake will result in a patient's nutritional requirements not being met and the risk of malnutrition increases drastically.

Loss of appetite is a common phenomenon in patients receiving HD (Kalantar-Zadeh *et al*. 2004:209) and this is associated with poor nutritional outcomes (Zabel *et al.* (2009:343). More than half of this study's participants who were at risk of malnutrition (58.3%), reported some degree of loss of appetite (i.e. moderate or severe) and this association was statistically significant.

A significant association between appetite and nutritional status in patients receiving HD was also found by Kalantar-Zadeh *et al*. (2004:209). In their study a loss of appetite was associated with a decrease in hemoglobin levels (HB), protein intake and quality of life, as well as an increase in the markers of inflammation and erythropoietin dose.

5.3.3 Weight loss

A significant association was found between weight loss and the risk of malnutrition. The majority of participants at risk of malnutrition, reported a loss of weight during the previous 3 months. The loss of weight could be explained by a reduction in food intake due to the diminished appetite experienced in the participants at risk for malnutrition as seen above.

Unintentional weight loss can be independently predictive of clinical outcomes in patients on HD (Campbell & MacLaughlin, 2010:414). The risk of mortality in patients on HD was 3 times higher if they had a weight-loss of ≥5 kg over the past 6 months.

5.3.4 Psychological stress and/ or acute disease

Nine out of the ten participants who had experienced psychological stress or acute illness during the past 3 months were at risk of malnutrition in this study. Exposure

to stressful situations can be associated with tissue damage and disease (Bruce *et al.,* 2009:586-7) by increasing heart rate and blood pressure, a risk factor of CKD.

Overall, being diagnosed with CKD and having the responsibility of attending dialysis for four hours three times a week and adhering to treatment, is stressful. There are also financial implications of the dialysis, including cost of chronic medication, other medical expenses not covered by their medical aid, dietary adjustments, supplementation, transport, etc. Many participants are male and are likely to be the main provider of the family. Being on HD three times a week, for a long period of time, is a possible reason for the large number of participants being medically boarded or unemployed. The factors named above lead to changes in lifestyle which may also affect the rest of the household as well. Psychological stress is therefore an important factor to take into consideration when monitoring the nutritional status of a patient on HD.

Loneliness and a lack of support from family and friends have also been identified as a contributing factor to malnutrition amongst HD patients (Bovio *et al.,* 2013:52). The detail of the psychological stress or acute disease reported by the participants at risk of malnutrition in this study is not clear but a significant association exists between psychological stress, acute disease and the risk of malnutrition.

Research has not yet established the degree to which social support impacts the development and progression of CKD and this is a possible to area to examine in future studies (Bruce *et al*., 2009:583).

5.4 STUDY LIMITATIONS

Some deviations in the methodology from the original research protocol were necessary due to practical and logistical reasons. Finishing the questionnaire also took much longer than anticipated and only a small number of patients could be assessed on a given day. Transport between the dialysis units also posed a problem with regards to time spent traveling by the researcher.

5.5 SUMMARY

In conclusion, the high risk for malnutrition in the HD population questions the need for screening and early intervention.

Despite ongoing record keeping of the HD patient's laboratory results and anthropometrical information, there are still a high percentage of patients at risk for malnutrition. The risk of malnutrition was expected to be high as PEM in HD is well described in the literature. The present study also found the majority of participants to be black, male, and older than 50 years of age although these findings were not significant.

The result of the SF-MNA was as expected, with a significant association between appetite, weight loss and psychological stress or acute disease and the risk of malnutrition in participants receiving HD. Most participants at risk for malnutrition did not view themselves as having any nutritional problems, although this finding was not significant.

Careful bio-psycho-social evaluation in HD patients is crucial and Bovio *et al*. (2011:57) recommended that the nutritional status of the HD patient be reassessed every 3-6 months. This assessment should involve the evaluation of the dietary intake, anthropometry and laboratory examinations.

Adequate and renal specific supplementation may improve nutritional status amongst HD patients (Roy et al., 2013:39). Roy and colleagues studied 15 HD patients for 3 months in which these patients received a low cost nutrient supplement. Various nutrition parameters were evaluated and it was concluded that nutritional supplementation designed for patients on HD improved their nutritional status.

Many of the causes of malnutrition are not in the control of the treating physician, nursing staff or the dietitian. Every individual is different and even with the best treatment plan, compliance to this plan is the responsibility of the patient.

In order to succeed in preventing the development and/ or progression of CKD, healthcare professionals, the professional society, government, private organizations, and the pharmaceutical companies must cooperate and work together when treating patients with CKD (Alebiosa & Ayodele, 2005:422) and this is true for SA.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

The main objectives of this study were to investigate the socio-demographic characteristics of the population currently receiving HD in PE, as well as evaluating their risk of malnutrition using the SF-MNA tool.

Three dialysis units in PE were visited for this study. Socio-demographic- and anthropometrical data were obtained from sixty eight HD patients, using standardised methods and procedures as described in Chapter 3.

6.2 CONCLUSION

The following conclusions can be drawn from the study:

- The majority of participants were male (57.4%) although gender was not found to be significantly associated with malnutrition in HD patients.

- The largest percentage of participants, (63.2%) was older than 50 years and correlate with age-associated decline in GFR.

- Half of the participants were black (n=34).

- Just under a third (29.4%) of the participants was unemployed, while 26.5% were employed on a full time basis. Pensioners made up 32.4% of the study population and only 2 participants were students. Financial constraints may have an impact on food availability and the ability of the participant to follow a strict renal diet.

- The majority of participants have been on HD for more than a year with half (48.9%) having been on HD for 1 to 5 years and 26.5% being on HD for more than 5 years.

- The risk of malnutrition is significantly less when HD is received for a longer period of time. A larger percentage of participants that have received HD for 1<5 years are not at risk of malnutrition compared to 90.9% of participants that have just started on HD that are at risk of malnutrition.

- The SF-MNA revealed a significant association between the risk of malnutrition and a loss of appetite experienced in the past three months.

- Weight loss is a significant risk factor for malnutrition in HD patients.

- Psychological stress or acute illness has a significant impact on the risk of malnutrition with a greater percentage of at risk participants reporting stress or illness in the past three months.

6.3 RECOMMENDATIONS

Based on the findings of the current study, the majority of participants receiving HD are at risk of malnutrition. The following recommendations are made from this study's results:

- Managing BP and blood glucose levels with the correct treatment to slow progression of CKD.

- Early referral to a support group for family, friends and fellow patients with CKD to offer emotional support is recommended.

- Early referral to a dietitian for nutritional counseling is recommended. Especially when major risk factors of CKD is present, such as obesity, DM, HPT and CVD.

- Renal specific nutritional counseling should be initiated as soon as patients start to show a decline in GFR.

- Nutritional supplements, specific for renal failure patients should be included in the National Therapeutic Programme (NTP).

- Nutritional supplementation should become standard practice in HD patients, especially during the first 6 months of dialysis.

- Dialysis has a catabolic effect and it is recommended that all patients on HD receive an individualized eating plan as calculated by a dietitian to ensure adequate intake of micro- and macronutrients.

- Strict monitoring of the patient's nutritional status, especially during the first 6 months of dialysis.

- It is recommended that patients be referred to a dietitian for nutrition intervention if they are overweight (BMI>24.9 kg/m^2) or experiencing drastic weight changes.

- Constant communication between doctors, unit staff and renal dietitians may aid in identifying problems in patients earlier.

- A loss of appetite, weight loss and acute illness should be reported immediately and patients should be referred as soon as this is noted. Early supplementation or nutrition education might improve the nutritional status.

- Monitoring dietary intake every 3-6 months by using food frequency questionnaires and 24 hour recalls is recommended. This could be done by the renal nurse to help identify any nutritional issues.

- Psychological stress should be kept in mind as this has a significant impact on the nutritional status of HD patients. Psychosocial intervention should be initiated to offer support to the patient and their family. The patient's

compliance to a HD programme also improves when the patient receives support from healthcare professionals, family and the social environment.

- Nutrition supplementation should be started when the patient is ill. Energy and protein requirements increase during acute illness. Ensuring the correct nutrition during illness may decrease the recovery time needed and improve the nutritional status of the patient.

- Patient recall of the MNA variables could be over- or under reported. Therefore more studies are needed to investigate the increase for this risk of malnutrition amongst patients on HD, e.g. food availability using dietary intake forms and food frequency questionnaires, medication as well as laboratory tests for malnutrition indicators.

- The findings of this study should be brought under the attention of the unit managers and other stakeholders to help improve the nutritional status amongst patients receiving HD.

APPENDICES

APPENDIX A

Permission from UFS to conduct the study

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS-UV
HEALTH SCIENCES
GESONDHEIDSWETENSKAPPE

IRB nr 00006240
REC Reference nr 230408-011
IORG0005187
FWA00012784

16 September 2015

MS A BOTHA
DEPARTMENT OF NUTRITION AND DIETETICS
FACULTY OF HEALTH SCIENCES
UFS

Dear Ms A Botha

ECUFS NR 171/2015
MS A BOTHA
DEPARTMENT OF NUTRITION AND DIETETICS
PROJECT TITLE: ASSESSING RISK OF MALNUTRITION IN ADULT PATIENTS ON HEMODIALYSIS IN PORT ELIZABETH

1. You are hereby kindly informed that, at the meeting held on 15 September 2015, the Ethics Committee approved the above project after all conditions were met.
2. Any amendment, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.
3. A progress report should be submitted within one year of approval of long term studies and a final report at completion of both short term and long term studies.
4. Kindly use the ECUFS NR as reference in correspondence to the Ethics Committee Secretariat.
5. The Ethics Committee 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 Ethics Committee of the Faculty of Health Sciences.

Yours faithfully

.....
DR SM LE GRANGE
CHAIR: ETHICS COMMITTEE

Cc: Dr L Meko

Ethics Committee
Office of the Dean: Health Sciences
T: +27 (0)51 401 7795/7794 | 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 G40) | Bloemfontein 9300 | South Africa
www.ufs.ac.za

APPENDIX B

Letter to the unit managers requesting permission to conduct the study

Dear Sir/ Madam,

RE: Permission to perform a research study at the dialysis unit.

I am currently a student registered for Masters Degree in Nutrition in the Department of Nutrition and Dietetics at the University of the Free State. I am currently self-employed and have a practice at the Health Centre. As part of my degree, I am undertaking a research project titled **"Assessing malnutrition in adult patients on hemodialysis in Port Elizabeth."** I hereby apply for permission to undertake this study in this dialysis unit. The purpose of this study is to determine the prevalence of malnutrition in patients receiving HD.

The study will involve:
Identifying patients on HD
The study will be explained by me and consent forms will be handed out.
The questionnaire will be explained after which I will conduct the assessment.
Height and weight will be taken.
Possible nutritional intervention by the dietitian

There is no risk to the participant. All information will be anonymous. Participation is voluntary and no compensation is offered. Patients have the right to withdraw from the study at any time.

The study will be submitted for approval to an Evaluation Committee of the school of allied professionals and the ethics committee of the Faculty of Health Sciences at the University of the Free State (UFS).

The completion of the questionnaire will take approximately 10 minutes. All information will be kept strictly confidential and no information will be used for

purposes other than the research project. The results may be published but the patients will remain anonymous.

Appointments with the patients identified as malnourished will be made with the dietitian (the researcher) for individual assessments. Patients will receive counseling on the dietary management of CKD and will receive an individualized meal plan. Monthly or quarterly follow-ups will be scheduled as required.

Questions regarding the study may be directed to the researcher at +27 829378142 and the Secretariat of the Ethics Committee of the Faculty of Health Sciences, UFS, at +27 51 401 7795.

Sincerely,

Angelique Botha

APPENDIX C

CONSENT TO PARTICIPATE IN RESEARCH

I, the undersigned, _____ (name and surname) give consent that I may participate in the project carried out by a registered dietitian for a Masters study at the University of the Free State. The following was explained to me:

The aims of the study:
To determine the prevalence of malnutrition in adult patients receiving hemodialysis in Port Elizabeth.

My participation involves no risk or adverse events.
My participation involves answering a questionnaire.
All information will remain confidential.
The results will be made available to other researchers and might be published.

I have been fully informed by _____ about the study.
I hereby agree voluntarily that I can partake in this study and realize that my permission can be withdrawn at any time.

Signed at _____ on _____ 2015.

Participant's signature: ----------

Researcher signature: _____

Witness' signature: ----------

APPENDIX D

PARTICIPANT INFORMATION DOCUMENT

Study title: Assessing risk of malnutrition in adult patients on hemodialysis in Port Elizabeth.

Dear participant,

I, Angelique Botha, am currently enrolled in a Masters in Nutrition programme at the Department of Nutrition and Dietetics at the University of the Free State. I am doing research on assessing the risk for malnutrition in patients with chronic kidney disease receiving hemodialysis. The results of this study will help us to determine the prevalence of malnutrition in this population.

A descriptive study will be conducted from September 2015. Patients will be approached by me at the dialysis unit.

I am inviting you to participate in the research study. The procedures include being informed of the study by the researcher, the handing out and explanation of the informed consent form, answering of questions concerning the study to clarify any misunderstandings, the obtaining of written consent from patients and answering questions on the screening tool. The questionnaire will take approximately 10 minutes to complete. The forms are available in English, Afrikaans and Xhosa. Weight and height measurements will also be taken to determine the participant's nutritional status.

The study procedures involve no risk or harm to the participant. Participation is voluntary and patients can withdraw from the study at any time. No incentive is given for participation. All questionnaires will remain confidential. Nutrition intervention will be offered to patients identified as malnourished. The results will be shared with other researchers and might be published but the patients will remain

anonymous. Results will be shared with patients who wished to be informed of the results.

Appointments with the patients identified as malnourished will be made with the dietitian (the researcher) for individual assessments with the participant's approval. Patients will receive counseling on the dietary management of CKD and will receive an individualized meal plan. Monthly or quarterly follow-ups will be scheduled as required.

The researcher can be contacted at the following number +27 829378142 with questions regarding the study. Alternatively the Secretariat of the Ethics Committee of the Faculty of Health Sciences, Ms. Strauss, can be contacted on +27 514 4017795.

Yours sincerely,

_____

Angelique Botha

APPENDIX E				
Questionnaire				
Section A: Sociodemographics				
1. Unit:				1
2. Patient number:				2 - 4
3. Date:				5 - 12
4. Date of Birth:				13 - 20
5. First language:	1	English		21
	2	Afrikaans		
	3	Isixhosa		
	4	Other: (specify)		
6. Race:	1	Black		22
	2	Coloured		
	3	Indian/Asian		
	4	White		
	5	Other: (specify)		
7. Gender:	1	Male		23
	2	Female		
8 . Marital status:	1	Never married		24
	2	Married		
	3	Separated/divorced		
	4	Widowed		

9. Highest level of education:	1	None		25
	2	Primary school		
	3	High School		
	4	Tertiary education		
10. Employment status:	1	Unemployed		26
	2	Self employed		
	3	Part-time employement		
	4	Full time employed		
	5	Pensioner		
	6	Student		
11.Transport to dialysis unit:	1	Own transport		27
	2	Public transport		
	3	Unit's transport		
12. Suburb where patient resides:				28 - 29
13. HD duration:	1	0 - 6 months		30
	2	6 - 12 months		
	3	1 - 5 years		
	4	More than 5 years		
14. How many days per week does participant attend the dialysis unit?	1	Once per week		31
	2	Twice per week		
	3	Three times per		

			week		
15. Which shift does the participant attend?		1	7am - 11am		32
		2	11am - 3pm		
		3	3pm - 7pm		
		4	7pm - 2am		
16. Does the participant have any of these illnesses?		Yes	No		
A.	Type 1 Diabetes	1	2		33
B.	Type 2 Diabetes	1	2		34
C.	Cardiovascular disease	1	2		35
D.	Hypertension	1	2		36
SECTION B: SF-MNA					
17. Appetite status over the past three months:		0	Severe loss of appetite		37
		1	Moderate loss of appetite		
		2	No loss of appetite		
18. Weight loss during the past 3 - 6 months:		0	>3kg weight loss		38
		1	Don't know		
		2	1-3kg weight loss		
		3	No weight loss		
19. Mobility:		0	Bed or chair bound		39
		1	Able to get out of bed/chair but does		

		not go out		
	2	Able to go out		
20. Suffered psychological stress or acute disease:	0	Yes		40
	2	No		
21. Current body mass index (kg/m2)	0	< 17		41
	1	17 - 18.9		
	2	19 - 20.9		
	3	≥ 21		
22. Self-view of nutritional status	0	View self as being malnourished		42
	1	Uncertain of nutritional state		
	2	Views self as having no nutritional problem		
23. MNA score				43 - 44
SECTION C: ANTHROPOMETRY				
24A. Dry weight:				45 - 49
24B. Pre-dialysis weight:				50 - 54
24C. Post-dialysis weight:				55 -

								59
25. Height:								60-64
26. Dry weight 3 months ago:								65-69
27. Dry weight 6 months ago:								70 - 74

APPENDIX F				
Vraelys				
Afdeling A: Sosiale demografie				
1. Eenheid:				1
2. Patient nommer:				2 - 4
3. Datum:				5 - 12
4. Geboorte datum:				13 - 20
5. Huis taal:	1	English		21
	2	Afrikaans		
	3	Isixhosa		
	4	Ander: (spesifiseer)		
6. Ras:	1	Swart		22
	2	Gekleurd		
	3	Indier/Asiaat		
	4	Blanke		
	5	Ander: (spesifiseer)		
7. Geslag:	1	Manlik		23
	2	Vroulik		
8 . Huwelik status:	1	Nog nooit getroud		24

	2	Getroud		
	3	Geskei		
	4	Weduwee		
9. Hoogste vlak van onderrig:	1	Geen		25
	2	Primere skool		
	3	Hoerskool		
	4	Tersiere onderrig		
10. Werk:	1	Werkloos		26
	2	Self onderhou		
	3	Deeltydse werknemer		
	4	Voltydse werknemer		
	5	Pensioner		
	6	Student		
11. Vervoer na dialise eenheid:	1	Eie vervoer		27
	2	Publieke vervoer		
	3	Eenheid vervoer		
12. Waar bly u? (stedelike gebied):				28 - 29
13. HD duurte dusver:	1	0 - 6 maande		30
	2	6 - 12 maande		
	3	1 - 5 jaar		
	4	Meer as 5 jaar		

14.Hoeveel keer per week besoek ontvang u dialise?		1	Een keer per week		31
		2	Twee keer per week		
		3	Drie keer per week		
15.Watter HD skof woon u by?		1	7vm – 11vm		32
		2	11vm – 3nm		
		3	3nm – 7nm		
		4	7nm – 2vm		
16.Het u enige van die volgende kondisies?		Yes	No		
A.	Tipe 1 Diabetes	1	2		33
B.	Tipe 2 Diabetes	1	2		34
C.	Kardiovaskulere Siekte	1	2		35
D.	Hipertensie	1	2		36
AFDELING B: SF-MNA					
17. Hoe was u eetlus die afgelope 3 maande?		0	Geen eetlus		37
		1	Middelmatige verlies in eetlus		
		2	Geen verandering in eetlus		
18. Hoeveel gewig het u verloor die afgelope 3		0	>3kg gewigsverlies		38

maande?				
	1	Weet nie		
	2	1-3kg gewigsverlies		
	3	Geen gewigsverlies		
19. Hoe mobiel is u?	0	Bed of stoel gebonde		39
	1	Kan uit bed of stoel klim maar gaan nie uit nie		
	2	In staat om uit te gaan		
20. Het u enige sielkundige stres of akute siekte onlangs ervaar?	0	Ja		40
	2	Nee		
21. Wat is u huidige liggaamlike massa indeks (kg/m2)	0	< 17		41
	1	17 - 18.9		
	2	19 - 20.9		
	3	≥ 21		
22. Hoe beskou u u voedingstatus?	0	Sien myself as wangevoed		42
	1	Onseker oor my nutrisionele		

		status							
	2	Sien nie myself as wangevoed nie							
23. MNA telling									43 - 44
AFDELING C: ANTROPOMETRIE									
24A. Droe gewig:									45 - 49
24B. Pre-dialise gewig:									50 - 54
24C. Post-dialise gewig:									55 - 59
25. Lengte:									60-64
26. Droe gewig 3 maande gelede:									65-69
27. Doe gewig 6 maande gelede:									70 - 74

APPENDIX G				
isiXhosa questionnaire				
Section A: Sociodemographics				
1. Unit:				1
2. Inombolo ka mguli:				2 - 4
3. Usuko:				5 - 12
4. Usuku lo ku zalwa:				13 - 20
5. Intetho:	1	Singezi		21
	2	Afrikaans		
	3	Isixhosa		
	4	Enye: (qaqisa)		
6. Ubuhlanga:	1	Umnyama		22
	2	iColoured		
	3	Indian/Asian		
	4	Umlungu		
	5	Enye: (qaqisa)		
7. Isini:	1	Indoda		23
	2	Umfazi		
8 . Ubume ngomtshado:	1	Ongatshatanga		24
	2	Otshatileyo		
	3	Ohlukeneyo		
	4	Umhlolokazi		

9. Imfundo yakho:	1	Ayikgo		25
	2	Ibanga eli phantsi		
	3	Ibanga eli phezulu		
	4	Ikholeji/ Idyunivesiti		
10. Umsebenzi wakho:	1	Awusebenzi		26
	2	U ya zisebenza		
	3	U sebenza part-time		
	4	U ya sebenza		
	5	U ngu penshini		
	6	U ya funda		
11.Itranspoto yo ku ya esibhedlele:	1	E ya kho		27
	2	E ye public		
	3	E ye sibhedlele		
12. Umguli u hlala phi:				28 - 29
13. Ixesha kwi HD:	1	Iminyaka e 0 - 6		30
	2	Iminyaka e 6 - 12		
	3	1 - 5 years		
	4	More than 5 years		

14. Umguli u ya esibhedlele iintsuku ezingaphi?		1	Kanye nge weki		31
		2	Kabini nge weki		
		3	Kathatho nge weki		
15. Umguli u ya kwe yiphi ishift?		1	7am - 11am		32
		2	11am - 3pm		
		3	3pm - 7pm		
		4	6pm - 2am		
16. Umguli u na zo zizifo ezi?		Ewe	Xha		
A.	Type 1 Diabetes	1	2		33
B.	Type 2 Diabetes	1	2		34
C.	Zifo ze ntliziyo	1	2		35
D.	Hypertension	1	2		36
SECTION B: SF-MNA					
17. Ukutya okuthandayo kokunjani: Appetite status over the past three months:		0	Ilahleke kakhulu		37
		1	Ilahleke kancinci		
		2	Ayilahlekanga		
18. Ubunzima bo mzimba behle kangakanani:		0	Behle <3kg		38
		1	Andazi		
		2	Behle 1-3kg		
		3	Ayehlanga		

19. U ya kwazi u ku hamba:	0	Xha, u hleli kwi beti okanye eshlalweni		39
	1	U ya phuma kwi beti kodwa a ka phumi ngaphandle		
	2	U ya phuma ngaphandle		
20. Umguli une sifo so nqcondo okanye ezinye:	0	Ewe		40
	2	Xha		
21. I 'body mass index' (kg/m2) ya kwa ngoku:	0	< 17		41
	1	17 - 18.9		
	2	19 - 20.9		
	3	≥ 21		
22. Umguli ubona ka njani imeko zo mzimba ba khe:	0	U si bona e'malnourished'		42
	1	Akazi		
	2	U si bona engena nkinga yo mzimba		
23. MNA score				43 - 44

SECTION C: ANTHROPOMETRY								
24A. Ubunzima:								45 - 49
24B.Pre-dialysis weight:								50 - 54
24C.Post-dialysis weight:								55 - 59
25. Ubude:								60-64
26. Ubunzima kwi nyanga e si 3 e si dlulileyo								65-69
27. Ubunzima kwi nyanga e si 6 e si dlulileyo:								70 - 74

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