Physical activity and lifestyle aspects of female students at a Tertiary Institution

Ms. T'Neil Sarelle Losper

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Physical activity and Lifestyle aspects of Female Students at a Tertiary Institution

T'Neil Sarelle Losper
(2006035543)

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Supervisor: Dr. M.M. Opperman
Co-Supervisor: Dr. F.F. Coetzee
Co-Supervisor: Prof. H.J. Bloemhoff

Dedication

I would firstly like to thank my Heavenly Father for the talents He has given me and for guiding me this far in the path I walk with Him. I truly can do all things through Him who gives me the strength. (Philippians 4v13)

To my parents and brother for their unending support throughout my studies, I appreciate you and love you dearly.

To my study leaders for always being willing to help, guide and advise when needed. Thank you for the patience you have shown towards me.

Statement by Supervisor
I declare that the dissertation/thesis hereby handed in by T'Neil Losper for the
qualification M.A. Human Movement Science (Sport Science) at the University of
the Free State, has not previously been submitted as a whole or partially to the
examiners for the qualification at/in another University or Faculty.

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Dr. M.M. Opperman

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Dr. F.F. Coetzee

_____
Prof. H.J. Bloemhoff

Statement by Student

I declare that the dissertation/thesis hereby handed in for the qualification M.A. Human Movement Science (Sport Science) at the University of the Free State, is my own independent work and that I have not previously submitted the same work for the qualification at/in another University or Faculty.

Copyright Statement

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ABSTRACT

BACKGROUND AND RATIONALE:

It is generally believed that a sharp rise in chronic diseases and unhealthy living has occurred. Researchers believe that the modern lifestyle and a lack in physical activity (PA) are the main reasons for this problem (McGinnis, 1992:S196).

Chronic diseases and obesity are factors that can be prevented or reduced with physical activity and a healthy way of living. The way in which physical activity can have an indirect influence on conserving health can be explained in two ways: Firstly physical activity can be used as trigger mechanism to change other destructive lifestyle habits (Weinstein, 1987:8; Eddy & Beltz, 1989:168). Secondly, participation in PA can have an indirect effect on the reduction of coronary diseases because of its reducing effect on depression, anxiety and tension, to name a few (Willis & Campbell, 1992:47).

According to Bray and Born, (2004:181) there is an increasing need for physical activity among young adults. Young adults attending universities gain increased control over their lifestyles. However, they may not necessarily develop positive behaviors like regular PA. The lifestyle that students live is questionable. Whether their activity levels are adequate and whether they generally lead to healthy lifestyles is unknown as little research is available on this matter, especially in South Africa.

Keating, Guan, Pinero and Bridges (2005:116) stated that it is well known that students' PA as a research topic has been seriously neglected. Young adulthood is considered to be an important phase of life, as many lifelong health behaviour patterns are established during this phase (Timperio, Salmon & Ball, 2004:20).

OBJECTIVES:

The purpose of the study is twofold:

1. To identify PA levels of undergraduate female students indifferent ethnic groups on a South African university campus, and

2. To establish the lifestyle profile and body composition of female students in different ethnic groups in a South African university campus.

RESEARCH METHODS:

The sample constituted of female students at the University of the Free State in their 1st, 2nd and 3rd year+ of study residing on the campus. The sample consisted of 244 students (78 1st years, 98 2nd years, 68 3rd years+; 139 black, 21 coloured and 84 white students).

The following three research instruments were used:

- International Physical Activity Questionnaire (IPAQ) (2012)
- Belloc and Breslow's 7 lifestyle habits questionnaire
- The Heath and Carter anthropometrical assessment.

RESULTS AND DISCUSSION:

By comparing the 1st, 2nd and 3rd year groups it is evident that 40.16% of the group as a whole (all ethnic groups) did take part in some form of physical activity. Fifty five point one percent (55.13%) of 1st year female students, 42.86% of the 2nd year and 44.12% of the 3rd year female students participated in PA.

The White female students had the highest physical activity participation rate (67.86%), followed by the coloured students (38.10%). The black students' physical activity participation (35.97%) was the lowest.

An average of 4 out of the 7 lifestyle habits being followed by the majority of the participants. The majority of participants eat breakfast daily (51.64%) but they do not eat 3 meals per day. Eighty seven present (87.70%) of the sample are non-smokers, with 77.05% of the respondents consuming little to no alcohol, and at least 66.80% of the group maintains a healthy body weight. Unfortunately their eating, sleeping and exercise habits are not optimal.

It is evident that the lifestyle habits of the students decrease from the 1st to the 2nd year, but that by the time they progress to the 3rd year+, they start trying to change their lifestyles habits to a certain extent. The ethnic groups do not show a significant difference among their lifestyle habits but white female students do have a more positive profile.

OPSOMMING

AGTERGROND EN RASIONAAL:

Dit is algemeen bekend dat 'n skerp styging in chroniese siektes en ongesonde lewensomstandighede plaasgevind het. Navorsers glo dat die moderne leefstyl en 'n gebrek aan fisieke aktiwiteit (FA) die vernaamste redes vir hierdie probleem is (McGinnis, 1992:S196).

Chroniese siektes en vetsug is faktore wat kan verminder of voorkom word met fisieke aktiwiteit en 'n gesonde leefwyse. Die wyse waarop die fisieke aktiwiteit 'n indirekte invloed op die behoud van gesondheid kan uitoefen kan op twee maniere verduidelik word: fisieke aktiwiteit kan eerstens as sneller meganisme vir destruktiewe afbrekende lewenstyl gewoontes gebruik word (Weinstein, 1987:8; Eddy & Beltz, 1989:168). Tweedens, kan deelname aan FA 'n indirekte invloed uitoefen op die vermindering van koronêre siektes wat op sy beurt vermindering van depressie, angs en spanning, om 'n paar tot gevolg het, te noem (Willis & Campbell, 1992:47).

Volgens Bray en Born (2004:181) is daar 'n toenemende behoefte aan fisieke aktiwiteit onder jong volwassenes. Jong studente verbonde aan universiteite het beheer oor hul lewenstyl. Nogtans is dit nie noodwendig dat hulle die ontwikkeling van positiewe gedrag soos gereelde FA sal ontwikkel nie. Die lewenstyl van studente word bevraagteken. Vanweë min navorsing beskikbaar veral is dit nie moontlik om te bepaal of studente se aktiwiteitsvlakke voldoende is om 'n gesonde lewenstyl te bewerkstellig nie.

Keating et al., (2005:116) is van mening dat dit algemeen bekend is dat studente se FA as 'n navorsingsonderwerp ernstig verwaarloos is. Die jong volwassestadium word beskou as 'n belangrike fase van lewe, aangesien lewenslange gesondheidsgedragspatrone reeds tydens hierdie fase gevestig word (Timperio et al., 2004:20).

DOELWITTE:

Die doel van die studie is tweeledig:

1. Om die FA vlakke van voorgraadse vroulike studente in die verskillende etniese groepe aan 'n Suid-Afrikaanse universiteitskampus te bepaal, en

2. Om die leefstyl profiel en liggaamsamestelling van die vroulike studente in die verskillende etniese groepe aan 'n Suid-Afrikaanse universiteitskampus te bepaal.

NAVORSINGSMETODES: Die steekproef is saamgestel uit vroulike studente aan die Universiteit van die Vrystaat in hul 1, 2 en 3 jaar + van studie wat op die kampus woonagtig was. Die steekproef het verder bestaan uit 244 studente (78 1ste jaar, 98 2de jaar, 68 3de jaar +, 139 swart, 21 bruin en 84 wit studente). Die volgende drie navorsing instrumente is gebruik:

• Die Internasionale Fisieke Aktiwiteitsvraelys (IPAQ) (2012);

• Belloc en Breslow se 7 lewenstyl vraelys;

• Die Heath en Carter antropometriese assessering.

RESULTATE EN BESPREKING:

Deur die vergelyking van die 1, 2 en 3 jaar groepe is dit duidelik dat 40,16% van die groep as 'n geheel (alle etniese groepe) wel aan FA deelgeneem het. Vyf en vyftig punt een persent (55,13%) van eerste of 1ste jaar vroulike studente, 42,86% van die 2de jaar en 44,12% van die 3de jaar vroulike studente het onderskeidelik aan FA deelgeneem.

Die wit vroulike studente het die hoogste fisieke aktiwiteit deelname getoon (67,86%), gevolg deur die bruin studente (38,10%). Die swart studente se fisieke aktiwiteit deelname (35,97%) was die laagste.

'n Gemiddeld van 4 uit die 7 lewenstyl gewoonte is deur die meerderheid van die deelnemers gevolg. Die meerderheid van die deelnemers eet ontbyt daagliks (51,64%), maar hulle eet nie 3 maaltye per dag nie. Sewe en tagtig persent van die (87,70%) steekproef is nie-rokers, terwyl 77,05% min of tot geen alkohol

gebruik nie, en ten minste 66,80% van die groep 'n gesonde liggaamsgewig handhaaf. Ongelukkig was hulle eet, slaap en oefen gewoontes nie optimaal nie.

Dit is duidelik dat die lewenstyl van die studente afneem van die 1ste tot die 2de jaar, maar teen die tyd dat hulle vorder na die 3de jaar +, het hulle begin om hul lewenstyl gewoontes tot 'n sekere mate te verander. Die etniese groepe toon geen beduidende verskil in lewenstyl gewoontes nie , maar wit vroulike studente het 'n meer positiewe profiel.

SLEUTELWOORDE: Fisieke aktiwiteit, lewenstyl, liggaamsamestelling, vroulike studente.

TABLE OF CONTENTS

List of Tables

Chapter 2

Chapter 3

Chapter 4

List of Figures

Chapter 1

Chapter 2

Chapter 4

List of Appendices

List of Abbreviations

ACSM – American College of Sports Medicine

WHO – World Health Organization

NICUS – Nutrition Information Centre University of Stellenbosch

PA – Physical Activity

IPAQ – International Physical Activity Questionnaire

FA – Fisieke Aktiwiteit

BMI – Body Mass Index

LBM – Lean Body Mass

WHR – Waist to Hip Ratio

PAL – Physical Activity Level

PAR – Physical Activity Ration

BMR – Basal Metabolic Rate

GLTEQ – Godin's Leisure Time Exercise Questionnaire

USDHHS – U.S. Department of Health and Human Services

CDC – Centre for Disease Control

CVD – Cardiovascular Disease

CHD – Coronary Heart Disease

TG – Triglycerides

LDL – Low-density Lipoprotein

NASPE – National Association for Sport And Physical Education

AHA – American Heat Association

HSFSA – The Heart and Stroke Foundation of South Africa

CHAPTER ONE:

PROBLEM STATEMENT AND OBJECTIVES

1.1 Introduction

There is an extensive body of empirical evidence, which demonstrates the physical and psychological health benefits of physical activity (PA) (Craike, Hibbins, & Cuskelly, 2010:20). These prophylactic benefits have been extolled throughout Western history (Cheng, Macera, Davis & Blair, 2000:116).

Young adults attending universities gain increased control over their lifestyles. However, they may not necessarily develop positive behaviours like regular PA (Bray & Born, 2004:181). The Business Dictionary (2011) defines lifestyle as a way of living of individuals, families (households), and societies, which they manifest in coping with their physical, psychological, social, and economic environments on a day-to-day basis. A healthy lifestyle includes being physically active, maintaining good eating habits, getting enough sleep, drinking little or no alcohol, not smoking and maintaining a healthy body weight. These factors are very important in the maintenance of one's health

(Belloc & Breslow, 1972:414). It is also well known and documented that secular modernisation has enhanced sedentary lifestyles (Rode & Shephard, 1994:516; Spence & Lee, 2002:7). A Sedentary lifestyle, being overweight and obese is major health, clinical, and economical challenges in modern societies.

The worldwide epidemic of excess body weight is due to imbalance between PA and dietary intake (Görner, Boraczyński, Rusiecki, & Štihec, 2009:7). The World Health Organization (2000) reports that about 60% of the global population do not adhere to the daily minimum recommendation of 30 minutes of moderate intensity PA. Insufficient PA in turn increases the risk of cardiovascular disease (CVD) (atherosclerosis, arterial hypertension, coronary heart disease (CHD), congestive heart failure, cerebral stroke), high content of triglycerides (TG) and low-density lipoproteins in the blood (LDL), obesity, post-meal postprandial hyperinsulinaemia and carbohydrate intolerance, type-two diabetes mellitus, osteoporosis, malignantneoplasms, depression, and others (Eriksson, 1986:982; Kohl, Gordon, Villegas & Blair, 1992:184; Kampert, Blair, Barlow, & Kohl, 1996:452; Wei, Kampart, Barlow, Nichaman, Gibbons, Paffenbarger & Blair, 1999:1547).

1.2 Problem Statement / Purpose of the Study

According to Miller, Stafen, Rayens and Noland (2005: 215), predictions of PA are often done according to gender and race. Studies of the PA levels of the different race groups indicate inconsistent results (Keating et al., 2005:116). McVeigh, Norris and de Wet (2004:982) found that there were significant racial differences with regard to patterns of activity in schools in South Africa. White children were found to be more active than black children, more likely to participate in physical education classes at schools and watched less television than black children (Timperio et al., 2004:20). This has serious consequences: young adulthood is considered to be an important phase of life, as many lifelong health behaviour patterns are established during this phase (Timperio et al., 2004:20). Suminiski, Petosa, Utter and Zhang (2002:75) found that Asian and African American students were the least active group compared with white and Hispanic students in the USA.

However, Dunn and Wang (2003:126) found no significant race differences in PA status in students.

Regular PA plays a very important role in health maintenance and in the prevention of chronic diseases. Numerous advantageous adaptive responses take place with regular physical exercises. These adaptations result in a more efficient system for oxygen transport to muscle and improvement of lipid utilization. In addition, the reduction of adipose tissue mass improves mechanical efficiency of human motion. Endurance training leads to improvement of the cardiorespiratory fitness and results in beneficial metabolic effects (improvement of the metabolic profile) (Bouchard 1990:147, 1994:77,National Institutes of Health 1996:241,Dunn, Garcia, Marcus, Kampert, Kohl & Blair, 1998:1076).

Many factors have been associated with obesity and weight gain. Factors like lower consumption of vegetables and fruit and skipping breakfast have been associated with a higher body mass index (BMI) (Lin & Morrison, 2002:28; Cho, Dietrich, Brown, Clark & Block, 2003:296; Tohill, Seymour, Serdula, Kettel-Khan & Rolls, 2004:365). A low level of physical activity (PA) combined with sedentary behaviors (e.g., watching television, sitting, and computing) have also been associated with weight gain and obesity (Hu, Li, Colditz, Willett, & Manson, 2003:1785; Meyer, Evenson, Couper, Stevens, Pereria, & Heiss, 2008:68). Other lifestyle factors known to influence body weight include short sleep duration (Chaput, Leblanc, Perusse, Despres, Bouchard & Tremblay, 2008, 2009:517), eating behaviors (dieting, restriction, disinhibition susceptibility) (Provencher, Drapeau, Tremblay, Despres, Bouchard & Lemieux, 2004:997), gender, socio-economic status, and education level (Ree, Riediger & Moghadasian, 2008:1255).

Limited information is available with regard to ethnic differences among South African students, more so literature is available on working class females that can be easier compared to female students than comparing children or adolescents to students.

1.3 Aims and Objectives

The purpose of the study is twofold, namely:

1. To identify PA levels of undergraduate female students in different ethnic groups at a South African university campus, and

2. To establish the lifestyle profile and body composition of female students in different ethnic groups at a South African university campus.

1.4 Necessity of the study

It is well known that students' PA as a research topic has been seriously neglected (Keating *et al.,* 2005:116). There is a need for a more precise understanding of the amount (and pattern) of PA levels (Haaströmer, Oja & Sjöström, 2006:755). Studies reported conflicting findings on the impact of gender on PA (Keating *et al.,* 2005: 116). Both PA and physical fitness are now accepted as independent risk factors for several chronic diseases. The identification of low level of PA and physical fitness necessitate strategies (Görner *et al.,* 2009:7), which can change the PA levels and lifestyle habits of female students.

1.5 Structure of the dissertation

CHAPTER 1: Introduction: Problem statement & objectives

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CHAPTER 2: Literature review: Physical activity and lifestyle

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CHAPTER 3: Research methods and procedures

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CHAPTER 4: Results, interpretation and discussion

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CHAPTER 5: Summary, conclusions and recommendations for future research

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REFERENCES

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APPENDICES: Relevant forms and data sheets used during the research study

FIGURE 1.1 Structure of dissertation

CHAPTER TWO: PHYSICAL ACTIVITY AND LIFESTYLE

2.1 Introduction

In this ever-changing and modernized world it is known that staying healthy is essential. A healthy lifestyle includes being physically active, maintaining good eating habits, getting enough sleep, drinking little to no alcohol, not smoking, and maintaining a healthy body weight. These factors are very important in the maintenance of one's health (Belloc & Breslow, 1972:409). It is generally stated that a sharp rise in chronic diseases and unhealthy living has occurred, and our modern lifestyle and therefore a lack in physical activity is being blamed as the main reason by researchers for this problem (McGinnis, 1992:S196). The health benefits of leisure-time physical activity are widely recognized, as inactivity is associated with increased risk of coronary heart disease, various cancers, obesity, and other health problems (USDHHS, 1996; Vainio & Bianchini, 2002).

Chronic diseases and obesity are factors that can be prevented or reduced with physical activity (referred to hereafter as PA), and a healthy way of living. Silliman, Rodas-Fortier and Neyman (2004:10) suggested that most college students may not achieve the nutrition and exercise guidelines designed to reduce the risk of chronic disease. The way in which PA can have an indirect influence on conserving health can be explained in two ways: Firstly PA can be used as a trigger mechanism to change other destructive lifestyle habits (Weinstein, 1987:8; Eddy & Beltz, 1989:168). Secondly, participation in PA can have an indirect effect on the reduction of coronary diseases because of its reducing effect on depression, anxiety and tension (Willis & Campbell, 1992:47).

According to Bray and Born, (2004:181) there is an increasing need for physical activity among young adults. Young adults attending universities gain increased control over their lifestyles. However, they may not necessarily develop positive behaviors like regular PA. The lifestyle that students live is questionable (Bray & Born, 2004:181). Little if any research exists with regard to the PA levels of students as well as their lifestyle habits on South African campuses.

Very little can be found to state whether PA levels, body composition, lifestyle habits and health status are indeed in a problematic state or not in South African tertiary institutions. There is indeed a need for research to determine whether students lead a healthy lifestyle.

College students are at a time and place in their lives where their behaviour is conducive to change.

In this chapter an in depth literature review will be done on the concepts of physical activity and lifestyle as it relates to females and in particular female students.

2.2 Health

Health, is defined by Nieman (1998:4), as a state of total physical, intellectual, social and spiritual wellbeing and not only the absence of disease. According to the Wikipedia (2011) health is the level of functional and/or metabolic efficiency of a living being. In humans, it is the general condition of a person in mind, body and spirit, usually meaning to be free from illness, injury or pain (as in "*good health*" or "*healthy*"). The World Health Organization (WHO, 2006) defined health in its broader sense in 1946 as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". Although this definition has been subject to controversy, in particular as lacking operational value and because of the problem created by use of the word "complete", it remains the most enduring (Callahan, 1973). In addition to health care interventions and a person's surroundings, a number of other factors are known to influence the health status of individuals, including their background, lifestyle, and economic and social conditions; these are referred to as "determinants of health." The maintenance and promotion of health is achieved through different combinations of physical, mental, and social well being, together sometimes referred to as the *"health triangle"*. The WHO's 1986 *Ottawa Charter for Health Promotion* furthered that health is not just a state, but also "a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities" (http://en.wikipedia.org/wiki/Health, 2012)

Health is an expression of each individual's functioning as an integrated whole – a totality of body, mind and spirit that includes coping and problem solving skills, a rationale between self-care and health service use, accomplishment at home and at work, successful social interactions, and a positive attitude and outlook (Cmich, 1984:31).

Rickert, (2010) suggests that to help with the definition of health, it can be divided into 6 aspects, namely:

> 1. *Physical.* Physical health refers to the way that the body functions. This includes correct eating, regular exercise, and recommended body

weight. Physical health is also avoiding drugs and alcohol and being free from disease and sickness.

2. *Social.* Social health is the quality of relationships with friends, family, teachers and others.

3. *Environmental.* Environmental health is keeping air and water clean, food safe, and the environment enjoyable and safe.

4. *Emotional.* Emotional health is expressing emotions in a positive, non-destructive manner.

5. *Spiritual.* Spiritual health is maintaining harmonious relationships with other living things and spiritual direction and purpose. This includes living according to one's ethics, morals and values.

6. *Intellectual/Mental.* Mental health is the ability to recognize reality and cope with the daily demands of life.

The World Health Organization (2011) states that the main determinants of health include the social and economic environment, the physical environment, and the person's individual characteristics and behaviors. They identify more specifically key factors that have been found to influence whether people are healthy or unhealthy. These include:

➤ Income and social status;
➤ Social support networks;
➤ Education and literacy;
➤ Employment/working conditions;
➤ Social environments;
➤ Physical environments;
➤ Personal health practices and coping skills;
➤ Healthy child development;
➤ Biology and genetics;
➤ Health care services;
➤ Gender;
➤ Culture;

These factors will only be named and not discussed to stay in the context of the study being done.

Fletcher, Breyden, Schneider, Dawson and Vandermeer (2007:482) found that limited evidence exists concerning the health of young adults. Wallace and Buckworth (2003:209) also reported that few studies have assessed the prevalence of exercise behavior and factors influencing exercise adoption and maintenance among university and college students.

Health-related behaviour in early life influences later risks for lifestyle-related disorders (Von Bothmer & Fridlund, 2005:118). It is therefore important to investigate health behaviors among young people. University students represent a major segment of the young adult population (Leslie, Owen, Salmon, Bauman, Sallis and LO. 1999). It makes sense to focus on them in a study of associations between health, motivation for a healthy lifestyle and different health habits in order to improve health promotion activities targeting this group.

Research shows that educating young adults about self-management of health maintenance and illness could be beneficial from the standpoint of altering unhealthy behavior at a younger age and subsequently reducing accrued risks of disease and developing behavioral techniques that will be applicable to all stages of life along the age continuum (Johnson-Saylor, 1980:9; Lipnickey, 1986:9; Fletcher *et al.*, 2007:482). Campuses of higher education institutions are settings where there are important, yet partially neglected opportunities to influence the health and physical activity habits of young adults (Leslie *et al.*, 2001:116). Therefore, Fletcher *et al.*, (2007:482) concludes that these institutions (i.e., universities and colleges) provide the ideal venue for health information and education intervention in an effort to reduce health-risk behaviors and provide opportunities to assist students in coping with their health and lifestyle issues.

2.3 Physical activity

Physical activity is a complex behavior that involves all daily activities resulting from muscle contraction, which implies energy expenditure (Cooper, 2003:83). The American College of Sports Medicine (2010:2) referred to hereafter as ACSM, defines PA as any bodily movement produced by the contraction of skeletal muscles that result in a substantial increase over resting energy expenditure. Physical inactivity on the other hand is defined as a state of minimal bodily movement where the energy consumption is equal to the basal energy levels (Miles, 2007:318). Although PA and movement of all types only account for 25% of energy expenditure in a typical day of a sedentary person (Bouchard, Blair & Haskel, 2007:3), regular PA is associated with various health benefits (Oguma & Shinoda-Tagawa, 2004:407).

Physical activity can have a positive influence on one's health and according to Robbins, Powers and Burgess (1991:41) PA consists of 5 health related components, namely:

- ➢ Cardiorespiratory endurance;
- ➢ Muscle strength;
- ➢ Muscular endurance;
- ➢ Flexibility; and
- ➢ Body composition;

Exercise is a type of PA consisting of planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness. Physical fitness again is defined as a set of attributes or characteristics that people have or achieve that relates to the ability to perform PA (ACSM, 2010:3).

Nieman (1998:4) indicates that physical fitness is the ability of the body to function optimally. Kohler (2005:38) on the other hand is of the opinion that physical fitness comprises more than just the ability to manage the daily physical demands on the body. Kohler (2005:38) rather sees it as an elevated state of functioning of the interactive physiological bodily systems;

11

the extent to which the heart, blood vessels, lungs and muscles can manage periods of higher physical exhaustion.

Andersen, (2004:323) remarked that the concept PA and physical fitness are often intertwined because of their close relationship. Physical activity and physical fitness are not used interchangeably because these are two separate factors, but PA can help determine the individuals' physical fitness. Andersen, (2004:323) also mentioned that physical fitness comprises two related concepts, namely; general fitness (a state of health and well-being), and specific fitness (a task-oriented definition based on the ability to perform specific aspects of sports or occupations). Physical fitness is generally achieved through correct nutrition, exercise, and enough rest.

Satcher, Lee, Joyner and McMillen (1999) and Bouchard *et al.* (2007:19) also states that physical fitness has further been defined as a set of attributes or characteristics that people have that relates to the ability to perform PA, (The above definition is from Physical Activity and Health: A Report of the Surgeon General), is the most common currently used definition of physical fitness. It was originally used by Caspersen, Powell and Christenson (1985:126) and has since been used extensively. However, Howley and Frank (1986) define physical fitness as a state of wellbeing with low risk of premature health problems and energy to participate in a variety of physical activities. While either is a good definition, most experts agree that physical fitness is both multidimensional and hierarchical. (http://en.wikipedia.org/wiki/Physical_fitness, 2012).

According to Brandon and Loftin (1991:564), physical fitness can influence stress in 3 ways, which can explain why exercise has a positive effect on health and quality of life, and they are as follows:

- It rids the body of stress related by-products like high levels of circulatory fat;

12

- It reduces the body's reaction to stress because of more relaxed muscles that is caused by physical activity, as well as change cognitive states like depression; and
- It strengthens internal organ systems, which are known to be most vulnerable because of the chronic effect of chronic stress.

The importance of PA in preventing a number of chronic diseases is highlighted in the 1996 Surgeon General's report on PA and health (General U.S. 1996:522). Among the numerous health benefits associated with physical activity also included are reduced mortality rates for both older and younger adults, a decreased risk of cardiovascular disease mortality in general and coronary heart disease in particular, a decreased risk of colon cancer and lower risk of developing non-insulin-dependent diabetes mellitus, hypertension, and improved control of the joint swelling and pain associated with arthritis, (General U.S. 1996:522; Satcher, *et al.*, 1999).

Unfortunately, many adults do not reach optimal levels of physical activity and are at risk for poor health outcomes. Older adults in particular are less likely than younger adults to be regularly active, which is unfortunate because older adults who lead sedentary lives report more physical limitations than their active peers (General U.S. 1996:522).

According to the WHO (2011), physical inactivity is the fourth leading risk factor for the development of global mortality. Increasing levels of physical inactivity are seen worldwide, in high-income countries as well as low- and middle-income countries. It is also well known and documented that secular modernisation has enhanced sedentary lifestyles (Rode & Shephard, 1994:516; Spence & Lee, 2002:7). Sharkey and Gaskill (2007:389) is of the opinion that physical inactivity is responsible for between 250 000 and 365 000 deaths per year and also adds that physical inactivity is an important contributing factor towards heart disease, diabetes mellitus, osteoporosis and certain forms of cancer. Windale (2011) mentioned that The World Health Organization has conducted a study on working class adults to determine the

prevalence of cardiovascular diseases in a cluster of countries including USA, Japan, Australia, Canada, New Zealand, European countries, India, certain African countries, other Asian countries and countries in the middle east, and they found that in these countries 8.2 million people suffered from coronary heart diseases.

Evidence to support the inverse relationship between physical activity and cardiovascular disease, hypertension, stroke, osteoporosis, type 2 diabetes, obesity, colon cancer, breast cancer, anxiety, and depression continues to accumulate (ACSM, 2010:8). Quality of life is directly related to functional status and the ability to maintain independence, and it appears that physical activity improves health-related quality of life by enhancing psychological well-being and improving physical functioning in persons with poor health (General U.S. 1996:522).

It is interesting to note the difference between males and females regarding PA participation at any level, hence the brief discussion that follows.

According to Adams and Rini (2007:106) an analysis of the IPAQ-data of the "World Health Survey" indicates that 42% of South African men and 50% of all South African women are currently physical inactive. The report stated that only 36% men and 24% women are physically active enough to bring about health benefits. The percentages indicate that women could possibly be identified as a risk group for low levels of PA. A 15 year-longitudinal study launched in South Africa confirms that women participate less in PA than men (Joubert, Norman, Lambert, Groenewald, Schneider, Buli & Bradshaw 2007:726). Steyn, Levitt, Hoffman, Marais, Fourie and Lambert (2004:237) support this assumption with their research findings namely that women from 15 years of age are physically less active than men of the same age. These statistics are of concern seeing that PA is not only associated with a reduced risk for the development of chronic diseases (Joubert et al., 2007:725), but also with increased productivity and reduced absenteeism (Sharkey & Gaskill, 2007:322). The PA participation profile normally differs during the lifespan and is usually associated with various stages in life (Popham & Mitchell,

2006:270). This is also related to the different roles for women regarding marriage, motherhood and career challenges (Scharff, Homan, Dreuter & Brennan, 1999:115; Nomaguchi & Bianchi, 2004:413). Culture, ethnic grouping and religion (Juarbe, Lipson & Turok, 2003:108), as well as transitional changes occurring in South Africa over the last decade may contribute to the changing profiles of women regarding physical activity participation (Kruger, Venter & Vorster, 2003:16).

Barriers that can prevent individuals from participating in any form of PA should be noted, especially for university students that are still adapting to the demands of student life. According to research done by Bloemhoff and Coetzee (2007:149) there are three dominant barriers for student participation in physical activities. They are in sequence of perceived importance: study responsibilities, a lack of time to participate and a lack of motivation to participate. Bloemhoff (2010:31) suggests that the prevalence of physical inactivity on campuses calls for strategic intervention by relevant professionals in higher education institutions. The latter author states that the epidemic of physical inactivity and resultant chronic diseases has become global. Students will not change their physical activity behaviour at the request of others. Strategies based on sound research must be developed to improve the health status of students, the future leaders of South Africa (Bloemhoff, 2010:31).

It has been suggested that PA habits during the senior year of college were one of the strongest predictors of PA levels in the years following graduation (Sparling & Snow, 2002:200). Therefore, the period in higher education has been identified as a critical juncture to halt declining PA involvement and increasing Body Mass Index (BMI) (Keating et al., 2005:116; McArthur & Readeke, 2009:80; American College Health Association [ACHA], 2010). According to Deng, Castelli, Castro-Pinero and Guan (2011:20) further study is warranted on how PA guidelines/standards/recommendations for this age group have impacted the regularity of student PA engagement. When health concerns are public, policies/recommendations have been utilized as a means

for changing individuals' behavior, by bringing them closer to the desired norms (i.e., being physically active for at least 150 minutes each week). They further state that for these reasons, it is important to monitor the overall PA and BMI and their changes within this population and implement effective interventions to ensure that university students have developed a healthy lifestyle by the time they graduate (Deng *et al.*, 2011:20).

Physical activity is known to be an important part of a healthy lifestyle and should be treated as such. According to the U.S. Department of Health and Human Services (2011) PA need not be strenuous to achieve health benefits. Men and women of all ages benefit from a moderate amount of daily physical activity. Health benefits can be achieved with a moderate amount of longer sessions of moderately intense activities (such as 30 minutes of walking) as in shorter sessions of more strenuous activities (such as 15-20 minutes of jogging). According to Robbins *et al.* (1991:41) humans are created for physical activity, but the sedentary lifestyle that most careers have and demand, does not allow enough PA.

There is an extensive body of empirical evidence, which demonstrates the physical and psychological health benefits of physical activity (Craike *et al.*, 2010:20). These prophylactic benefits have been extolled throughout Western history (Cheng *et al.*, 2000:116). As previously stated, young adults attending universities gain increased control over their lifestyles. However, they may not necessarily develop positive behaviours like regular physical activity (Bray & Born, 2004:184).

The U.S. Department of Health and Human Services (2011) points out certain benefits that physical activity can have:
  ➤ Reduces the risk of dying from a coronary heart disease and of developing high blood pressure, colon cancer and diabetes:
  ➤ Can help reduce blood pressure in some people with hypertension;
  ➤ Helps maintain healthy bones, muscles and joints;
  ➤ Reduces symptoms of anxiety and depression and fosters improvements in mood and feelings of well-being; and

> Helps control weight, develop lean muscle and reduce body fat.

According to the Mayoclinic (2011), PA has certain benefits that can improve quality of life considerably. They are:
> Improves mood;
> Combats chronic diseases;
> Helps to manage weight;
> Boosts energy levels;
> Promotes better sleeping;
> Improves sex life; and
> Could be fun.

These are just a few of the benefits that PA can hold. It should be noted that there are many more benefits ranging from health related to social oriented benefits.

However, given a supportive environment, increasing levels of PA bring health benefits across all age groups. The WHO (2011) provides recommendations for optimal amounts of activity, but doing a little physical activity is better than doing none. All sectors and all levels within governments, international partners, civil society, non-governmental organizations and the private sector have vital roles to play in shaping healthy environments and contributing to the promotion of PA (WHO, 2011). The guidelines and recommendations provided by the WHO (2011) regarding PA are listed below:

1. Five -17 years old
People aged 5 -17 years should accumulate at least 60 minutes of moderate to vigorous physical activity daily. Amounts of physical activity greater than 60 minutes provide additional health benefits.

2. Eighteen - 64 years old
Adults aged 18–64 years should do at least 150 minutes of moderately

intense physical activity throughout the week or at least 75 minutes of vigorous- activity throughout the week or an equivalent combination of moderate- and vigorous activity. All activity should be performed in bouts of at least 10 minutes duration.

3. Adults aged 65 and above

The main recommendations for adults and older adults are the same. In addition, older adults with poor mobility should do physical activity to enhance balance and prevent falls three or more days per week. When older adults cannot do the recommended amount of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow.

4. Doing some physical activity is better than doing none

Inactive people should start with small amounts of physical activity and gradually increase duration, frequency and intensity over time. Inactive adults, older adults and those with disease limitations will have added health benefits when they become more active.

Pregnant, postpartum women and persons with cardiac events may need to take extra precautions and seek medical advice before striving to achieve the recommended levels of physical activity.

5. Supportive environments and communities may help people to be more physically active

Urban and environmental policies can have huge potential to increase the physical activity levels in the population. Examples of these policies include: ensuring that walking, cycling and other forms of active transportation are accessible and safe for all; or that schools have safe spaces and facilities for students to spend their free time actively.

Unless specific medical conditions indicate the contrary, these recommendations apply to all people, irrespective of gender, race, ethnicity or income level. They also apply to individuals with chronic non-communicable

conditions, not related to mobility, such as hypertension or diabetes. These recommendations can be valid for adults with disabilities as well, (WHO; 2011).

The WHO (2011), also included some relevant information that all individuals should know regarding PA, these statements are listed below:

1. Physical inactivity is the fourth leading risk factor for global mortality
Globally, six percent of deaths are attributed to physical inactivity. This follows high blood pressure (13%), tobacco use (9%) and is equal to high blood glucose (6%).

Moreover, physical inactivity is the main cause for approximately 21–25% of breast and colon cancers, 27% of diabetes and 30% of ischaemic heart disease burden.

2. Regular physical activity helps to maintain a healthy body
Physically active persons:

- Have lower rates of coronary heart disease, high blood pressure, stroke, diabetes, colon and breast cancer, and depression;
- Have a lower risk of falling and of hip or vertebral fractures; and
- Are more likely to maintain their weight.

3. Physical activity should not be mistaken for sport
Physical activity is any bodily movement produced by the skeletal muscles that uses energy. This includes sports, exercise and other activities such as playing, walking, doing household chores, gardening, and dancing.

4. Both moderate and vigorous intensity physical activity bring health benefits
Intensity refers to the rate at which the activity is being performed. It can be thought of as *"how hard a person works to do the activity"*.

The intensity of different forms of physical activity varies between people.

Depending on an individual's relative level of fitness, examples of moderate physical activity could include: brisk walking, dancing or household chores. Examples of vigorous physical activity could be: running, fast cycling, fast swimming or moving heavy loads (WHO, 2011).

There are various methods available that can be used to measure an individual's physical activity level. (Note that these methods are only mentioned in this chapter and will be discussed later as part of the methodology of research.)

For example Sharkey's Physical Activity Index; Physical Activity Ration (PAR) X Basal Metabolic Rate (BMR); Physical Activity level (PAL) = Total Energy Expenditure / Basal Metabolic Rate (BMR); Godin's Leisure Time Exercise Questionnaire (GLTEQ) and the International Physical Activity Questionnaire (IPAQ) (2012) to name a few.

For the purpose of this study the researcher will be making use of the IPAQ (2012) due to the reliability and validity of the questionnaire. Overall, the IPAQ (2012) questionnaires produced repeatable data (Spearman's rho clustered around 0.8), with comparable data from short and long forms. Criterion validity had a median rho of about 0.30, which was comparable to most other self-report validation studies. The "usual week" and "last 7 days" reference periods performed similarly, and the reliability of telephone administration was similar to the self-administered mode (Craig, Marshall, Sjorstrom, Bauman, Booth, Answorth, Pratt, Ekelund, Yngve, Sallis, and Oja, 2003:1381).

An epidemiologic study of adults (Tremblay, Despres, Leblanc, Craig, Ferris, Stephens & Bouchard, 1990:153) found that those who engaged in greater amounts of free-living vigorous physical activity had lower general and central adiposity, even after control for total physical activity energy expenditure (EE), Hence the discussion on body composition that follows.

2.3.1 Body composition

Body composition, a health-related component of physical fitness is unlike the other health-related components in that it is not a performance measure. Body composition requires no movement (Corbin, Corbin, Welk, & Welk, 2008:276), although physical movement/activity can have an effect on body composition.

Body composition can be expressed as the relative percentage of body mass that is fat and fat-free tissue. Measurement of height, weight, circumferences, and skinfolds are used to estimate body composition. Skinfold measurement on the contrary provides a better estimate of body fatness, than measurements based only on height, weight, and circumferences (ACSM, 2010:62-63).

A number of techniques developed to assess body composition as well as their ratings of variability and objectivity as stated by Corbin *et al.* (2008:278), is represented in Table 2.1.

Table 2.1:   Ratings of the variability and objectivity of body composition methods (Corbin *et al.*, 2008:278).

Method	Precise	Objective	Accurate	Valid Equations	Overall Rating
Skinfold measurement	4.0	3.5	3.5	3.5	3.5
Bioelectric impedance	4.0	4.0	3.5	3.5	3.5
Circumferences	4.0	4.0	3.0	3.0	3.0
Body mass index (BMI)	5.0	5.0	1.5	1.5	2.0

Adapted from Houtkooper, Lohman, Going& Howell (1996:436S)

Precise: can the same person get the same result time after time?

Objective: can two people get the same result consistently?

Accurate: do values compare favorably with under water weighing?

Valid: is the formula accurate for predicting fat from measurements?

5 = excellent; 4 = very good; 3 = good; 2 = fair; 1 = unacceptable

(Corbin *et al.*, 2008:278).

It is known that PA can influence body composition in the following ways, namely:

- Reduction in percentage body fat;
- Increases in lean body mass; and
- Firmer muscle tone (Brandon &Loftin, 1991:564).

By having these factors influenced by physical activity and leading a healthier lifestyle, it increases self-image and influences self-awareness in a positive way. Van Huss, Heusner and Mickelsen (1969:9) states that it has long been recognized that knowledge of and insight into "self" is essential for a positive state of both physical and mental health.

According to Jung, Bray and Ginis (2008:523) a reduction in physical activity appears to be the defining characteristic in female freshman weight gain.

D'Angelo *et al.* (2010:311) is of the opinion that to positively affect body composition in the sedentary women energy balance should be controlled. However, when females train regularly it is necessary to control both energy balance and composition of daily meals. Cilliers, Senekal and Kunneke (2006:234) states that students with a normal body mass index (BMI) do more exercise than those who are underweight or overweight and that higher inactivity levels are associated with a higher BMI.

According to Malinauskas, Raedeke, Aeby, Smith and Dallas (2006:11) female college students, regardless of weight status, would benefit from open discussions with health educators regarding healthy and effective dieting practices to achieve/maintain a healthy body weight. Another factor that needs attention is the fact that freshmen students, on average, gain weight during their first semester; however, this weight gain may be more modest than generally perceived, (Hajhosseini, Holmes, Mohamadi, Goudarzi, McProud & Hollenbeck 2006:123). No relevant research in this regard could be obtained therefore it is evident that research is required relating to South African students.

Different assessment techniques for body composition exist (i.e. hydrodensitometry, plethysmography, dual energy x-ray absorptiometry

(DEXA) etc.). For the purpose of this study the following methods were implemented and will therefore be discussed:

- Skinfold Measurements;

- Body Mass Index (BMI); and

- Circumferences (Waste-to-Hip ratio)

2.3.1.1   Skinfold measurement

Percentage body fat measures the total amount of fat and is unable to measure fat distribution or patterning in the body. Body fatness is expressed in terms of fat as a percentage of body weight, and is therefore a measure of obesity (Rush, Puniani, Valencia, Davies & Plank, 2003:1399). Body composition determined from skinfold measurements correlates well (r=0.70 – 0.90) with body composition determined by hydrostatic weighing. The principles behind this technique are that the amount of subcutaneous fat is proportional to the total amount of body fat: however, the exact proportion of subcutaneous-to-total fat varies with gender, age and ethnicity (Bellisari & Roche, 2005:119). Skinfolds are deemed an accurate measurement of body fat as up to 50% of the subcutaneous fat is located underneath the skin, therefore a skinfold would represent subcutaneous fat, surrounded by 2 layers of skin (Heyward & Wagner, 2004:49).

The norms for percentage body fat based on BMI are between 21-32% for females in a healthy BMI range (Table 2.2), whereas Table 2.3 illustrates the norms for body fat percentage for females based on skinfold measurements. Individuals with a percentage body fat above the upper limit of their gender specific norm are deemed to be obese, with an increased risk of cardiovascular disease (Corbin & Lindsay, 1994:160; Nakanishi, Nakamura, Matsou & Tatara, 2000:276). The advantages of the use of the skinfold method in predicting body fat are that the equipment necessary is inexpensive; the results are reliable if the correct measurement procedures are followed and it can be taken in the field. The method involves low technology and it is relatively simple and easy to use. Other advantages include little discomfort for the subject, as it is a noninvasive method, which

requires little space and time, which also makes it suitable for large-scale epidemiological surveys (Heyward & Wagner, 2004:49). In Table 2.2 the percentages for body fat applicable to females based on BMI are presented.

Table 2.2: Predicted body fat percentage based on BMI for African American and White Adults (ACSM, 2010:64).

BMI (kg/m-2)	Health Risk	20-39 years	40-59 years	60-79 years
Women				
<18.5	Elevated	<21%	<23%	<24%
18.6-24.9	Average	21%-32%	23%-33%	24%-35%
25.0-29.9	Elevated	33%-38%	34%-39%	36%-41%
>30	High	≥39%	≥40%	≥42%

Table 2.3: Body composition (% Body fat) for woman (ACSM, 2010:72).

AGE							
%	20-29	30-39	40-49	50-59	60-69	70-79	
99	9.8	11	12.6	14.6	13.9	14.6	VL
95	13.6	14	15.6	17.2	17.7	16.6	
90	14.8	15.6	17.2	19.4	19.8	20.3	E
85	15.8	16.6	18.6	20.9	21.4	23	
80	16.5	17.4	19.8	22.5	23.2	24	
75	17.3	18.2	20.8	23.8	24.8	25	G
70	18	19.1	21.9	25.1	25.9	26.2	
65	18.7	20	22.8	26	27	27.7	
60	19.4	20.8	23.8	27	27.9	28.6	
55	20.1	21.7	24.8	27.9	28.7	29.7	F
50	21	22.6	25.6	28.8	29.8	30.4	
45	21,9	23.5	26.5	29.7	30.6	31.3	
40	22.7	24.6	27.6	30.4	31.3	31.8	
35	23.6	25.6	28.5	31.4	32.5	32.7	P
30	24.5	26.7	29.6	32.5	33.3	33.9	
25	25.9	27.7	30.7	33.4	34.3	35.3	
20	27.1	29.1	31.9	34.5	35.4	36	
15	28.9	30.9	33.5	35.6	36.2	37.4	VP
10	31.4	33	35.4	36.7	37.3	38.2	
5	35.2	35.8	37.4	38.3	39	39.3	
1	38.9	39.4	39.8	40.4	40.8	40.5	
n =	1360	3597	3808	2366	849	136	
Total n = 12116							
Norms are based on Cooper Clinic patients							
Very lean - No less than 10-13% body fat is recommended for females							
VL - very lean; E - excellent; G - good; F - fair; P - poor; VP - very poor							

2.3.1.2 Body mass index (BMI)

According to the ACSM (2010:63) the BMI is used to assess weight relative to height and is calculated by dividing body weight in kilograms by height in meters squared (kg•m^2). For most people, obesity-related health problems increase beyond a BMI of 25. The *Expert Panel on the Identification, Evaluation, an Treatment of Overweight and Obesity in Adults* (Panel N. O. E. I. E., 1998:51S) lists a BMI of 25.0 to 29.9 kg•m^2 for overweight and a BMI of ≥30.0 kg/m^2 for obesity (Table 2.3). Although BMI fails to distinguish between body fat, muscle mass or bone, an increased risk of hypertension, total cholesterol/high-density lipoprotein (HDL) cholesterol ratio, coronary disease, and mortality are associated with a BMI bigger than 30.0 kg•m^2. A BMI of less than 18.5kg•m^2 also increases the risk of cardiovascular disease (Panel N. O. E. I. E., 1998:51S).

Corbin and Lindsey (1994:149) are of the opinion that the BMI is the most accurate way to use weight and height to assess fatness. In contrast, Norton and Olds (1996:371) refer to BMI as a measure of heaviness, and not fat, and state that while increments in heaviness at a population level are most often associated with increments in fat, this assumption cannot be made when determining disease risk at an individual level (Karelis, St-Pierre, Conus, Rabasa-Lhoret, Poehlman, 2004:2573).

It has been well documented that PA and BMI are primary factors affecting individuals' overall health, (US Department of Health and Human Services [USDHHS], 2001). Maintaining PA levels and BMI values during the pre-graduate years may generate positive effects on student lifestyles in the years following graduation, (Sparling & Snow, 2002:200). Tracking PA and BMI over time during the tenure in higher education is essential (Levy & Cardinal, 2006:476), but it is not easy because of the mobility of the population. Despite the tendency of PA to decline with age while BMI shifts in the opposite direction, the need for students to maintain sound health cannot be overstated given its role in completing studies, as healthy students can learn better academically (El Ansari & Stock, 2010:509).

An international classification of adult underweight, overweight and obesity as determined by the WHO (2006) is presented in Table 2.4.

Table 2.4: The international classification of adult underweight, overweight and obesity according to BMI (WHO, 2006).

CLASSIFICATION	BMI	
	PRINCIPL CUT-OFF POINTS	**ADDITIONAL CUT-OFF POINTS**
UNDERWEIGHT	**< 18.50**	**<18.50**
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
NORMAL RANGE	**18.50 - 24.99**	**18.50 - 22.99**
		23.00 - 24.99
OVERWEIGHT	**≥25.00**	**≥25.00**
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
OBESE	**≥30.00**	**≥30.00**
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

For the purpose of this study the skinfold measurement method for the determination of body composition will be made use of as mentioned earlier. A skinfold represents the amount of fat that lies between two thicknesses of skin. It is known that half of the body's fat is located just under the skin or in-between two skinfolds. By measuring skinfold thickness of various sites around the body, it is possible to estimate the total body fatness (Corbin *et al.*, 2008:278).

2.3.1.3 Lean Body Mass (LBM)

Lean body mass (LBM) on the other hand comprised of everything in the body besides body fat. As indicated in Figure 2.1, lean body mass includes organs, blood, bones, muscle and skin, and anything else in our bodies that has mass and is not fat. In the average adult female, about 35% of body weight is skeletal muscle.
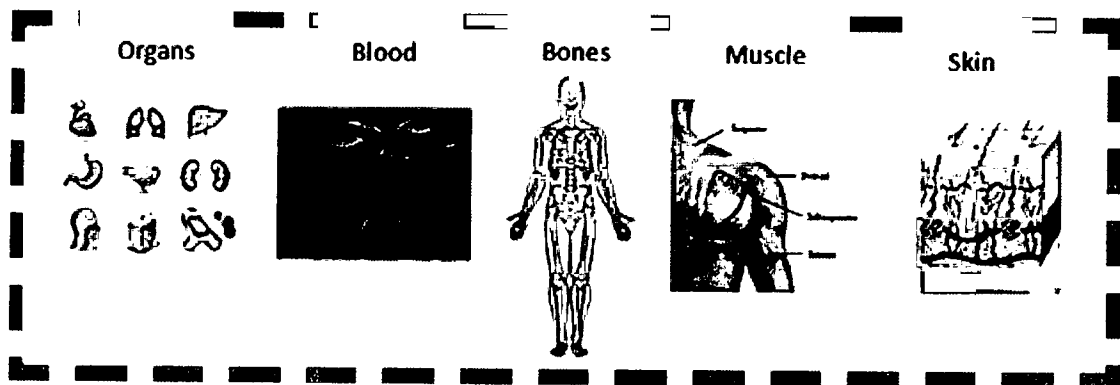
Figure 2.1: The constituents of lean body mass

Lean Body Mass is determined by the following formula:

Lean Body Mass = Body Weight – (Body Weight x Body Fat %).

This equation takes body weight in kilograms and subtracts it from the amount of fat, (http://www.builtlean.com/2011/08/24/lean-body-mass-definition-formula/).

Lean body mass is also defined by MedicineNet (2012) as the mass of the body minus the fat (storage lipid). There are a number of methods for determining the lean body mass. Some of these methods require specialized equipment such as underwater weighing (hydrostatic weighing), BOD POD (a computerized chamber), and DEXA (dual-energy X-ray absorptiometry). Other methods for determining the lean body mass are simple such as skin callipers and bioelectric impedance analysis (BIA). (http://www.medterms.com/script/main/art.asp?articlekey=25887).

2.3.1.4 Circumferences: Waist-to-hip ratio (WHR)

The waist-to-hip ratio (WHR) is an index is used to define android and gynoid obesity (Bray, 1992:489S). The ratio is calculated by dividing the waist circumference with the hip circumference (Norton & Olds, 1996:378; ACSM, 2010:64). Bray (1992:489S) classified a high ratio as indicative of android obesity while a low ratio indicates gynoid obesity. An android pattern of fat distribution refers to the ventral or upper body fat whereas a gynoid fat is lower-body-segment fat, particularly the hipsand thighs, (Ley, Lees & Stevenson, 1992:950) Android fat has been related directly to an increase in the development of cardiovascular disease (Donahue, Abbott, Bloom, Reed, & Yano, 1987:821) as well as indirectly through lipid profiles associated with cardiovascular risk (Despres, Allard, Tremblay, Talbot, & Bouchard, 1985:967). The waist-to-hip ratio norms for females are presented in Table 2.5.

Table 2.5:   Waist-to-hip ratio norms for females

	Acceptable		Unacceptable		
	excellent	good	average	high	extreme
female	< 0.75	0.75 - 0.80	0.80 - 0.85	0.85 - 0.90	> 0.90

(http://www.topendsports.com/testing/tests/WHR.htm)

The ACSM (2010:64) classifies a waist-to-hip ratio of >86 as a very high health risk. Significant relationships have been found to exist between WHR and cardiovascular disease (CVD) (Hodgson, Wahlqvist, Balazs & Boxall 1994:43). Croft, Keenan, Sheridan, Wheeler and Speers, (1995:60) warns that different ethnic groups have different normal values for WHR, and further caution that a single sex-specific cut point for all age and race groups may lead to an overestimation of persons at a high risk for CVD. Ramachandran, Snehalatha, Viswanathan, Viswanathan and Haffner (1997:121) support this statement with results from a study they conducted on different ethnic groups regarding obesity and diabetes mellitus. The latter authors (1997:121) stated that WHR was significant only in Asian Indians and Mexican Americans,

although non-Hespanic whites had a high WHR. Probably the biggest advantage of the WHR is that it is an inexpensive and simple technique and discomfort to the test is minimal. In several studies the WHR has been found to be the best index for determining risk and disease, associated with fat and weight distribution (Silventoinen, Jousilahti, Vartianen & Tuomilehto, 2003:289; Snijder, Dekker, Visser, Bouter, Stenhouwer, Kostense, Yudkin, Heine, Nijpels & Seidell, 2003:1195).

2.4 Lifestyle

The Business Dictionary (2011) defines lifestyle as a way of living of individuals, families (households), and societies, which they manifest in coping with their physical, psychological, social, and economic environments on a day-to-day basis. A healthy lifestyle includes being physically active, maintaining good eating habits, getting enough sleep, drinking little or no alcohol, not smoking, and maintaining a healthy body weight. These factors are very important in the maintenance of one's health (Belloc & Breslow, 1972:414). Currently, there is extensive evidence that lifestyle factors, such as unhealthy diet, excessive alcohol consumption, smoking and sedentary lifestyle, contribute to an increase in morbidity and mortality due to the development of chronic diseases such as CVD, type 2 diabetes and cancer, among others (Thiele, Mensink & Beitz, 2004:29; Mokdad, Marks, Stroup & Gerberding, 2004:1238)

Lifestyle is expressed in both work and leisure behaviour patterns and (on an individual basis) in activities, attitudes, interests, opinions, values, and allocation of income. It also reflects people's self-image or self-concept; the way they see themselves and believe they are seen by others. Lifestyle is a composite of motivations, needs, and wants and is influenced by factors such as culture, family, reference groups, and social class. Leading a healthy lifestyle is critical for personal health and wellbeing, but the demands of daily life and the career paths chosen do not always allow that. According to Bouchard, Shephard, Stevens, Sulton and McPherson (1990:155) there are three factors that determine the individual's lifestyle, and they are:

- ➢ Biological factors;
- ➢ Circumstantial factors; and
- ➢ Social factors.

Bouchard *et al.* (1990:156) states that the biological composition of the person forms the basis of behavior, but a person's innate needs can in essence only be satisfied when circumstantial factors allow it. They further suggest that social factors influence and determine the lifestyle choices made.

Belloc and Breslow (1972:415) recommended seven lifestyle habits that are positively related to an individual's health and they are as follows:
- ➢ 3 meals per day without in-between eating;
- ➢ Eating breakfast;
- ➢ 2-3 times per week participation in moderate activity;
- ➢ No smoking;
- ➢ Little / no alcohol intake;
- ➢ Enough sleep (7 – 8 hours); and
- ➢ Maintaining a healthy weight;

Each of the lifestyle habits will be discussed separately.

2.4.1 Eating 3 meals per day without in-between eating.

It is recommended that meals are well spaced and balanced between different nutrients required per day. In-between eating, adds more food to be digested by the body in a 24 hour cycle, making it more difficult for the body to break down all foods (Belloc & Breslow, 1972:415).

Al-Rethaiaa, Fahmy, Al-Shwaiyat (2010:39) stated in a study done on college students in Saudi Arabia that although irregular meals consumption was reported in 63.3% of students, the vast majority of them (88.6%) have breakfast at least three times per week. Most of the participants (55.7%) eat two meals per day, while 31.4% of them eat three meals.

Smallberger (2006:18) is of the opinion that the western diet should be classified as one of the risk factors for the development of chronic diseases. It can also be added that one of the major causes of obesity is the changes in the diet, in terms of quantity and quality, which has become more "Westernized" (Antonio & Chiara, 2005:1). According to Holford, Nagle, Kyne and Rix (2008:42) the western diet includes intake of high levels of saturated fats, sugar, salt, processed foods and decreased fiber, antioxidants, cilium and proteins. Since the 1960s the South African daily energy, protein, carbohydrate and fat intake has increased, while PA has decreased (Smallberger, 2006:20). According to Smallberger (2006:20) this has resulted in an increased prevalence of obesity, hypertension, ischemic heart diseases, strokes and diabetes mellitus. Yahia, Achkar, Abdallah and Rizk (2008:32) are of the opinion that dietary habits of young adults are affected by the fast-food market. As a consequence, overweight and obesity are increasingly observed among the young. Obesity in combination with an unhealthy life style, such as smoking and physical inactivity, may increase the risk of chronic diseases (Yahia *et al.*, 2008:32).

Studies have indicated that very few South Africans consume enough fruits and vegetables, which can lead to a lack of essential vitamins and minerals, which in turn becomes a risk factor for developing chronic heart diseases (Smallberger, 2006:20). Haskell (2003:247) is also of the opinion that a healthy diet which is rich in fruit, vegetables, whole grain products, nuts and the regular intake of oily fish, as well as a limited intake of high-fat animal products and processed food, decreases the development of cardiovascular diseases.

2.4.2 Eating breakfast.

Breakfast is considered the most important part of daily food intake (Sharkey & Gaskill, 2007:352) as it starts the metabolism. The later the metabolism starts working, less food will be digested and broken down in the body (Belloc & Breslow, 1972:417). Therefore, breakfast is important for energy and cellular metabolism (Skarkey & Gaskill, 2007:352).

2.4.3 Participation in moderate physical activity 2-3 times per week.

Taking part in moderate intensity PA helps keep the heart working at a regular pace and keep it strong (Belloc & Breslow, 1972:418). The HSFSA (2008) highlights that the risk to develop heart diseases are twice as high for individuals that are inactive and three times the risk to die of a heart attack as active individuals. Adams (2004) further states that a sedentary lifestyle is more dangerous than smoking, and it is proven that 20% of all deaths of individuals 35 years and younger is because of a lack of PA. PA is analyzed by the ACSM (2006:3) in separate components, namely skills-related fitness, health-related fitness and physiologic-related fitness. Health-related fitness includes PA that improves general health and energy, as well as the ability to perform daily tasks (Jackson, Morrow, Hill & Dishman 1999:9).

2.4.4 No smoking.

Lung cancer is one of the most common cancers in modern society, which is caused by smoking. Cigarettes contain tar which is captured by the lungs and helps with the development of cancer (Belloc & Breslow, 1972:419). Sharkey and Gaskill (2007:352) see smoking as the most prominent cause of premature deaths in the USA. The American Heart Association (2008) supplied the following statistics for individuals 18 years and older for the year 2005:

- 23.9% males and 18.1% females smoke;
- 24% white men and 26.7% black men smoke; and
- 20% white women and 17.3% black women smoke.

It has been found that the relationship between smoking and the risk to develop cardiovascular diseases depends on the amount of cigarettes smoked per day (Mukamal, 2006:199), with the risk for heavy smokers three times more than that of non-smokers (Nieman, 1998:170). Even limited smoking habits (e.g. four or five cigarettes per day), increases the risk of coronary heart diseases. Smoking increases the risk to develop peripheral vascular diseases that lead to the development of gangrene that later leads to amputation (Robbins, Powers, & Burgess, 2005:262). According to Robbins *et al.* (2005:262) heavy smokers can lose approximately six minutes of the life

expectancy with every cigarette that they smoke, which means a loss of five to eight years. More people die of cigarette smoking than alcohol, cocaine, heroin, suicide, murder, motor vehicle accidents and AIDS combined (Robbins *et al.*, 2005:262). The Heart and Stroke foundation of South Africa (2008) supplied the following benefits when smoking habits are terminated:

- Within 8 hours oxygen and carbon dioxide level normalize in the blood;
- Within 24 hours the risk for a heart attack or stroke starts to decrease;
- Within 48 hours the nerve-endings, taste and smell senses begin to restore themselves;
- Lung capacity increases and coughing spells decrease within 72 hours;
- The formation of blood clots decrease within days;
- After 3 weeks the participation in PA is easier;
- After 1-3 months blood circulation and sperm count (in men) increases;
- After 2 months the individual feels more energetic;
- Within 5 years the risk to develop lung cancer has decreased by half; and
- With 5-15 years the risk to develop heart diseases are the same as a non-smoker.

2.4.5 Little / no alcohol intake

Alcohol is a carbohydrate that inhibits lipolysis, which is the breakdown of fat in the body, which in turn can increase fat stored and accumulated in the body (Belloc & Breslow, 1972:419). Alcoholism is defined through Holmes (1994:200) by the WHO as the use of alcohol to the extent that it causes emotional, social and physical harm. Holmes (1994:200) is further of the opinion that the over- use of alcohol can be linked to underlying problems like, anxiety, depression, unemployment, financial problems, marriage problems and physical trauma. Alcohol misuse can also be associated with diseases like liver diseases, neurologic syndrome, cardiomyopathy, pulmonary tuberculosis, anemia, hypoglycemia and inflammation of the pancreas (Holmes, 1994:201). The problem regarding alcohol use and its relation to coronary heart diseases is that it is admitted that smoking is a general habit of drinkers. Seeing that smoking has a direct relation to increased risk of all

coronary heart diseases, it can cover the true effect of alcohol use on the risk of coronary heart disease (Mukamal, 2006:199).

Although heavy alcohol use has established consequences, a growing literature suggests that young people can reduce their risk for alcohol-related problems by using protective strategies to change the pace or manner of drinking or avoid drinking in high-risk situations. Strategies include mixing drinks with less alcohol, alternating non-alcoholic with alcoholic drinks, avoiding drinking games, and using a designated driver. Although such strategies are widely promoted by colleges as a way to temper drinking-related consequences, it is difficult to determine their actual prevalence. One study reported that 54% of men and 64% of women reported alternating alcoholic and non-alcoholic drinks in the three months prior to college (Sutfin, Light, Wagoner, McCoy, Thompson, Rhodes, et al 2009:610-619), while another study found that 37% of undergraduates reported using this strategy while in college (Martens, Taylor, Damann, Page, Mowry, & Cimini, 2004:390).

2.4.6 Enough sleep (7 – 8 hours).

Getting enough sleep helps the body replenish the energy that was used during the day, to make sure that the body has enough to continue throughout the next day (Belloc & Breslow, 1972:420). Sleep is defined as an unconscious state of decreased awareness of the environment that typically is paired with a relaxed posture and minimal movement (Moorcroft, 2005:24). Insomnia is defined as the inability to fall asleep or stay asleep, waking up too early or not experiencing refreshing sleep (Nadolski, 2005:167-168; Rajan-George, 2005:7). According to Rajan-George (2005:7) there are external factors that can add to insomnia. The factors include nicotine, caffeine, alcohol, large dinners, anxiety, depression, extreme temperature differences and female hormonal fluctuations. Robbins *et al.* (2005:92) is of the opinion that exercise can have a positive impact on an individual's sleeping patterns. Individuals who participate in exercise fall asleep easier and faster, stay asleep longer and experience more refreshing sleep compared to individuals who do not exercise.

Most people need 7-8 hours of sleep per night and according to Sharkey and Gaskill (2007:351) too little sleep can have a negative effect on one's health. Nadolski (2005:168) further states that individuals with insomnia have a four times bigger risk developing depression as well as an increased risk for the development of diseases such as heart diseases.

2.4.7 Maintaining a healthy weight.

In response to the emerging body of scientific, medical, and behavioral data about the link between excess adiposity and coronary heart disease, the American Heart Association (AHA) has reclassified obesity as a major, modifiable risk factor for coronary heart disease (Eckel & Krause, 1998:2099). Obesity related interventions are needed at all levels in society, regardless of age, gender and ethnicity (USDHHS, 2001). Overweight and obesity are becoming significant problematic in countries like South Africa. In the most recent Demographic and Health Survey in South Africa, 54.9% of the adult women and 29.8% of adult men were overweight or obese; the proportions for 15 to 24 year-olds were 30.7% and 11.5%, respectively (Department of Health, 2007).

The prevalence of overweight and obesity has escalated worldwide at an alarming rate in both developing and developed countries, reflecting increasing consumption of energy dense diets high in fats and sugars, compounded by decreased participation in physical activity (Bouchard & Blair, 1999:498). The prevalence of obesity is extremely high in women in South Africa and obesity is rising especially among those living in adjacent countries, such as Botswana, Namibia and Zimbabwe (Walker, Adam & Walker, 2001: 368).

Many factors, such as genetics, metabolism, and behavioral and environmental factors influence overweight and obesity (Kazi & Coopoo, 2010:104). Stein and Colditz (2004:2522) suggested that the obesity epidemic is fuelled more by behavioral and environmental influences than by biological changes. An imbalance between the energy consumption and energy

expenditure has led to a positive energy balance resulting in a marked increase in overweight in society. Some of the trends that could contribute to an increased energy balance and observed rise in obesity are increased percentage of food consumed outside the home including fast foods and large portion size (Harnack, Jeffrey & Boutelle, 2000:1478) and greater soft drinks, salty snacks and pizza consumption (Nielsen, Siega-Riz, & Popkin, 2002:370). Behavioral risk factors, mainly smoking, drinking and obesity are known causes of certain cancers, diabetes mellitus and cardiovascular disease (Sturm, 2002:245).

Weight gain and behavioral patterns during college years may contribute to being overweight and also being obese in adulthood (Rachette,Deusinger, Strube, Highstein & Deusinger 2005:245). Sedentary lifestyles and excessive caloric intake contribute to being overweight and obese , and the period between adolescence and early adulthood is accompanied by lifestyle changes that predispose young adults to become less physically active (Kolbe, 1997:55).

According to Teamflex (2011), making healthy conscious choices makes individuals feel very powerful and strong. They are in charge of their own health and their own lifestyle. Nobody likes to be the victim of his/her own environment. Teamflex provides several healthy lifestyle tips that could be followed:

- ➢ Educate yourself and your family about healthy eating and living;
- ➢ Build a support group;
- ➢ Avoid all temptations;
- ➢ Take a bottle of water with you everywhere you go;
- ➢ Take a walk around the block for about 20min a day;
- ➢ Get yourself new role models that can help you with eating healthy foods and living a healthy lifestyle;
- ➢ Get yourself new activities that you can do alone and with your family, for example hiking;
- ➢ Change your mind-set;

> Get personal by signing up to the gym and getting a few classes from a personal trainer; and

> Prepare for the new environment you are entering, the gym can be very intimidating at first so rather go prepared than scared.

The South African Food Based Dietary Guidelines (NICUS, 2012) were developed specifically for South Africans and are as follows:

1. Enjoy a variety of food. Variety means eating different foods within a meal, on different days and preparing food in different healthy ways. This ensures that our diet contains sufficient nutrients and that it is more enjoyable. The more colorful a plate of food, the better the variety.

2. Be active. Regular exercise has many benefits including weight control, reducing the risk of heart disease and osteoporosis, relaxation and better sleeping patterns. Aim to do at least one 30- 45 minutes physical activity session every day, or three short 10-minute sessions over the course of the day. Make use of every opportunity to move!

3. Drink lots of clean, safe water. Every person should drink at least six to eight glasses (or more according to thirst or when physically active) of clean, safe water every day. This also includes Rooibos and other herbal teas with no added sugar or milk and low energy or sugar free cold drinks.

4. Make starchy foods the basis of most meals Starchy foods include maize meal, cereals, samp, bread, rice, pasta, potatoes and sweet potato. These foods are rich sources of carbohydrates, our main source of energy, and should be consumed with every meal. It is important to choose unrefined starchy foods which are high in fiber since these increase satiety, supports healthy bowel functioning and lower the risk of developing diseases such as obesity and heart disease. Unrefined starches include whole- wheat bread, brown rice, whole-wheat pasta, high fiber cereals, oats and course maize meal.

5. Eat plenty of vegetables and fruit every day Fruit and vegetables are high in vitamins, minerals, fiber and water and one should aim to eat 5 portions or more per day. Try to eat different vegetables and fruit e.g. at least one good source of Vitamin C *(e.g. tomato, the cabbage family,*

citrus fruit and guavas) and one dark green or dark yellow vegetable.

6.   Eat dry beans, split peas, lentils and soy regularly. Legumes (or plant proteins) should be eaten two to three times per week. They are affordable, high in protein and fiber and low in fat and can easily be included in soups and stews.

7.   Chicken, fish, meat, milk or eggs can be eaten daily Small portions of these foods can be eaten daily, but need not be eaten daily.   Animal-based foods are higher in fat (saturated fat) and we tend to eat more thereof than we need to. Try to include more plant protein sources and fatty fish *(e.g. snoek, sardines, pilchards, mackerel, , and salmon)* and less red meat.

8.   Eat fats sparingly. Fat intake should be limited, especially saturated- and trans fats *(animal fats, full cream dairy products, chocolate, coconut, hard margarine, full cream products, baked goods for e.g. pies and cookies and palm oils e.g. coffee creamers and artificial cream).*Rather include   more   mono-unsaturated   fats   in   limited   amounts   in   your diet *(e.g. use canola oil or olive oil instead of sunflower oil, spread avocado or peanut butter instead of margarine on bread and use polyunsaturated fat rather than saturated fat.)*

9.   Use salt sparingly. Use small amounts of salt in food preparation and avoid the use of extra salt at the table. Rather use herbs, salt-free spices and flavorings instead of salt. Also avoid processed foods with a high salt content.

10.   Use food and drinks containing sugar sparingly and not between meals. Sugar is rich in energy, but it contains no other nutrients and can cause obesity if eaten in excess or with fatty foods. Choose foods and drinks with little or no sugar and avoid consuming sweet food and drinks between meals as this can cause tooth decay.

11.If you drink alcohol, drink sensibly. Alcohol is high in energy and contains no other nutrients. One does not need to drink alcohol, but if so, use it in moderate amounts (1 drink for women and 2 drinks for men per day). A standard drink is classified as 1 can of beer, 1 tot of spirits, 125ml of wine and 60ml sherry (NICUS, 2012).

The abovementioned guidelines can contribute to maintaining a healthy weight in the female students. The behavioral and lifestyle choices people make early in their life influence their subsequent health status. Despite recent attention to health promotion and illness prevention during formative years, young people continue to engage in high rates of unhealthy behaviors, including those associated with a range of chronic diseases of lifestyle (Adlaf *et al.*, 2005; Dawson, Schneider, Fletcher & Breyden 2007: 38) The time spent at university or college represents an important transition period in the life of most young people and should be an ideal time point for interventions to reduce the risk of developing chronic disease of lifestyle (Hendricks, Herbold, & Fung, 2004:981; Taylor, McCarthy, Herbert & Smith 2009: 255).

For the purpose of this study the following lifestyle aspects with regard to ethnic differences, will be reported on:

- Eating habits (Eating breakfast and eating 3 meals per day);
- Physical activity;
- Smoking;
- Alcohol consumption;
- Sleep; and
- Ideal body weight.

Deng *et al.* (2011:20) has pointed out that it is important to help university students adopt a healthy lifestyle consisting of adequate PA and a healthy diet due to the following three reasons. First, university students may play a critical role in developing social and cultural norms because they may well become decision-makers and opinion leaders; second, many university students decrease their PA levels (Gyurcsik, Bray & Brittain, 2004:130; Keating *et al.*, 2005:116; McArthur & Readeke, 2009:80) while their BMI's rise (Adams & Rini, 2007:361; Crombie, Ilich, Dutton, Panton, and Abood, 2009:83). To date, only 30% to 50% of university students meet the recommended amount of PA for health benefits (Keating *et al.*, 2005:116; Rachette *et al.*, 2005:245). The third reason that this group should be targeted for intervention is that young

adulthood PA and diet habits have valuable carry-over effects (Deng *et al.*, 2011:20).

University aged students have a high risk of making unhealthy lifestyle choices that could affect their health and wellbeing (Dawson *et al.*, 2007:38; Taylor *et al.*, 2009:255). This is the result and influence of a variety of popular cultures among young adults, the newfound freedom they experience and the typical peer pressure encountered during these years (Bell & Lee, 2005:227). Uninformed, university and college students could formulate inaccurate and incomplete notions regarding health, lifestyle, physical activity and fitness, as well as practice non-recommended methods of weight loss (Dawson *et al.*, 2007:38; NASPE, 2007).

2.5 Ethnic Differences

Limited information is available regarding South African students ethnic differences relating to eating habits, PA, smoking, alcohol consumption, sleeping habits an ideal body weight.

2.5.1 Eating habits

Most college students may not achieve the nutrition and exercise guidelines designed to reduce the risk of chronic disease, typically consuming diets high in fat, sodium, and sugar and low in fruits and vegetables (Dinger & Waigandt, 1997:360; Grace, 1997:243; TLHS, 2000; Anding, Suminiski & Boss, 2001:167; Hiza & Gerrior, 2002:3). These poor eating habits may result from frequent snacking, excess dieting, and consumption of calorie dense but nutrient poor snacks and meals, such as those provided by fast food restaurants (Georgiou, Betts, Hoerr, Keim, Peters, Stewart & Voichick, 1997:754). Physiological and psychological factors in the college environment, which may cause the onset of disordered eating include: identity and role changes, insufficient exercise, cafeteria food, and the availability and the ease of snacking on junk food (Striegel-Moore, Silberstein & Rodin, 1986:246; Levitsky, Halbmaier, & Mrdjenovic, 2004:1435). In their qualitative study, based on eight university focus groups, Greaney, Less, White, Dayton,

Riebe, Blissmer and Greene (2009:281) found that college students identified temptations, lack of self-discipline, and social and environmental issues such as time constraints and willingness to eat unhealthy food as obstacles to keeping a healthy lifestyle or maintaining their weight.

2.5.1.1 Black females

Szabo and Hollands, (1997:531) as well as Le Grange, Telch and Tibbs (1998:250) have both shown that eating disorder pathology is at least as common among black females as it is among Caucasian (Coloured) females. A study done by Le Grange, Louw, Russell and Silkstone (2006:401) stated that 11.9% of the black respondents showed anorexia nervosa habits while 5.6% of the group showed bulimia or binge eating habits.

2.5.1.2 Coloured females

The same study as above (Le Grange *et al.*, 2006:401) showed that 8.7% of the coloured respondents indicated an anorexia nervosa behavior in their eating habits and 2.8% binge eating or bulimia habits.

2.5.1.3 White females

Seventeen and a half percent (17.5%) of the white participants in the study of Le Grange *et al.* (2006:401) showed anorexia nervosa like behavior and 5.2% showed binge eating or bulimia habits.

Several surveys of disordered eating among South Africans over the past decade have shown Black Africans to score as high (Szabo & Hollands, 1997:531; Wassenaar, Le Grange, Winship & Lachenicht 2000:225; Caradas, Lambert & Charlton, 2001:111; Senekal, Steyn, Mashego, & Nel, 2001:45), or in some instances higher (Le Grange *et al.*, 1998:250; Marais, Wassenaar & Kramers, 2003:44), than their White counterparts on measures of disordered eating. Le Grange *et al.* (2006:401) found that even though their results are more mixed, it echoes these studies. These findings are quite similar to the first South African survey of eating attitudes among young adults done in

1998 (Le Grange *et al.*, 1998:250).The prevalence of similar eating disorders in the different ethnicity group is thus obvious.

2.5.2 Physical activity

Results from the 1995 National College Health Risk Behavior Survey (Douglas, Collins, Warren, Kann, Gold, Clayton, Ross & Kolbe, 1995:55) indicated that 42.2% of undergraduates did not participate in moderate or vigorous PA. The rates for female and minority college students (non-Caucasian) tend to be worse; however, information on ethnic differences is limited (Douglas *et al.*, 1995:55). Many explanations have been proposed to account for low levels of female physical activity. Desmond, Price, Lock, Smith and Stewart (1990: 220) suggested that women, especially minority women, might be less informed about the importance of physical activity and suggested that this may stem from insufficient education or role-modelling during women's childhood and adolescence (Ainsworth, Keenon, Strogatz, Garrett & James, 1991: 1477). Women may lack support to be physically active from others; as a consequence, they may not develop positive beliefs concerning exercise or the confidence to engage in physical activity (i.e., self-efficacy) (USDHHS, 1996).

Physical inactivity has been shown to be influenced by the interaction among several determinants, including biological, environmental, and socio-cultural factors. Understanding the barriers for PA from various ethnicities and cultural groups can be informative on potential common themes underlying this area and possible differences to be expected. Results from the 2001 Women's Cardiovascular Health Network Project conducted on Caucasian, African American, Latina, and American Indian women aged 20–50 years, indicated that family priorities were the main barrier to PA across all groups. African American, American Indian, and Latina participants felt that they had greater responsibilities to their families than Caucasian women and perceived that Caucasian women were "brought up" to know how to exercise (Eyler, Matson-Koffman, Evenson, Sanderson, Thomson, Wilbur & Rohm-Young, 2002: 123). The American Indian groups mentioned that traditional PA such as dance or daily activities were accepted, but their culture frowned upon women who

exercised for the sole purpose of exercising (Eyler *et al.*, 2002:123). In addition, being unemployed was identified as a barrier amongst rural African American, urban African American, and rural Caucasian women (cited in Pan & Nigg, 2011: 1).

2.5.2.1 Black females

Participation in leisure and work-related physical activity with black females was measured by the BRISK-study in the Cape Peninsula in South Africa (Steyn *et al.*, 2004:483). Like most studies, this study used questionnaires to assess the PA participation when they are at work and during their leisure time. The BRISK-study showed that 27.3% of black urban females between 15 and 64 years are relatively inactive during work hours, where the majority of their activities are done sitting or standing (Steyn *et al.*, 2004:483). Physical activity outside the workplace was absent in 34.5% of the total research sample (n=544) (Steyn *et al.*, 2004:483). The age group that was represented the worst by black females regarding PA, was aged 25 – 34 years where 31.5% reported that they are relatively inactive during working hours and 43% indicated that they did not take part in any extra mural activities (Steyn *et al.*, 2004:483). A study by Bloemhoff (2010:30) comparing physical activity levels of different ethnic groups at a South African university indicated that black female students predominantly participated in low and moderate exercise with 38.5% and 36.7% respectively.

2.5.2.2 Coloured females

During the studying of coloured females in the Cape Peninsula, researchers (Steyn *et al.*, 2004:623) indicated the individuals who had an energy expenditure of <3230 kj/week as determined by means of a questionnaire, did not adhere to the classification of PA during working hours. Physical activity that was equal to an energy expenditure of <8400kj/week was also classified as not enough for physical exercise outside the work place (Steyn *et al.*, 1985:623). Of the 498 coloured females (15-64 years) in the Cape Peninsula an average of 96.2% and 84.9% respectively were classified as inactive during working hours and leisure time and that coloured females aged

15-24 years showed the highest physical activity participation rate (77%) during the study (1985:623).

A follow-up publication of Steyn *et al.* (2004:74) confirmed that coloured females aged 15-24 years reported the highest amount of participation in PA (53.4%).

2.5.2.3 White females

Not enough information is available in the literature for white females. In the study done by Bloemhoff (2010:30) 42.4% of his respondents that are white female students participated in low exercise intensities whereas 30.5% participated in moderate exercise intensities.

2.5.3 Smoking

Tobacco use remains the leading cause of preventable death among all racial groups in the United States (USDHHS, 2010). Smoking among younger adults (18-25 years old) has slightly declined since 2005 but remains a public health problem (Centers for Disease Control and Prevention [CDC], 2011). College students represent a group of younger adults who are malleable to their social environment (Otsuki, Tinsley, Chao, & Unger, 2008:514) and are vulnerable to peer influences of cigarette smoking (USDHHS, 2012). Despite notions that education is inversely related to tobacco use, college smoking remains stable (Rigotti, Lee & Wechsler, 2000:699-705). Furthermore, smoking prevention and intervention programs on college campuses are almost nonexistent (Wechsler, Kelley, Seibring, Kuo, & Rigotti, 2001:205-211).

2.5.3.1   Black females

Steyn *et al.* (2004:229) compares the percentage smokers of urban black females from the Cape Peninsula with rural black females from QwaQwa. Ten point three percent (10.3%) of urban black females reported that they were smokers compared to the 4% reported by the rural group. The percentage smokers amongst urban black females in Durban were 6.74% where only

3.4% smoke more than 10 cigarettes per day (Seedat, Mayet, Latiff & Joubert 1992: 253).

2.5.3.2 Coloured females

The CRISIC-study showed that 41.4% of coloured females in the Cape Peninsula are users of tobacco en that all the respondents were cigarette smokers (Steyn*et al.*, 2004:147). It is evident from this study that especially coloured females aged 25 to 34 years are the most prominent users of tobacco and cigarettes (Steyn *et al.*, 2004:147). Coloured females (aged15 – 64 years) smoked an average of 13.1 ± 8.9 cigarettes per day, (Steyn *et al.*, 2004:147). National representative statistics regarding smoking habits of coloured females show that in total 59% of the coloured females in South Africa are smokers (Reddy, Resnicow, James, Kambaran, Omardien & Mbewu, 2008:1390). With contradiction to smoking habits it comes across that alcohol use makes up a smaller amount of daily use among coloured females in South Africa.

It can be highlighted that literature regarding coloured females with reference to lifestyle (regular physical activity, maintaining a healthy body weight, eating breakfast, consuming three meals a day and sleeping at least 8 hours per day), is insufficient and does not exist.

2.5.3.3 White females

According to Steyn *et al.* (2004:229) the percentage of white female smokers in the rural areas decreased from 17.5% in 1979 to 12.1% in 1991. The biggest decrease came about with the ladies that smoked more than 10 cigarettes a day, from 12.6% to 8.8% (Steyn *et al.*, 2004:29). In the study of Joubert (1995:90), 23.6% (n=71) of the urban white females between the ages of 35 and 49 years were smokers. From this it can be denoted that smoking habits are more general among urban white females compared to rural white females. As a result of a lack of research on white females insufficient information with regard to their lifestyle habits exists, which creates a need for further research.

2.5.4 Alcohol consumption

For many young people, heavy drinking and its associated problems dramatically increase during the transition from high school to college (Park, Sher, & Krull, 2009:404). However, most determinates for heavy drinking are established long before the first day of class (Larimer, Anderson, Baer, & Marlatt, 2000:53; White, McMorris, Catalano, Fleming, Haggerty & Abbott, 2006:810; Arria, Kuhn, Caldeira, O'Grady, Vincent & Wish, 2008:3; Walls, Fairlie, & Wood, 2009:908) Heavy drinkers are at the greatest risk for alcohol-related problems (Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001:1310). In the long term, students who engage in frequent heavy drinking episodes have a relatively low risk for alcohol dependence, at approximately 16% (Schulenberg, O'Malley, Bachman, Wadsworth & Johnston, 1996:289). However, compared to non-heavy drinkers they are seven to 10 times as likely to engage in unplanned sexual activity, get injured, and damage property (Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994:1672) and are eight times as likely to get behind in their schoolwork (Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee, 1998:57).

2.5.4.1 Black females

Regarding alcohol use Levitt, Katzenellenbogen, Bradshaw, Hoffman and Bonnici, (1993:603) reported that 82% of the urban black females that where surveyed in Cape Town, do not use alcohol. Of those that do use alcohol, 13% indicated that they drink less than 2 drinks per day during the week and less than 8 drinks during weekends (Levitt *et al.*, 1993:603). Only 5% had consumed more than the volume mentioned and was classified as heavy drinkers (Levitt *et al.*, 1993:603). The literature review of Vorster, Oosthuizen, Jerling, Veldman, Burger and Mclachlan (1997:116) also showed that ±75% of South African black females are non-drinkers and that this number stayed relatively constant since 1975.

2.5.4.2 Coloured females

It appears that the majority of coloured females (73%) in South Africa consume less alcohol than the other ethnic groups (Vorster *et al.*, 1997:116).

2.5.4.3 White females

As mentioned before a lack of research on white females exists and therefore insufficient information with regard to their lifestyle habits exists, which creates a need for further research.

2.5.5 Sleeping habits

Sleep and sleeping habits have been studied across many population segments. For adults, literature supports 7-8 hour of sleep each night as optimal (Hublin, Partinen & Koskenvuo, 2007:1245; Chaput, Despres, Bouchard & Tremblay, 2008:517). Mounting evidence also suggests less than optimal amounts of sleep may be associated with a number of health problems, including increased risk for obesity, coronary heart disease, type 2 diabetes, and hypertension (Ayas, White, Manson, Stampfer, Speizer, Malhotra & Hu, 2003:205; Hasler *et al.*, 2004:661; Taheri, Lin, Austin, Young & Mignot, 2004:210; Gangwisch, Heymsfield, Boden-Albala, Buijs, Kreier, Pickering, & Malaspina, 2006:833; Lumeng,Somashekar, Appugliese, Kaciroti, Corwyn & Bradley, 2007:1020; Beihl, Liese & Haffner, 2009:351). Studies recognize that sleep disturbances have an important role in triggering metabolic disorders (Crispim, Zalcman, Da'ttilo, Padilha, Edwards, Waterhouse, Tufik & Tu'ilo, 2007:195). Studies suggest that sleep loss is associated with problems concerning glucose metabolism, a risk factor for insulin resistance and diabetes development (Crispim *et al.*, 2007:195).

Varying reports on sleep duration in college students exist. Hicks, Femandez, and Pellegrini (2001:648) sampled three separate large cohorts of students over three consecutive decades and reported a median sleep duration of 6.65 hours in 2000, or one full hour less than reported in the late 1970s. Despite the breadth of literature on racial disparities in health, there are limited

inquiries into the topic of how sleep varies by race (Rao, Poland, Lutchmansingh, Ott, McCracken & Lin, 1999:419).

2.5.5.1 Black females

Using objective data on a group of 38- to 50-year-olds in the CARDIA study, Lauderdale, Knutson, Yan, Rathouz, Hulley, Sidney and Liu (2006:5) found that blacks have lower average sleep duration, lower sleep efficiency, and higher sleep latency than their white counterparts, even after controlling for various socioeconomic and demographic factors. Hale and Phuong Do (2007:1096) stated in their study that black individuals and to some extent other racial minorities have higher odds than whites of having high-risk sleep durations.

2.5.5.2 Coloured females

The study of Szalontai (2006:863) found that coloured females sleep an average of 568 minutes (9.47 hours) per day in a 7day week.

2.5.5.3 White females

Hale and Do (2007:1096) stated that 23.5% of the white participants in their study slept ≤6 hours which is seen as a short duration and 8.9% slept for ≥9 hours which is a long duration.

2.5.6 Ideal body weight

Not only is obesity a problem, but increments of increased weight above a normal body weight are also associated with increased risk of numerous health problems (Wei *et al.,* 1999:89; Cheng *et al.,* 2000:141). The World Health Organization has recommended prevention of weight gain and promotion of weight maintenance as the first two basic steps in the effective control of obesity (WHO, 2000:10).

2.5.6.1   Black females

In females, there is little ethnic difference in overweight; however, the obesity, rates were highest in blacks (Reddy *et al.,* 2008:204). Black women are at high risk for obesity. Nearly 49% are overweight compared to 33% of white

women (Kuczmarski, Flegal, Campbell and Johnson, 1994:205). Black women are also at increased risk for obesity-related health problems, such as cardiovascular disease, strike and diabetes (Kimanyika, 1993:651)

2.5.6.2 Coloured females

In the NHFSC rates of overweight and obesity were higher for black children and children of mixed descent (i.e. 'coloured') than for white and children of Indian descent (Reddy *et al.,* 2008:204).

2.5.6.3 White females

Reddy et al. (2008:204) found the highest rates of obesity among whites during the study that they conducted on South African adolescents.

CHAPTER 3:
RESEARCH METHODS AND PROCEDURES

3.1 Introduction

3.2 Study Design

3.3 Study Participants

3.4 Research Instruments

3.5 Methodological and Measurement errors

3.6 Analyses of the data

3.7 Ethics

3.8 Limitations of the study

3.1 Introduction

This chapter describes the protocol that was designed to investigate the objectives stated in chapter one. A description of the instruments that were used as well as the technique for every measurement will be discussed. In preparation for this dissertation, literature was collected from electronic databases such as Pubmed, EbscoHost, Google Scholar, academic journals and textbooks.

3.2 Study Design

This study could be described as a one-time, non-randomized cross-sectional study, based on the availibility of the population.

3.3 Study Participants

All 1st, 2nd and 3^{rd+} year female students residing on the campus of the University of the Free State were invited to participate in the study. Details of
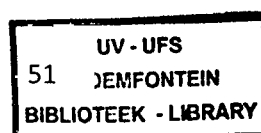
203 766 01.

the study as well as testing procedure were explained to each subject, where-after written consent was obtained.

An informational letter (appendix D) was handed to all participants willing to take part in the study. Written informed consent was obtained from the participants (appendix E). Participation in the study was anonymous and voluntary and participants could discontinue at any time, but were encouraged to complete the study.

The population in the study included female students at the University of the Free State and the sample constituted female students in their 1st, 2nd and 3rd+ year of study residing on campus in the residences of the University of the Free State. The sample consisted of 244 female students in total. The respondents according to year group and ethnicity are shown below in Table 3.1.

Table 3.1:   Female respondents according to year and ethnicity

	1st years (n=77)	2nd years (n=98)	3rd years+ (n=68)
Black students (n=139)	31	65	43
Coloured students (n=21)	5	7	9
White students (n=83)	41	26	16

The different age, height and weight averages according to the year groups are indicated in Table 3.2.

Table 3.2: Average age, height and weight of respondents in the different year groups

	1st years	2nd years	3rd years+
Age	19yrs	20yrs	21yrs
Height	1.64m	1.64m	1.63m
Weight	61.7kg	65.2kg	61.6kg

The different age, height and weight averages according to the ethnic groups are indicated in Table 3.3.

Table 3.3: Average age, height and weight of respondents in the different ethnic groups

	20yrs	20yrs	20yrs
	1.63m	1.63m	1.67m
	61kg	57kg	62.5kg

The aim was to test at least 50 respondents per ethnic group in each of the year groups (first, second and third year). The target was not reached due to the respondent's lack of willingness to participate in this study.

The testing of participants was performed at the residences on the campus of the University of the Free State. Participants were informed about the procedure with regard to the research project and asked to participate at a residence meeting one day prior to the day of testing. The testing took place between 08:00 and 18:00 daily at the respective residence for that specific day. All measurements were done personally by the researcher.

3.4 Research Instruments

The researcher made use of two questionnaires, and a measurement protocol to determine the PA levels, lifestyle habits and body composition of the respondents.

3.4.1 *International Physical Activity Questionnaire (IPAQ) (2012)*
(www.ipaq.ki.se/scoring.pdf, 2005)(Appendix A).

Physical inactivity is a global concern, but diverse physical activity measures in use prevent international comparisons. The International Physical Activity Questionnaire (IPAQ) (2012) was developed as an instrument for cross-national monitoring of physical activity and inactivity. (Craig et al, 2003). The IPAQ (2012) was created in the early 1990's to allow researchers from across the globe to employ the same questionnaire within their country (Medina Garcia, 2013). Overall, the IPAQ (2012) questionnaires produced repeatable data (Spearman's rho clustered around 0.8), with comparable data from short and long forms. Criterion validity had a median rho of about 0.30, which was comparable to most other self-report validation studies. The "usual week" and "last 7 days" reference periods performed similarly, and the reliability of telephone administration was similar to the self-administered mode (Craig *et al.*, 2003:1381-1395).

The IPAQ (2012) has two forms known as the short and the long forms. The short form was used for the purpose of this study. The reason for using the short version is because it is more widely used and was sufficient for the information needed to draw suitable conclusions. The long form of the IPAQ (2012) is much more extensive and time consuming and not all of the information gathered in the long form was required.

Characteristics of the IPAQ (2012) short form are summarized as follows:

1. The IPAQ (2012) assesses physical activity undertaken across a comprehensive set of domains including:
   - a.   Leisure time physical activity;
   - b.   Domestic and gardening (yard) activities;
   - c.   Work-related physical activity; and
   - d.   Transport-related physical activity;

2. The IPAQ (2012) short form asks about three specific types of activities

undertaken in the four domains introduced above. The specific types of activities that are assessed are walking, moderate-intensity activities and vigorous intensity activities.

3. The items in the short IPAQ (2012) form are structured to provide separate scores on walking, moderate intensity and vigorous intensity activity. Computation of the total score for the short form requires summation of the duration (in minutes) and frequency (days) of walking, moderate intensity and vigorous intensity activities. Domain specific estimates cannot be estimated (www.ipaq.ki.se/scoring.pdf, 2012).

The IPAQ (2012) is scored in three categories ranging from low to high:
Category 1: Low
This is the lowest level of physical activity. Individuals who do not meet criteria for categories 2 or 3 are considered to have a 'low' physical activity level.

Category 2: Moderate
The pattern of activity to be classified as 'moderate' is either of the following criteria namely:

- 3 or more days of vigorous intensity activity of at least 20 minutes per day, OR
- 5 or more days of moderate intensity activity and/or walking of at least 30 minutes per day, OR
- 5 or more days of any combination of walking, moderate intensity or vigorous intensity activities achieving a minimum total physical activity of at least 600 MET-minutes/week.

Individuals meeting at least one of the above criteria would be defined as accumulating a minimum level of activity and therefore be classified as 'moderate'.

Category 3: High
A separate category labeled 'high' can be computed to describe higher levels of participation. The two criteria for classification as 'high' are:

- Vigorous intensity activity on at least 3 days achieving a minimum total physical activity of at least 1500 MET-minutes/week, OR
- 7 or more days of any combination of walking, moderate intensity or vigorous intensity activities achieving a minimum total physical activity of at least 3000 MET-minutes/week. (www.ipaq.ki.se/scoring.pdf, 2005)

3.4.2 *Belloc and Breslow's7 lifestyle habits questionnaire* (Belloc & Breslow, 1972:409), (Appendix B).

Belloc and Breslow (1972:409) identified 7 key aspects that lead to a healthy lifestyle, namely:

- *3 meals per day without in-between eating.* It is recommended that meals are well spaced and balanced between the different nutrients that are required per day. In-between eating adds more food to be digested by the body in a 24-hour cycle making it more difficult for the body to break down all foods;
- *Eating breakfast.* Breakfast is considered the most important part of the daily food intake as it starts the metabolism, and the later the metabolism starts working the less food will be digested and broken down in the body;
- *2-3 times per week participation in moderate activity.* Taking part in moderate activity helps keep the heart working at a regular pace and keep it strong;
- *No smoking.* Lung cancer is one of the most common cancers in modern society, which is caused by smoking. Cigarettes contain tar which is captured by the lungs and helps with the development of cancer;
- *Little / no alcohol intake.* Alcohol is a carbohydrate that inhibits lipolysis which is the breakdown of fat in the body, which in turn can increase fat stored and accumulated in the body;
- *Enough sleep (7 – 8 hours).* Getting enough sleep helps the body replenish the energy that was used during the day, to make sure that the body has enough to continue throughout the next day; and

- *Maintaining a healthy weight.* By maintain a healthy weight the individual avoids any chances of being overweight or even obese, since statistics show that obesity starts as early as the age of 5 years in certain societies.

These lifestyle habits are rated according to the amount of habits the individual adheres to:

- ≤ 3 lifestyle habits = poor health lifestyle;

- 4-5 lifestyle habits = moderate health lifestyle; and

- 6-7 lifestyle habits = healthy lifestyle.

3.4.3 *The Heath and Carter anthropometrical assessment* (Appendix C). The following skinfold measurements were performed on each subject. These measurements were carried out by researcher and the measurement technique followed the guidelines of the International Standards for Anthropometric assessment (Marfell-Jones, Olds, Stewart & Carter 2006:31)

- Triceps:
  Definition: The most posterior part of the Triceps when viewed from the side at the marked Mid-acromiale-radiale level.
  Subject position: When marking the sites for the Triceps skinfold the subject assumes the anatomical position.
  Location: The Triceps skinfold site is marked over the most posterior part of the Triceps when viewed from the side at the marked Mid-acromiale-radiale level.

- Subscapular
  Definition: The site 2 cm along a line running laterally and obliquely downward from the Subscapular landmark at a 45° angle.
  Subject position: The subject assumes a relaxed standing position with the arms hanging by the sides.

Location: Use a tape measure to locate the point 2 cm from the Subscapular in a line 45° laterally downward.

- Suprailiac

Definition: The site at the center of the skinfold raised immediately above the marked Iliocristale.

Subject position: The subject assumes a relaxed position with the left arm hanging by the side and the right arm abducted to the horizontal.

Location: This skinfold is raised immediately superior to the Iliocristale. Align the fingers of the left hand on the Iliocristale landmark and exert pressure inwards so that the fingers roll over the iliac crest. Substitute the left thumb for these fingers and relocate the index finger a sufficient distance superior to the thumb so that this grasp becomes the skinfold to be measured. Mark the center of the raised skinfold. The fold runs slightly downwards anteriorly as determined by the natural fold of the skin.

- Abdominal/Para-Umbilicus

Definition: The site 5 cm to the right hand side of the omphalion (midpoint of the navel).

Subject position: The subject assumes a relaxed standing position with the arms hanging by the sides.

Location: This is a vertical fold raised 5 cm from the right hand side of the omphalion.

- Anterior mid thigh

Definition: The site at the mid-point of the distance between the Inguinal fold and the anterior surface of the patella (Anterior patalla) on the midline of the thigh.

Subject position: The subject assumes a seated position with the torso erect and the arms hanging by the sides. The knee of the right leg should be bent at a right angle.

Location: The measurer stands facing the right side of the seated subject on the lateral side of the thigh. The site is marked parallel to the long axis of the thigh at the mid-point of the distance between the

Inguinal fold and the superior margin of the anterior surface of the patella (while the leg is bent). The Inguinal fold is the crease at the angle of the trunk and the thigh. If there is difficulty locating the fold the subject should flex the hip to make a fold. Place a small horizontal mark at the level of the mid-point between the two landmarks. Now draw a perpendicular line to intersect the horizontal line. This perpendicular line is located in the midline of the thigh. If a tape is used be sure to avoid following the curvature of the surface of the skin.

- Medial calf

  Definition: The site on the most medial aspect of the calf at the level of the maximal girth.

  Subject position: The subject assumes a relaxed standing position with the arms hanging by the sides. The subject's feet should be separated with the weight evenly distributed.

  Location: The level of the maximum girth is determined and marked with a small horizontal line on the medial aspect of the calf. The maximal girth is found by using the middle fingers to manipulate the position of the tape in a series of up or down measurements to determine the maximum girth. View the marked site from the front to locate the most medial point and mark this with an intersecting vertical line.

According to Marfell-Jones *et al.* (2006:63), the skinfold site should be carefully located using the correct anatomical landmarks. Anthropometric measurements are done with a skinfold caliper, but it should be noted that the accuracy of the test is dependent on the measurer and his/her skill level. Body fat percentage is determined by means of the Carter (1982:109) formula, namely: (the sum of the 6 skinfolds X 0.1548) + 3.58. The 6 skinfold measurements are as follows:

- Triceps;
- Subscapular;
- Suprailiac;

- Abdominal/Para-Umbilicus;
- Anterior Mid Thigh; and
- Medial Calf.

The measurements were taken on the right side of the body in an upright standing position, with exception of the Medial Calf, which is taken in the sitting position, (from the example of Carter & Heath, 1990:368).

Table 3.4: Body composition (% Body fat) for woman (ACSM, 2010:72).

AGE							
%	20-29	30-39	40-49	50-59	60-69	70-79	
99	9.8	11	12.6	14.6	13.9	14.6	VL
95	13.6	14	15.6	17.2	17.7	16.6	
90	14.8	15.6	17.2	19.4	19.8	20.3	E
85	15.8	16.6	18.6	20.9	21.4	23	
80	16.5	17.4	19.8	22.5	23.2	24	
75	17.3	18.2	20.8	23.8	24.8	25	G
70	18	19.1	21.9	25.1	25.9	26.2	
65	18.7	20	22.8	26	27	27.7	
60	19.4	20.8	23.8	27	27.9	28.6	
55	20.1	21.7	24.8	27.9	28.7	29.7	F
50	21	22.6	25.6	28.8	29.8	30.4	
45	21,9	23.5	26.5	29.7	30.6	31.3	
40	22.7	24.6	27.6	30.4	31.3	31.8	
35	23.6	25.6	28.5	31.4	32.5	32.7	P
30	24.5	26.7	29.6	32.5	33.3	33.9	
25	25.9	27.7	30.7	33.4	34.3	35.3	
20	27.1	29.1	31.9	34.5	35.4	36	
15	28.9	30.9	33.5	35.6	36.2	37.4	VP
10	31.4	33	35.4	36.7	37.3	38.2	
5	35.2	35.8	37.4	38.3	39	39.3	
1	38.9	39.4	39.8	40.4	40.8	40.5	
n =	1360	3597	3808	2366	849	136	
Total n = 12116							
Norms are based on Cooper Clinic patients							
Very lean - No less than 10-13% body fat is recommended for females							
VL - very lean; E - excellent; G - good; F - fair; P - poor; VP - very poor							

The following girths are measured to calculate the waist to hip ratio namely:

- Waist

Subject position: The subject assumes a relaxed standing position with the arms folded across the thorax.

Method: This girth is taken at the level of the narrowest point between the lower costal (10th rib) border and the iliac crest. The anthropometrist stands in front of the subject who abducts the arms slightly allowing the tape to be passed around the abdomen. The stub of the tape and the housing are then both held in the right hand while the anthropometrist uses the left hand to adjust the level of the tape at the back to the adjudged level of the narrowest point.

The anthropometrist resumes control of the stub with the left hand and using the cross-hand technique positions the tape in front at the target level. The subject is instructed to lower their arms to the relaxed position. The tape is then readjusted as necessary to ensure it has not slipped and does not excessively indent the skin. The subject should breathe normally and the measurement is taken at the end of a normal expiration (end tidal). If there is no obvious narrowing the measurement is taken at the mid-point between the lower costal (10th rib) border and the iliac crest.

- Hip

Subject position: The subject assumes a relaxed standing position with the arms folded across the thorax. The subject's feet should be together and the gluteal muscles relaxed.

Method: The girth is taken at the level of the greatest posterior protuberance of the buttocks which usually corresponds anteriorly to about the level of the symphysis pubis. The anthropometrist passes the tape around the hips from the side. The stub of the tape and the housing are then both held in the right hand while the anthropometrist uses the left hand to adjust the level of the tape at the back to the adjudged level of the greatest posterior protuberance of the buttocks. The anthropometrist resumes control of the stub with the left hand, and

62

using the cross-hand technique, positions the tape in front and the sides so that the tape is held in a horizontal plane at the target level. The tape is then readjusted as necessary to ensure it has not slipped and does not excessively indent the skin.

- Arm (relaxed)

  Subject position: The subject assumes a relaxed standing position with the arms hanging by the sides. The subject's right arm is abducted slightly to allow the tape to be passed around the arm.

  Method: The girth of the arm is measured at the marked level of the Mid-acromiale-radiale. The tape should be positioned perpendicular to the long axis of the arm.

- Arm (flexed and tensed)

  Subject position: The subject assumes a relaxed standing position with the left arm hanging by the side. The subject's right arm is raised anteriorly to the horizontal with the forearm supinated and flexed at about 45-90° to the arm.

  Method: The flexed and tensed arm girth is measured at the level of the peak of the contracted Biceps. The measurer stands to the side of the subject and with the tape loosely in position. The subject is asked to partially tense the elbow flexors to identify the probable peak of the contracted muscles. The subject is encouraged to contract the arm muscles as strongly as possible and hold it while the measurement is made at the peak of the Biceps. If there is no obvious peak of the Biceps this girth should be measured at the level of the Mid-acromiale-radialelandmark.

- Calf (maximum)

  Subject position: The subject assumes a relaxed standing position with the arms hanging by the sides. The subject's feet should be separated with the weight evenly distributed.

  Method: The maximum girth of the calf at the marked Medial calf skinfold site. The subject stands in an elevated position. The elevated position will make it easier for the measurer to align the eyes with the

tape. The anthropometrist passes the tape around the calf and then slides the tape to the correct plane. The stub of the tape and the housing are both held in the right hand while the anthropometrist uses the left hand to adjust the level of the tape to the marked level. The anthropometrist resumes control of the stub with the left hand and using the cross-hand technique positions the tape so that it is held in a plane perpendicular to the axis of the leg. The tape is then readjusted as necessary to ensure it has not slipped and does not excessively indent the skin.

The waist to hip ratio is calculated by dividing the waist circumference (cm) with the hip circumference (cm) and it determines the relative size of the subject's waist and can also be linked to the risk factors of coronary heart diseases. The norms for females that coincide with the norms the ACSM (2010:64) provide as high health risk of >0.86, are shown below in Table 3.4:

Table 3.5: Waist-to-hip ratio (WHR) norms for females

	acceptable		unacceptable		
	excellent	good	average	high	extreme
female	< 0.75	0.75 - 0.80	0.80 - 0.85	0.85 - 0.90	> 0.90

(http://www.topendsports.com/testing/tests/WHR.htm)

According to the ACSM (2010:63) the BMI is used to assess weight relative to height and is calculated by dividing body weight in kilograms by height in meters squared (kg•m^2). A BMI of 25.0 to 29.9 kg•m^2 is listed for overweight and a BMI of more or equal to 30.0 kg/m^2 for obesity. A BMI of less than 18.5kg•m^2 also increases the risk of cardiovascular disease (ACSM, 2010:63). Body mass index is one means of determining whether an individual is at an appropriate weight. Individuals of abnormally high or abnormally low BMI are at risk for various diseases and disorders, making BMI an important diagnostic tool in medicine and personal health monitoring. However, BMI isn't always a reliable measure of health.

Table 3.6: Classification of disease risk based on body mass index (BMI) and waist circumference (ACSM, 2010:72)

		Disease risk relative to normal weight and waist circumference		
	BMI (kg•m²)	Women ≤88cm		Women >88cm
Underweight	<18.5	--		--
Normal	18.5 - 24.9	--		--
Overweight	25 - 29.9	Increased		High
Obesity				
Class I	30 - 34.9	High		Very high
Class II	35 - 39.9	Very high		Very high
Class III	≥40	Extremely high		Extremely high

The following breadths were also measured to calculate the average bone breadths of the students. Bone breadth was measured to the nearest 0.1 cm with a large sliding caliper (Campbell 54cm: Rosscraft). In cases where the measurement error of the first two readings was greater than 2 mm, a third measurement was taken. The median of the three measurements were taken as the final value (Marfell-Jones *et al.,* 2006:8).

- Bi-epicondylar humerus
  Subject position: The subject assumes a relaxed standing or seated position. The right arm is raised anteriorly to the horizontal and the forearm is flexed at right angles to the arm.
  Method: The distance is measured between the medial and lateral epicondyles of the humerus. With the small sliding caliper gripped correctly, use the middle fingers to palpate the epicondyles of the humerus, starting proximal to the sites. The bony points first felt are the epicondyles. Place the caliper faces on the epicondyles and maintain strong pressure with the index fingers until the value is read.

Because the medial epicondyle is normally lower than the lateral epicondyle the measured distance may be somewhat oblique (Marfell-Jones *et al.,* 2006:116).

- Bi-epicondylar femur

  Subject position: The subject assumes a relaxed seated position with the palms resting on the thighs. The right leg is flexed at the knee to form a right angle with the thigh.

  Method: The distance is measured between the medial and lateral epicondyles of the femur. With the subject seated and the caliper in place, use the middle fingers to palpate the epicondyles of the femur beginning proximal to the sites. The bony points first felt are the epicondyles. Place the caliper faces on the epicondyles and maintain strong pressure with the index fingers until the value is read (Marfell-Jones *et al.,* 2006:117).

Height and weight was also part of the variables measured.

- Height was measured with two flexible steel (anthropometric) tapes each 1.5m long placed against the wall to measure the individuals' height.

- Weight was measured with a bathroom scale, that was calibrated every morning before testing started.

3.4.4 Informed consent and declaration of accurate information

The testing procedures, risks, benefits, and confidentiality of information was explained to each participant in a language in their command. Participants then signed an informed consent form (Appendix E) declaring the giving of accurate information, voluntary participation, and the use of information for scientific purposes.

3.5 Methodological and measurement errors

There are no known methodological and measurement errors to report. All measurements were carried out by the researcher.

3.6 Analyses of the data

Data from the questionnaires was captured electronically in Microsoft Excel by the researcher. Any further analysis was done by a statistician using SAS Version 9.2. Descriptive statistics namely frequencies and percentages were calculated for categorical data. For numerical data, mean and standard deviations were calculated when data was evenly distributed, and medians and percentiles were calculated where data was not normally distributed. The Shapiro-Wilk test (Villasenor Alva & Gonzalez Estrada, 2009:1871) was used to investigate the normality of numerical data. All numerical data were skewed and consequently the medians and percentiles were calculated. The Chi-Square statistics (of Fischer's- exact test) (Thomas, Nelson & Silverman, 2011:134) was used to investigate proportional differences between year groups and ethnic groups. The Kruskal-Wallis test (Thomas *et al.*, 2011:187) was used to investigate median differences between the year groups and ethnic groups. A significance level of ($p < 0.05$) was used throughout the research study. Where no significant difference was achieved a level of ($p = > 0.05$) was used throughout the research study.

3.7 Ethics

Ethics approval was obtained from the Ethics Board of the Faculty of Humanities, University of the Free State.

3.8 Pilot study

A pilot study with three students was conducted three months prior to the study. The researcher made use of two questionnaires and a measurement protocol to determine the PA levels, lifestyle habits and body composition of the respondents The questionnaires was found effective in testing the proposed objectives. The somatotyping was also performed without any difficulties.

3.9 Limitations of the study

Some of the possible errors that can occur are listed below:

- Questionnaires that are not answered truthfully; and
- Small sample. The sample target was not reached due to the unwillingness of students to participate in the project.

CHAPTER FOUR:

RESULTS, INTERPRETATION AND DISCUSSION

4.1 Introduction

The aim of this study was to compile a physical activity and lifestyle profile of female students residing on campus at the University of the Free State. Data were gathered with regard to their physical activity (PA) level, lifestyle habits and body composition. All respondents were required to provide information about their year of study, age, physical activity level (current and future intention to participate in physical activity), the lifestyle they maintain and anthropometric measurements were done on the participants.

The data was compared in the year of study as well as in the three major ethnic groups on campus (black, coloured and white). A total of 244 questionnaires were handed out to the respondents, the anthropometric measurements were also performed once the questionnaire were completed

by participants. Two hundred and forty-four (244) questionnaires were gathered for data processing, constituting a 100% response rate.

4.2 Demographic Information

Various demographic data was collected regarding the participants. These included data about the participants' age, ethnicity, year of study, physical activity participation in 2012, the amount of time they spent on physical activity, lifestyle habits and their anthropometric data. To illustrate the demographics, bar graphs and pie charts are made use of.

4.2.1 Age

The average age in the group was 20 years old over the year groups and ethnic groups. The average range was between 19 and 21 years old. These results are illustrated in Table 4.1 below (n = 224).

Table 4.1:   Average age of students

20	19.00	21.00

4.2.2 Ethnic dispersion of students

The three major ethnic groups on the campus who were willing to participate in this study were compared. The majority of the group was black students (56.17%), with coloured students only (8.61%) and white students (34.43%). Figure 4.1 illustrate the ethnic dispersion of the three groups.
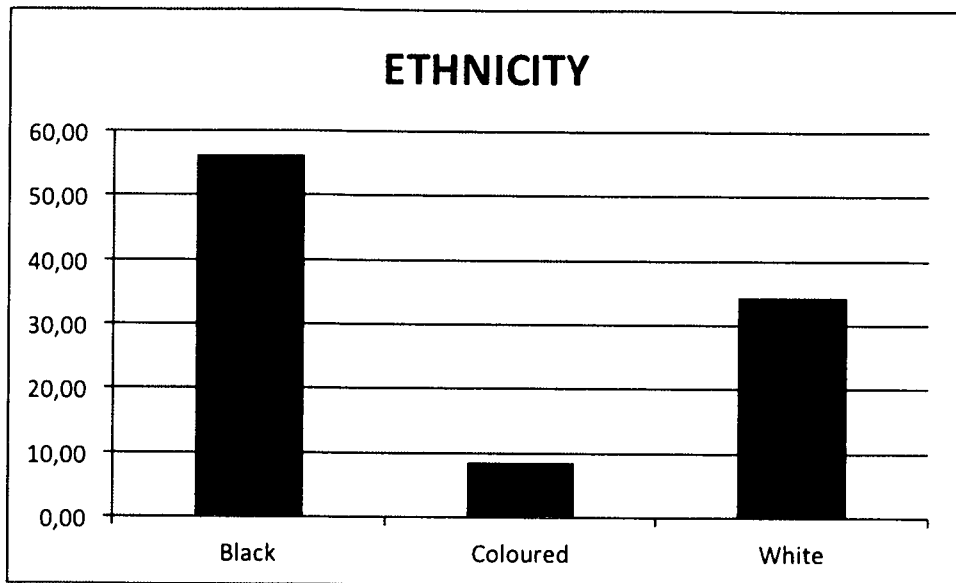
Figure 4.1: Ethnicity dispersion of students (X: Percentage; Y: Ethnicity)

4.2.3 Year of study

The majority of the respondents were 2nd year students (40.16%) with the least of the students being 3rd year+ (27.87%). The ethnicity dispersion is shown in Figure 4.2.
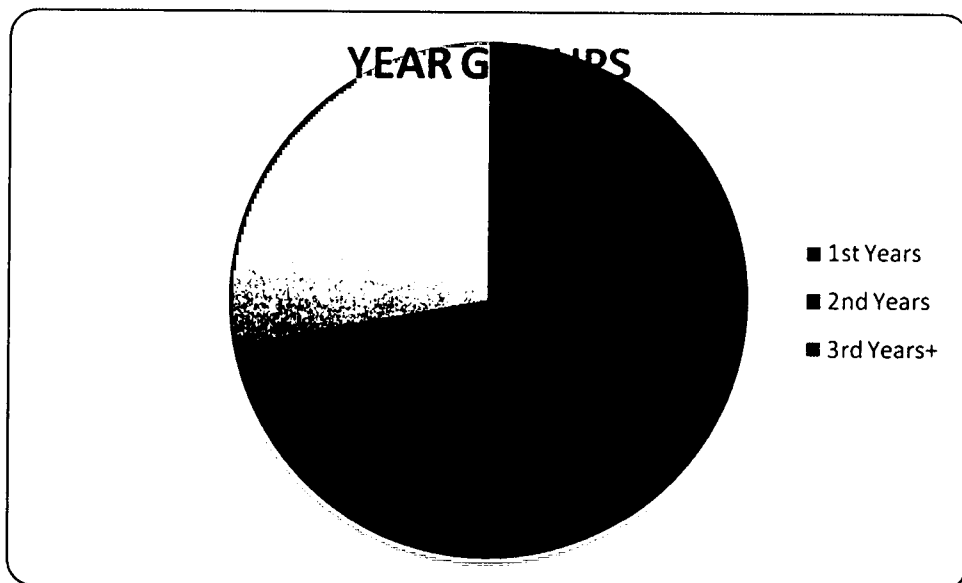
Figure 4.2: Year group dispersion of students

4.2.3 Physical activity participation of students

The participants indicated that during 2012, 40.16% did take part in some form of physical activity. The physical activity participation of the participants is illustrated in Figure 4.3.

PA PARTICIPATION: 2012

- YES
- NO

Figure 4.3: Physical activity participation of students

4.2.4 Sport codes dispersion between ethnic groups

In 2012, 39.29% of the respondents indicated that they played soccer, hockey 23.41% and netball 28.57% respectively. The sport code dispersion is illustrated in Figure 4.4 below.
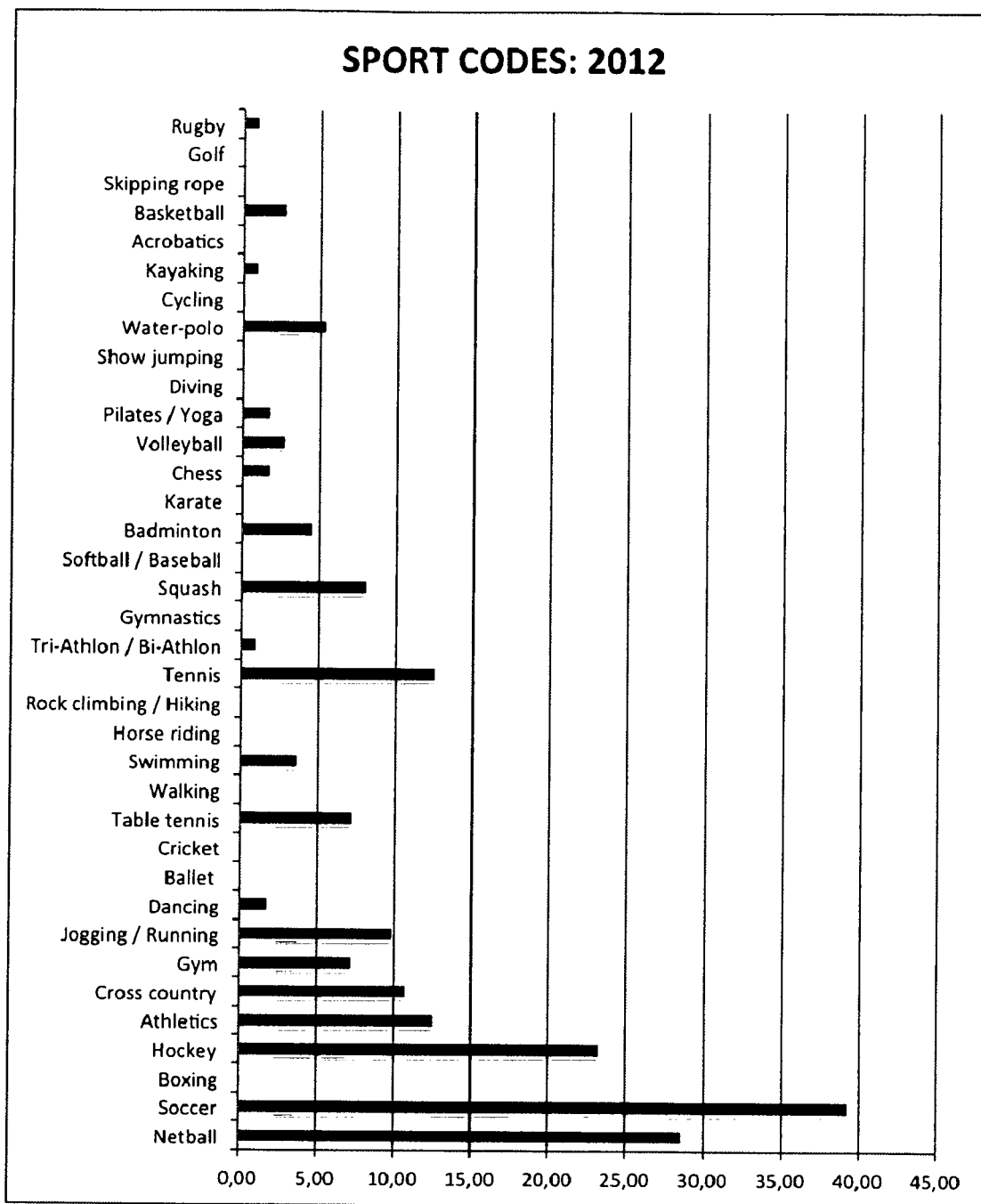
SPORT CODES: 2012

Figure 4.4: Sport code dispersion of the ethnic groups (X: Sport Codes; Y: Percentages)

4.2.5 Days spent doing physical activity by students

All of the participants walk every day of the week. It is also important to note that the participants spent at most 2 days, doing moderate and vigorous PA (Figure 4.5).
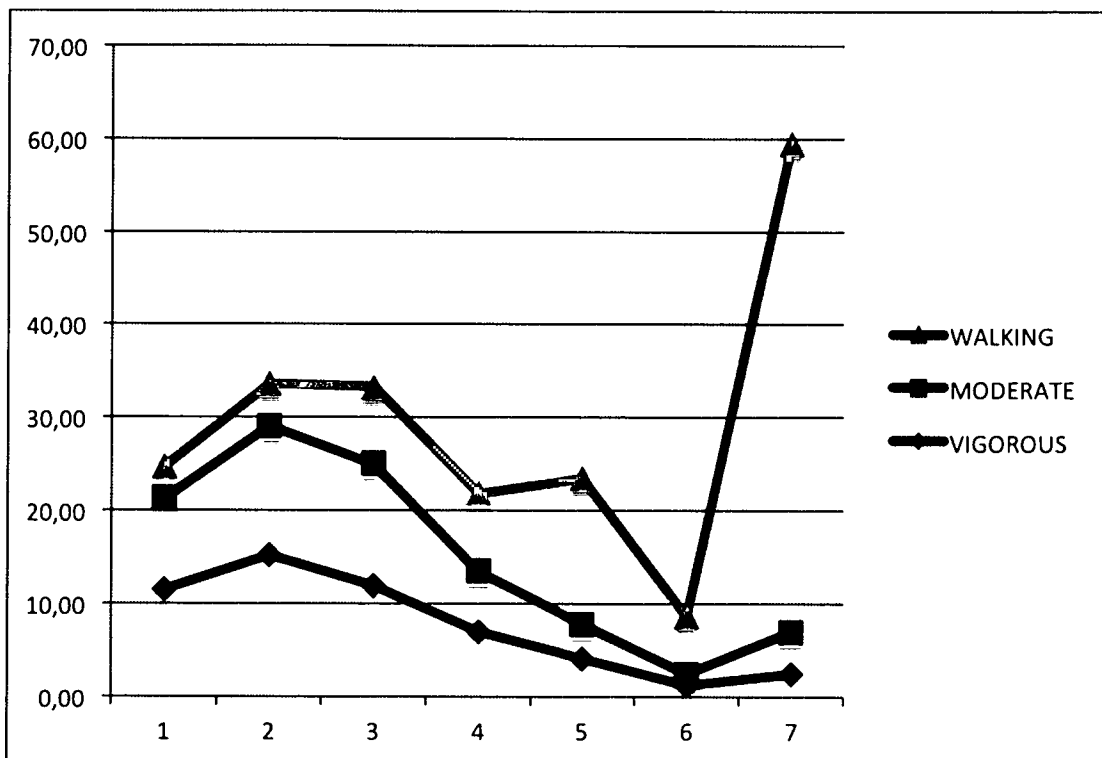
Figure 4.5: Amount of time per week spent doing PA by students (X: Percentages; Y: Number of days)

The participants were also asked to indicate the amount of time they spent doing PA. The majority of the students indicated that they do vigorous PA (42.5 min), moderate PA (30min) and walking activity 35 minutes (Figure 4.6).
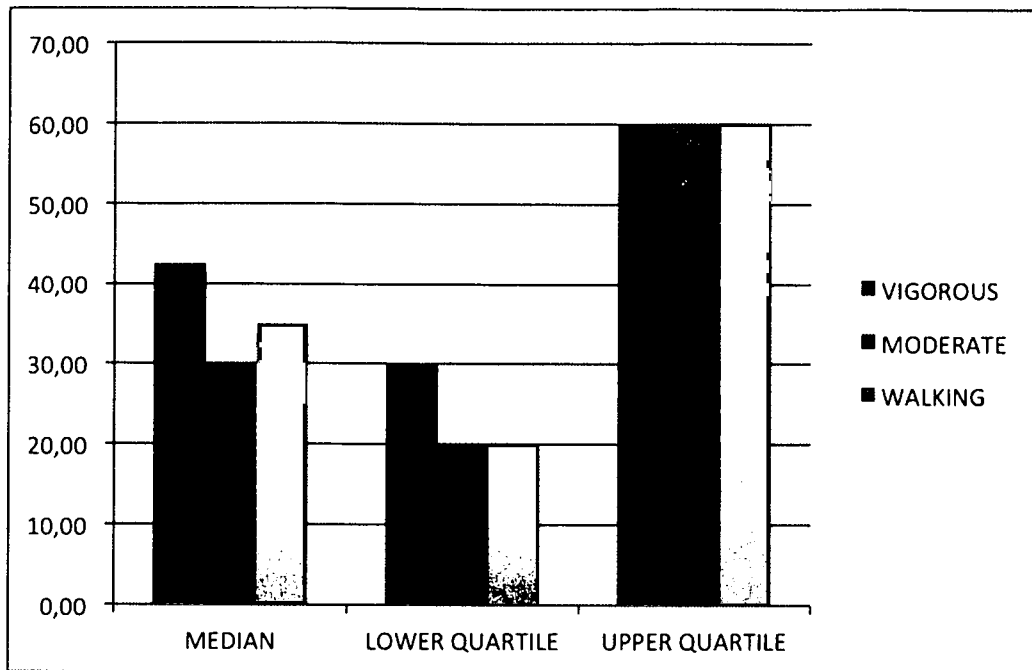
Figure 4.6: Amount of time spent doing PA by students (X: Percentages; Y: Quartiles)

4.2.6 Lifestyle habits of students

The respondents were asked to provide information on their lifestyle habits by means of completing the questionnaire of Belloc and Breslow, (1972: 409) 7 lifestyle habits. An average of 4 out of the 7 lifestyle habits is being followed by the majority of the participants. The majority of participants eat breakfast daily (51.64%) but they do not eat 3 meals per day. Eighty-seven present (87.70%) of the sample are non-smokers, with 77.05% of the respondents consuming little to no alcohol, and at least 66.80% of the group maintains a healthy body weight. Unfortunately their eating, sleeping and exercise habits are not optimal (Figure 4.7).
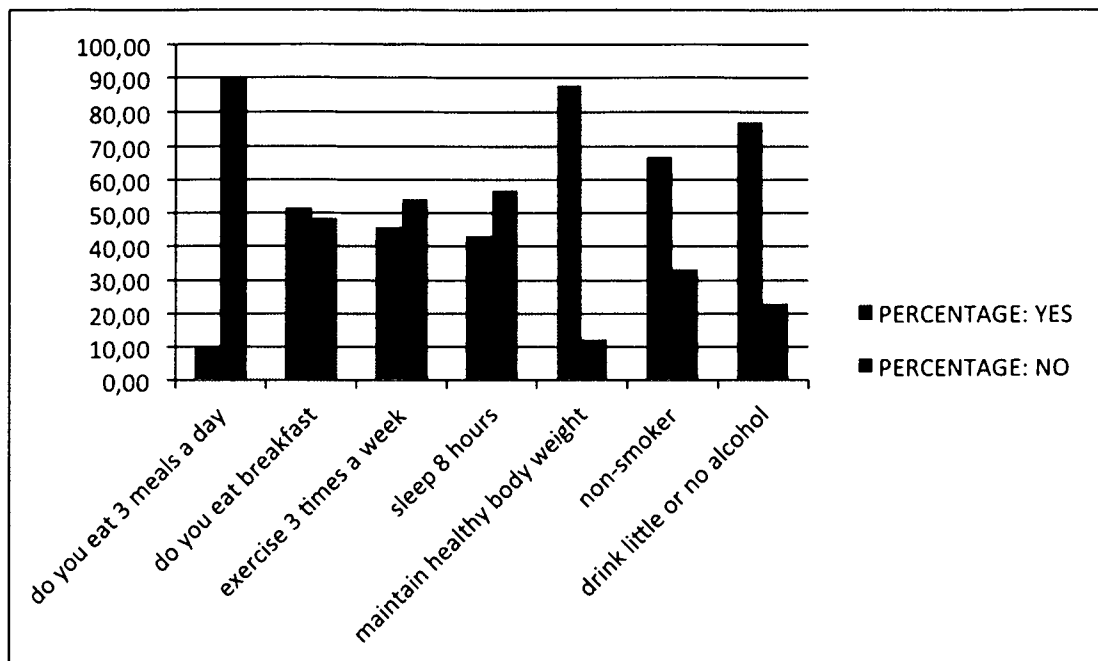
Figure 4.7: Lifestyle habits of students (X: Percentages; Y: Lifestyle habits)

4.2.7 Anthropometric profile of students

The anthropometric measurements indicated that the average female student at the University of the Free State is 164cm tall and weighing 61.50kg. The average skinfold measurements are; triceps (20.10mm), subscapular (17.10mm), suprailiac (18.60mm), abdomen (24.0mm), medial thigh (36.80mm) and medial calf (19.50mm), which results in a body fat percentage of 25% (according to the classification of ACSM,(2010:72)). It is important to note that this is classified as poor. The averages BMI of the female students were 23. However, aaccording to the International Classification of Adult Underweight, Overweight and Obesity, the BMI of the average female student falls within the normal range (WHO, 2006). The average waist and hip circumferences of the participants are 71cm and 102cm respectively, which results in a waist-to-hip ratio of 0.69 (the norm is <0.75). This also indicates again that the average female student is classified as having an excellent waist to hip ratio with a lean body mass of 45kg and a fat mass of 16.5kg. Unfortunately, the average body fat of the female students is too high. The anthropometric profile of the female students is shown below in Table 4.2 which includes the lower and upper quartile range in which these results fall.

76

Table 4.2:   Anthropometric profile of students

STATURE			
Weight (kg)	61.50	54.00	68.00
Height (cm)	164.00	160.00	168.00
SKINFOLD MEASUREMENTS (mm)			
Triceps	20.10	15.50	26.40
Subscapular	17.10	12.40	25.60
Suprailiac	18.60	13.40	26.20
Abdomen	24.00	17.60	30.50
Anterior Mid Thigh	36.80	28.80	46.60
Medial Calf	19.50	15.20	25.60
GIRTH MEASUREMENTS (cm)			
Waist	71.00	66.00	77.00
Hip	102.00	97.00	108.00
Calf (Maximum)	36.00	34.00	38.00
Arm (Relaxed)	27.00	25.00	29.00
Arm (Flexed and Tensed)	29.00	27.00	31.00
BONE BREADTHS (cm)			
Bi-epicondylar Humerus	6.00	5.50	6.00
Femur	9.00	8.50	9.50
SUMMARY			
Fat Percentage (%)	25.00	20.00	30.00
Lean Body Mass (LBM) (kg)	45.00	41.00	50.00
Body Mass Index (BMI)	23.00	20.00	25.00
Waist-to-Hip Ratio (W:H Ratio)	0.69	0.67	0.74

4.3 Profile of 1st year female students

4.3.1 Age of 1st year students

The average age amongst the 1st year group was 19 years old, with the upper and lower quartiles being 19 and 21 years old respectively (Table 4.3).

Table 4.3 Average age of 1st year students

19	19	21

4.3.2 Ethnic dispersion of 1st year students

Of all the respondents (n = 224) in the 1st year group, 53.85% were white female students, 40.0% black female students and the minority were coloured female students with 6.41%. Figure 4.8 shows the dispersion of the ethnic groups amongst 1st years female students at the University of the Free State who were willing to participate in this study.
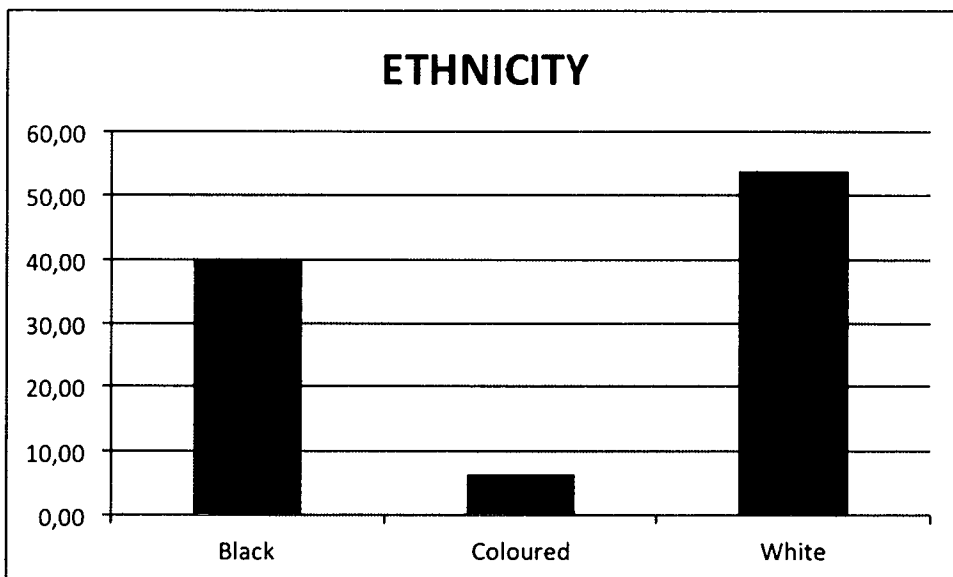
Figure 4.8: Ethnic dispersion of 1st year students (X: Percentages; Y: Ethnicity)

4.3.3 Physical activity participation of 1st year students

Figure 4.9 indicate that only 55.13% of 1st year students participate in PA.

PA PARTICIPATION: 2012

■ YES
■ NO

Figure 4.9: Physical activity participation of 1st year students

4.3.4 Sport codes participation of 1st year students

Figure 4.10displays all the sport codes in which first years at the University of the Free State on the campus participated in. Soccer (46.34%) is the most popular code followed by hockey (31.71%) and netball (24.39%). All the other sport codes in which 1st year students participated is illustrated in Figure 4.10
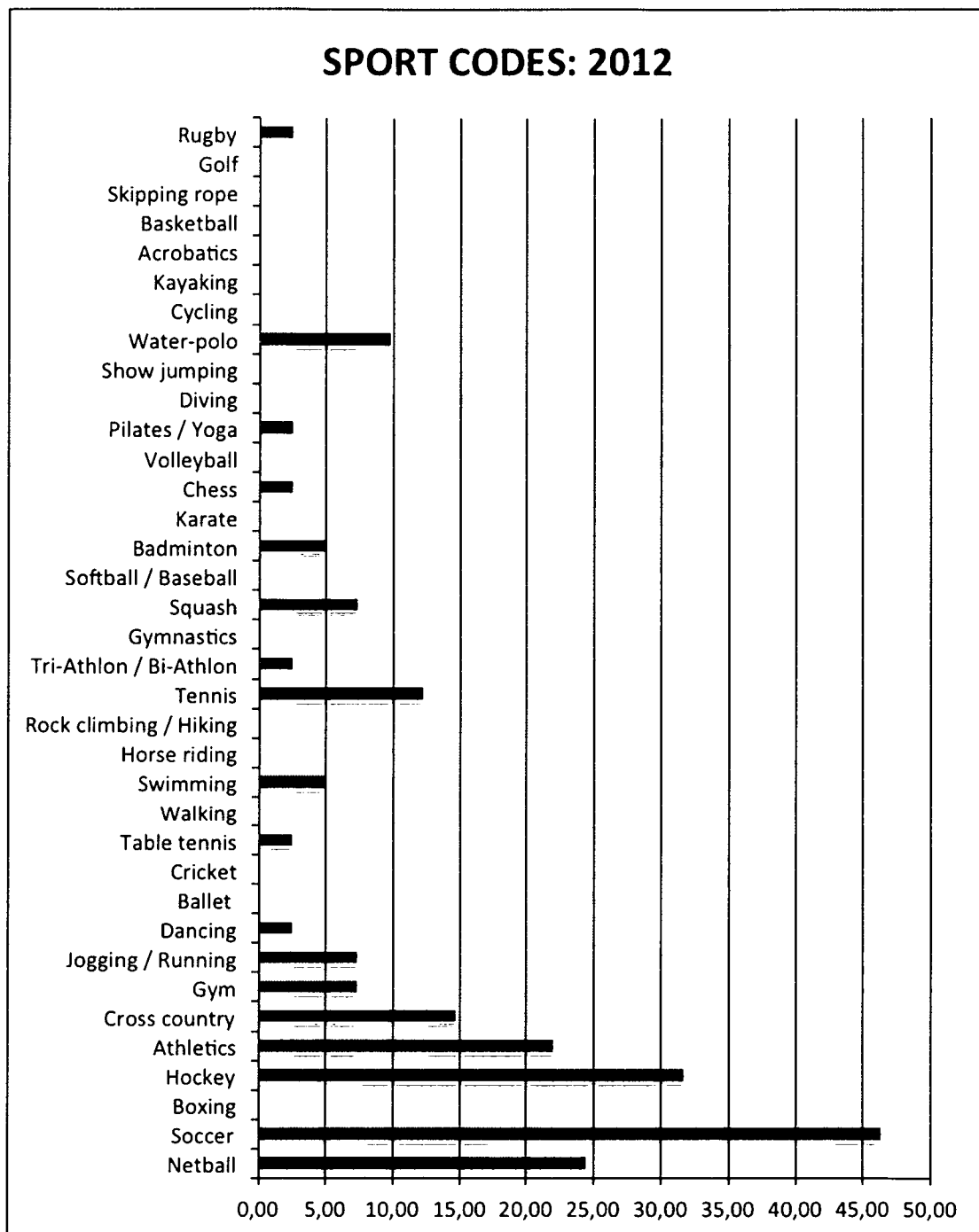
Figure 4.10: Sport code dispersion of 1st year students (X: Sport codes; Y: Percentages)

4.3.5 Days spent on physical activity by 1st year students

The 1st year group indicated that they participated in walking (53.85%), 7 days a week. Vigorous and moderate activities are also illustrated in Figure 4.11.
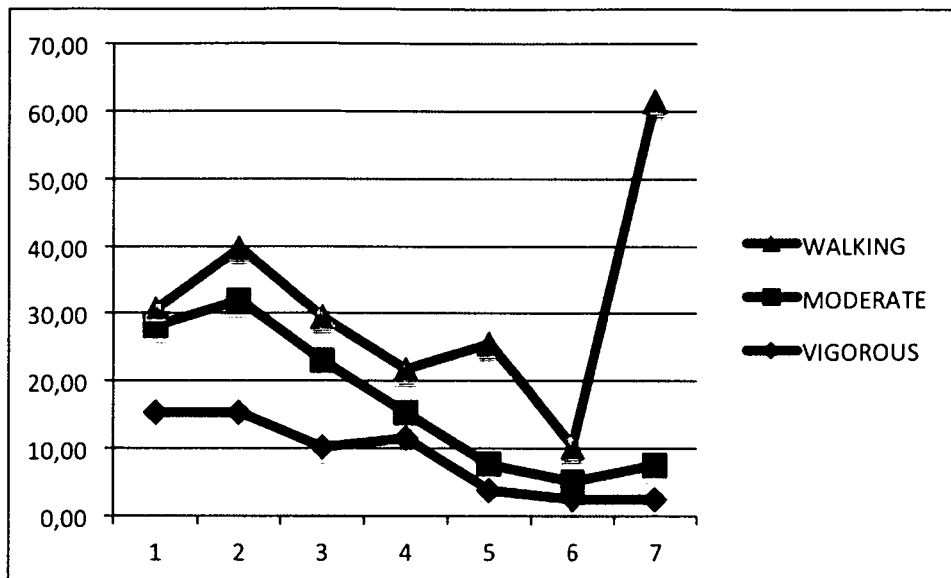
Figure 4.11: Amount of days spent doing PA by 1ˢᵗ year students (X: Percentages; Y: Number of days)

The average time spent by first year students doing vigorous, moderate and walking activity was 40min, 30min and 45min, respectively. Figure 4.12 below shows the lower and upper quartiles in which these results fall for the 1ˢᵗ year group.
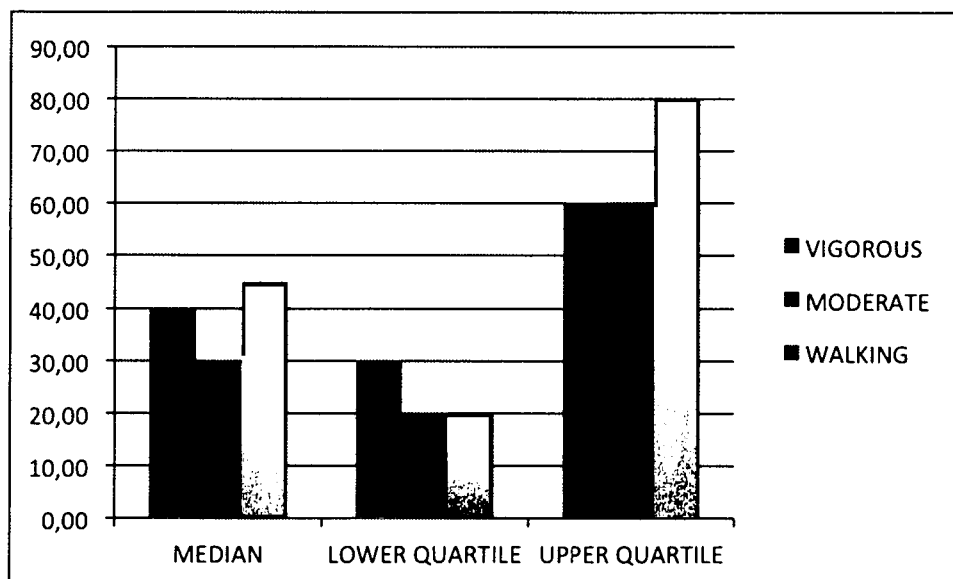
Figure 4.12: Amount of time spent doing PA by 1ˢᵗ year students (X: Percentages; Y: Quartiles)

4.3.6 Lifestyle habits of 1st year students

The 1st year group has a "somewhat good" classification for maintaining a healthy lifestyle in 5 of the 7 lifestyle habits (Belloc and Breslow, 1972: 409). These habits are; eating breakfast daily (60.26%), they exercise at least 3 times a week (55.13%), 93.59% of the 1st years maintain a healthy body weight, while 74.36% are non-smokers and 76.92% consume little to no alcohol. Unfortunately, the eating and sleeping habits of the 1st year students are not satisfactory. The results of the lifestyle habits of the 1st year female students are illustrated in Figure 4.13.
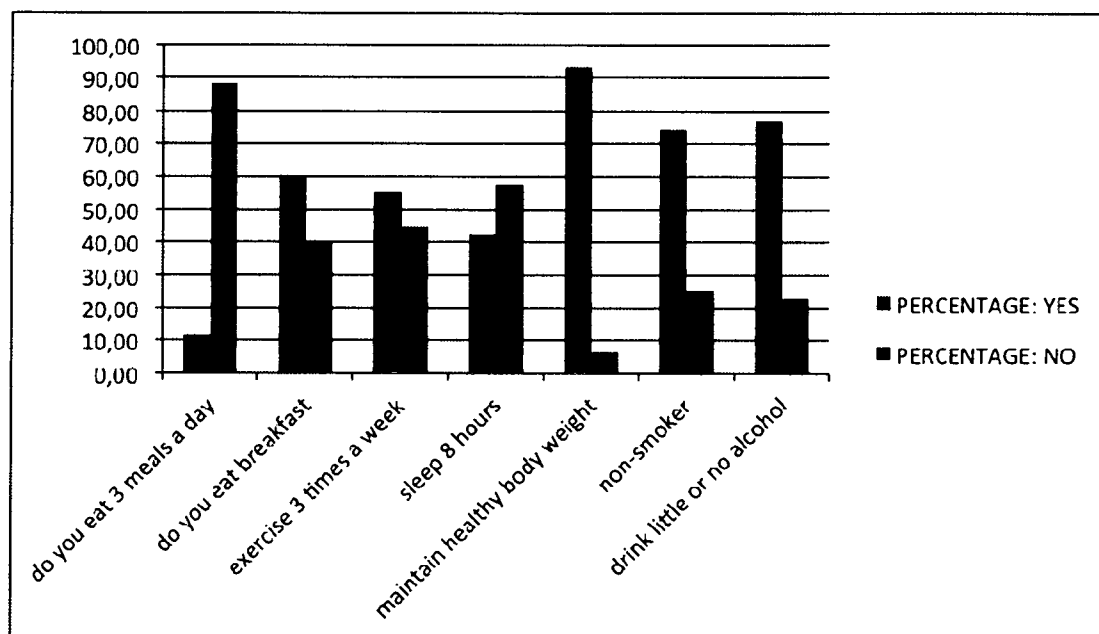
Figure 4.13: Lifestyle habits of 1st year students (X: Percentages; Y: Lifestyle habits)

4.3.7 Anthropometric profile of 1st year students

The average 1st year female student at the University of the Free State is 164cm tall with a body weight of 60kg. The skinfold measurement were respectively ; triceps (20.80mm), subscapular (16.10mm), suprailiac (18.40mm), abdomen (23.80mm), anterior medial thigh (34mm) and medial calf (18.60mm), which results in a body fat percentage of 25%. According to the classification of ACSM (2010:72), 25% body fat is classified as fair. However, the average BMI of the 1st year students was 22. According to the

82

International Classification of Adult underweight, Overweight and Obesity, the average female student falls within the normal BMI range (18.5-24.9), (WHO, 2006; ACSM 2010:63).

The average waist and hip circumferences were 72cm and 100cm respectively, which results in a waist-to-hip ratio of 0.71 (the norm is <0.75,) Therefore the average female student is classified as having an excellent waist-to-hip ratio, with a lean body mass off 45kg, and a fat mass of 15kg. The results are shown below in Table 4.4. The table includes the lower and upper quartile range.

Table 4.4: Anthropometric profile of 1st year students

STATURE			
Weight (kg)	60.00	52.00	67.00
Height (cm)	164.00	160.00	169.00
SKINFOLD MEASUREMENTS (mm)			
Triceps	20.80	14.60	26.60
Subscapular	16.10	11.00	23.80
Suprailiac	18.40	14.20	24.00
Abdomen	23.80	17.60	29.60
Anterior Mid Thigh	34.00	26.00	42.40
Medial Calf	18.60	13.80	24.20
GIRTH MEASUREMENTS (cm)			
Waist	72.00	66.00	78.00
Hip	100.00	94.00	107.00
Calf (Maximum)	35.00	33.00	38.00
Arm (Relaxed)	27.00	25.00	29.00
Arm (Flexed and Tensed)	28.50	26.00	30.00
BONE BREADTHS (cm)			
Bi-epicondylar Humerus	6.00	5.50	6.00
Femur	8.50	8.50	9.00
SUMMARY			
Fat Percentage (%)	25.00	19.00	29.00
Lean Body Mass (LBM) (kg)	45.00	40.00	50.00
Body Mass Index (BMI)	22.00	20.00	24.00
Waist to Hip Ratio (W:H Ratio)	0.71	0.69	0.75

4.4 Profile of 2nd year students

4.4.1 Age

The average age amongst the 2nd year group was 20 years, with the upper and lower quartiles being 20 and 20 years respectively (See Table 4.5).

Table 4.5: Average age of 2nd year students

20	20	20

4.4.2 Ethnicity of 2nd year students

Of the respondents in the 2nd year group, 66.33%% were black female students and the minority of the group was coloured female students with 7.14%. Figure 4.14 shows the dispersion of the ethnic groups amongst 2nd year female students who were willing to participate in this study at the University of the Free State.
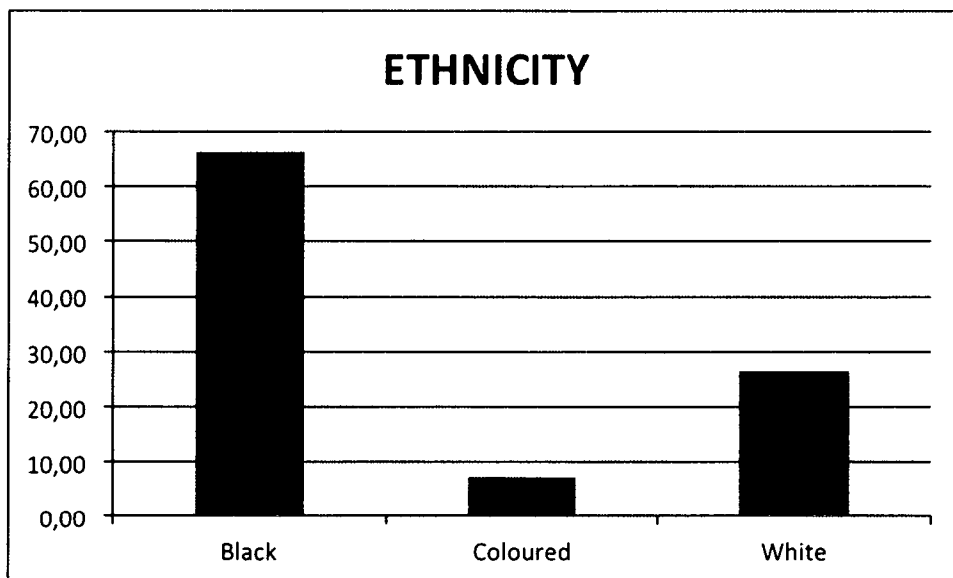
Figure 4.14: Ethnicity dispersion of 2nd year students (X: Percentages; Y: Ethnicity)

4.4.3 Physical activity participation of 2nd year students

The participants were asked to provide information about their PA participation during 2012. The results presented in Figure 4.15 indicated that only 42.86% of the 2nd year students participated in PA.

Figure 4.15: Physical activity participation of 2nd year students

4.4.4 Sport codes dispersion of 2nd year students

Figure 4.16 indicated that soccer (43.90%) was the most popular code for 2nd year students, followed by netball (34.15%) and hockey (17.07%). Figure 4.16 shows all the sport codes dispersion of 2nd year female students.
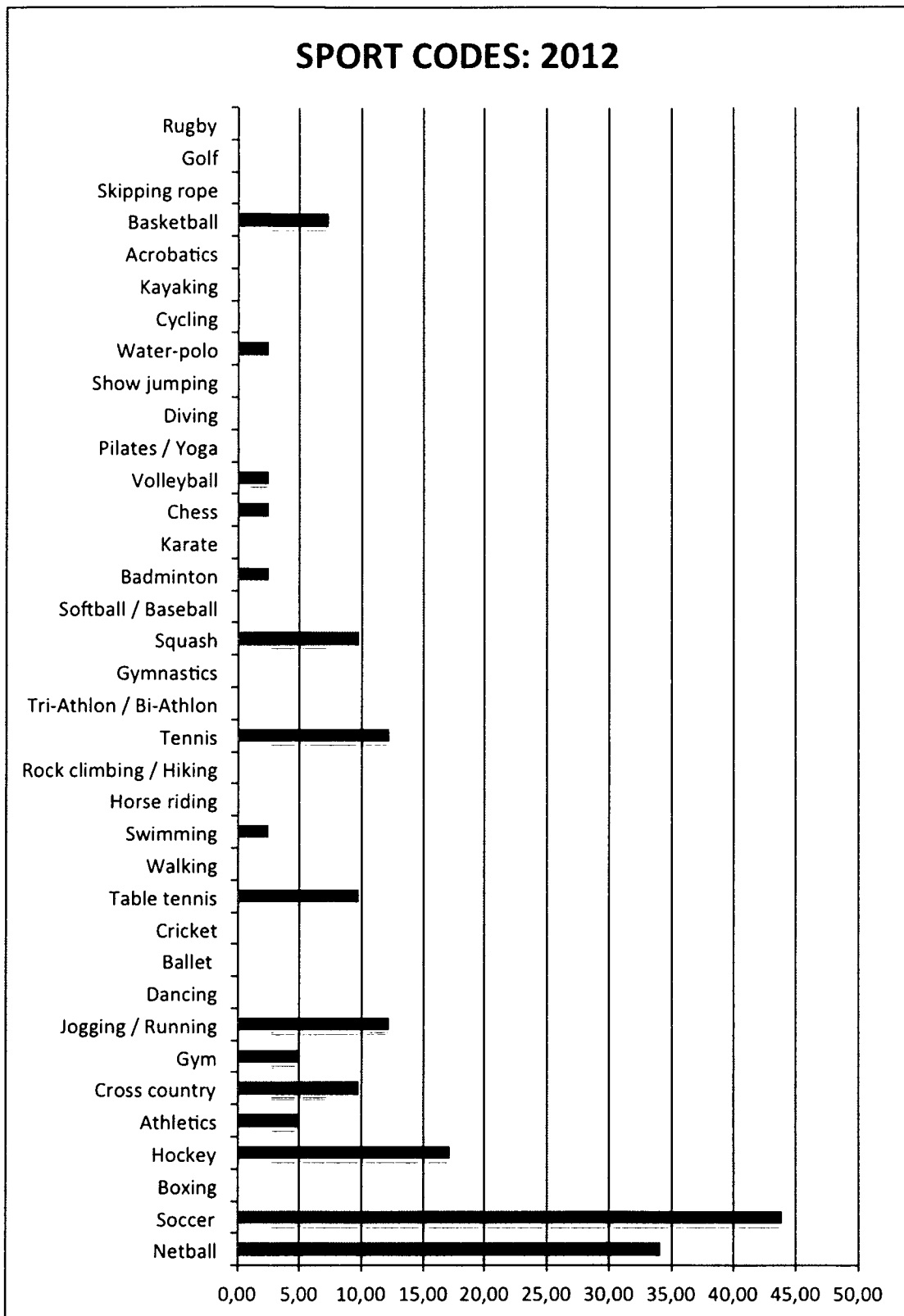
# SPORT CODES: 2012

Figure 4.16: Sport code dispersion of 2nd year students (X: Sport codes; Y: Percentages)

4.4.5 Days spent on physical activity by 2nd year students

The 2nd year group indicated similar results to that of the 1st years namely that they also participated in PA for most days of the week (7 days) and that the preferred physical activity of the majority of the 2nd year group was walking (47.96%). The days spent on vigorous and moderate activity are illustrated in Figure 4.17.
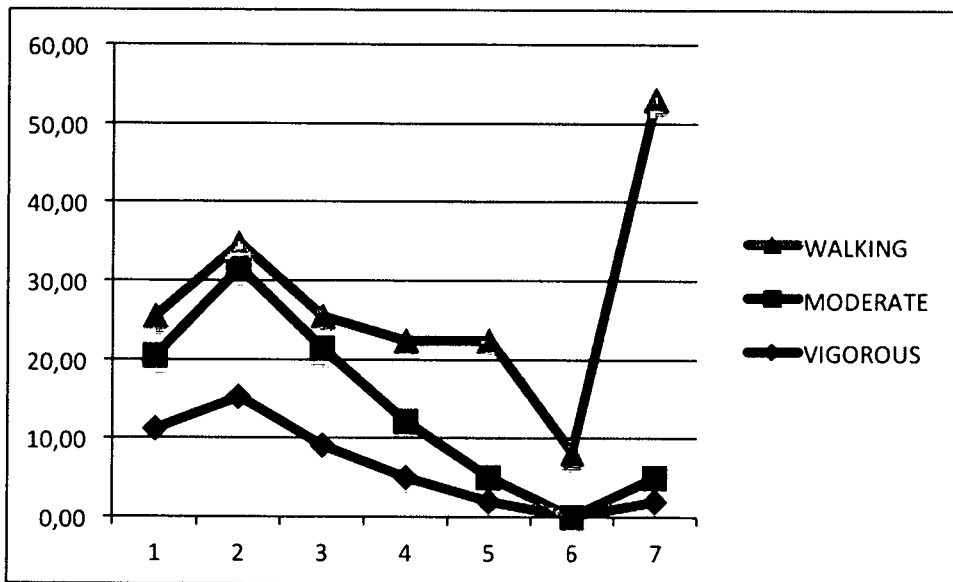
Figure 4.17: Days spent doing PA by 2nd year students (X: Percentages; Y: Number of days)

The average time spent doing vigorous, moderate and walking activity was 30min each. Figure 4.18 below illustrates the lower and upper quartiles of days spent doing PA.
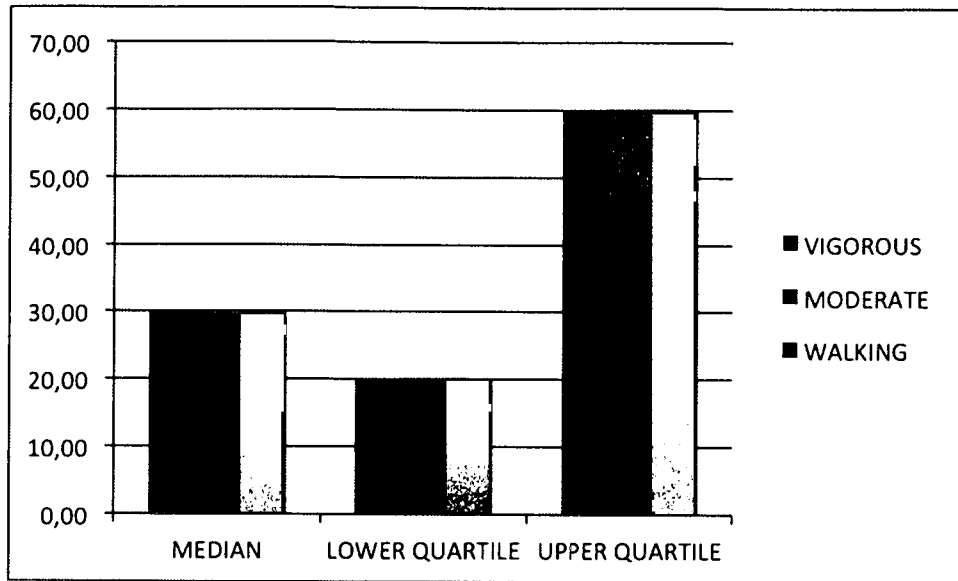
Figure 4.18: Time spent doing physical activity by 2ⁿᵈ year students (X: Percentages; Y: Quartiles)

4.4.6 Lifestyle habits of 2ⁿᵈ year students

It is important to note that the 2ⁿᵈ year group has according to the classification of Belloc and Breslow, (1972: 409) lifestyle index a "poor lifestyle"($\leq$ 3 lifestyle habits) for maintaining only 3 of the 7 lifestyle habits being namely, maintaining a healthy body weight (83.67%), 58.16% being non-smokers and 79.59% consume little to no alcohol. Unfortunately, the 2ⁿᵈ year students do not eat regularly, sleep enough, or train regularly enough to maintain a healthy lifestyle. The lifestyle habits of the 2ⁿᵈ year students are illustrated in Figure 4.19.
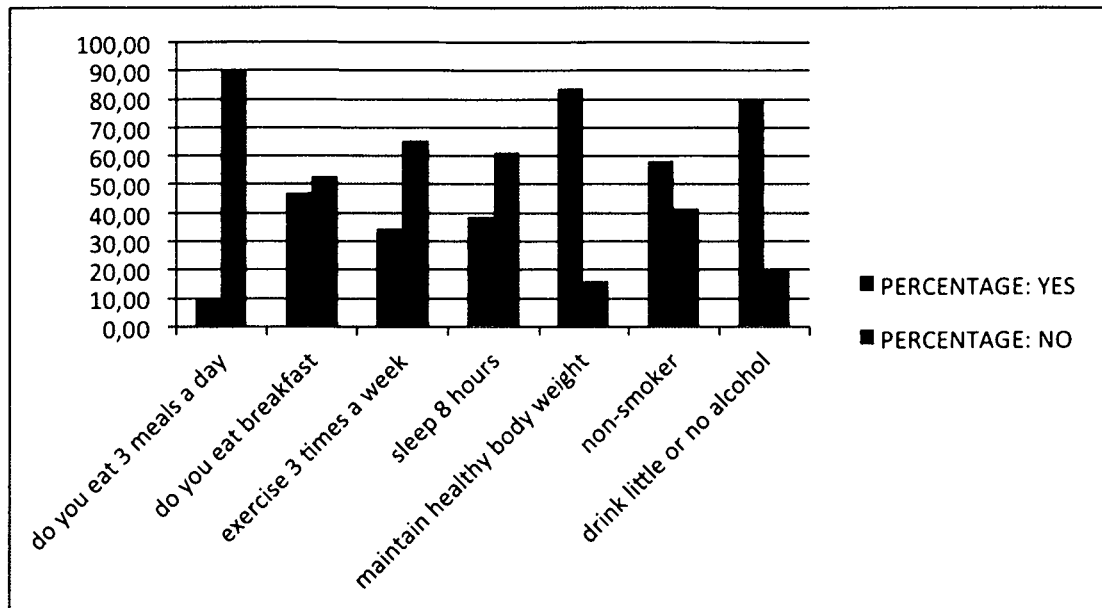
Figure 4.19: Lifestyle Habits of 2nd year students (X: Percentages; Y: Lifestyle habits)

4.4.7 Anthropometric profile of 2nd year students

The average 2nd year female student at the University of the Free State is 164.5cm tall, with a body weight of 63kg. The skinfold measurements were; triceps (20.30mm), subscapular (18.60mm), suprailiac (18.70mm), abdomen (24.20mm), anterior medial thigh (38mm) and medial calf (20mm), which results in a body fat percentage of 25%.This is classified as fair according to ACSM (2010:72). The 2nd year students have a BMI of 23 which aaccording to the International Classification of Adult underweight, Overweight and Obesity, is within the normal BMI range (18.5-24.9) (WHO, 2006; ACSM 2010:63). The average waist and hip circumferences were 71cm and 103cm respectively, which results in a waist-to-hip ratio of 0.70. The norm is <0.75, and therefore the average 2nd year female student is classified as having an excellent waist-to-hip ratio, with a lean body mass of 46kg, with a fat mass of 17kg. The anthropometric data are presented in Table 4.6 below, which includes the lower and upper quartile range of the results.

Table 4.6: Anthropometric profile of 2nd year students

STATURE			
Weight (kg)	63.00	55.00	70.00
Height (cm)	164.50	161.00	169.00
SKINFOLD MEASUREMENTS (mm)			
Triceps	20.30	16.80	27.40
Subscapular	18.60	13.00	27.20
Suprailiac	18.70	13.40	27.20
Abdomen	24.20	17.80	31.20
Anterior Mid Thigh	38.00	30.60	49.20
Medial Calf	20.00	15.20	27.00
GIRTH MEASUREMENTS (cm)			
Waist	71.00	67.00	80.00
Hip	103.00	98.00	112.00
Calf (Maximum)	36.00	34.00	38.00
Arm (Relaxed)	27.50	25.00	30.00
Arm (Flexed and Tensed)	28.50	27.00	31.00
BONE BREADTHS (cm)			
Bi-epicondylar Humerus	6.00	5.50	6.00
Femur	9.00	8.50	9.50
SUMMARY			
Fat Percentage (%)	25.00	21.00	32.00
Lean Body Mass (LBM) (kg)	46.00	43.00	50.00
Body Mass Index (BMI)	23.00	21.00	26.00
Waist to Hip Ratio (W:H Ratio)	0.70	0.67	0.74

4.5 Profile of 3rd year+ female students

4.5.1 Age

The average age amongst the 3rd year+ group was 21 years, with the upper and lower quartiles being 21 and 22 years respectively (see Table 4.7).

Table 4.7: Average age of 3rd year+ students

21	21	22

4.5.2 Ethnicity of 3rd year+ students

Of the respondents in the 3rd year+ group, 63.24%% were black female students and the minority of the group was coloured female students with 6.41%. Figure 4.20indicates the dispersion of the ethnic groups amongst 3rd year+ students at the University of the Free State who was willing to participate in this study.
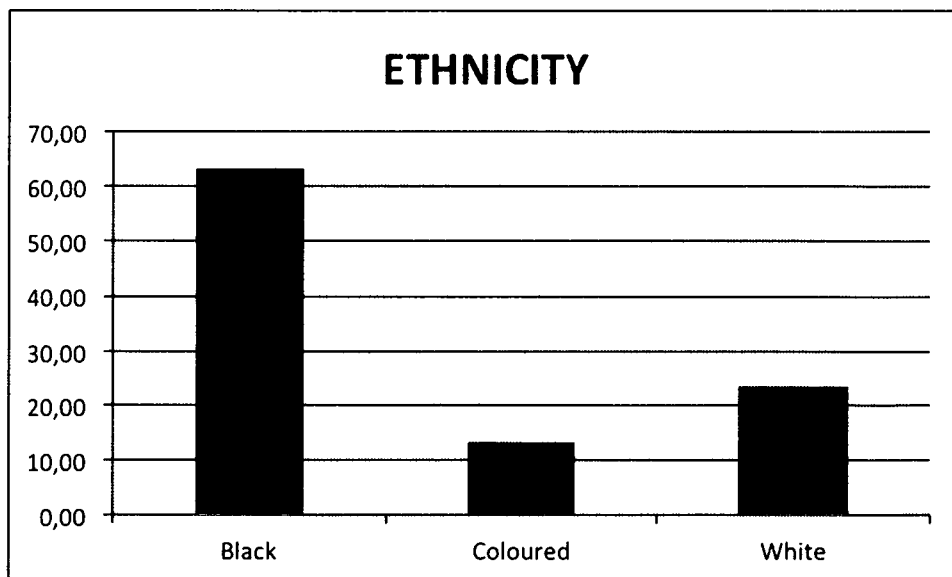
Figure 4.20: Ethnicity dispersion of 3rd year+ student (X: Percentages; Y: Ethnicity)

4.5.3 Physical activity of 3rd year+ students

The 3rd year+ female students were asked to provide information with regard to their PA participation in 2012.Only 44.12% participated in PA(Figure 4.21).

PA PARTICIPATION: 2012

- YES
- NO

Figure 4.21: Participation in PA activity by 3rd year+ students

4.5.4 Sport codes participation by 3rd year+ students

As indicated in Figure 4.22, netball (26.67%) was the most popular sport code for 3rd year+ students. The 2nd most popular was soccer (23.33%) and hockey was the 3rd sport code with 20%. All the sport codes in which the 3rd year+ students participated are presented in Figure 4.22.
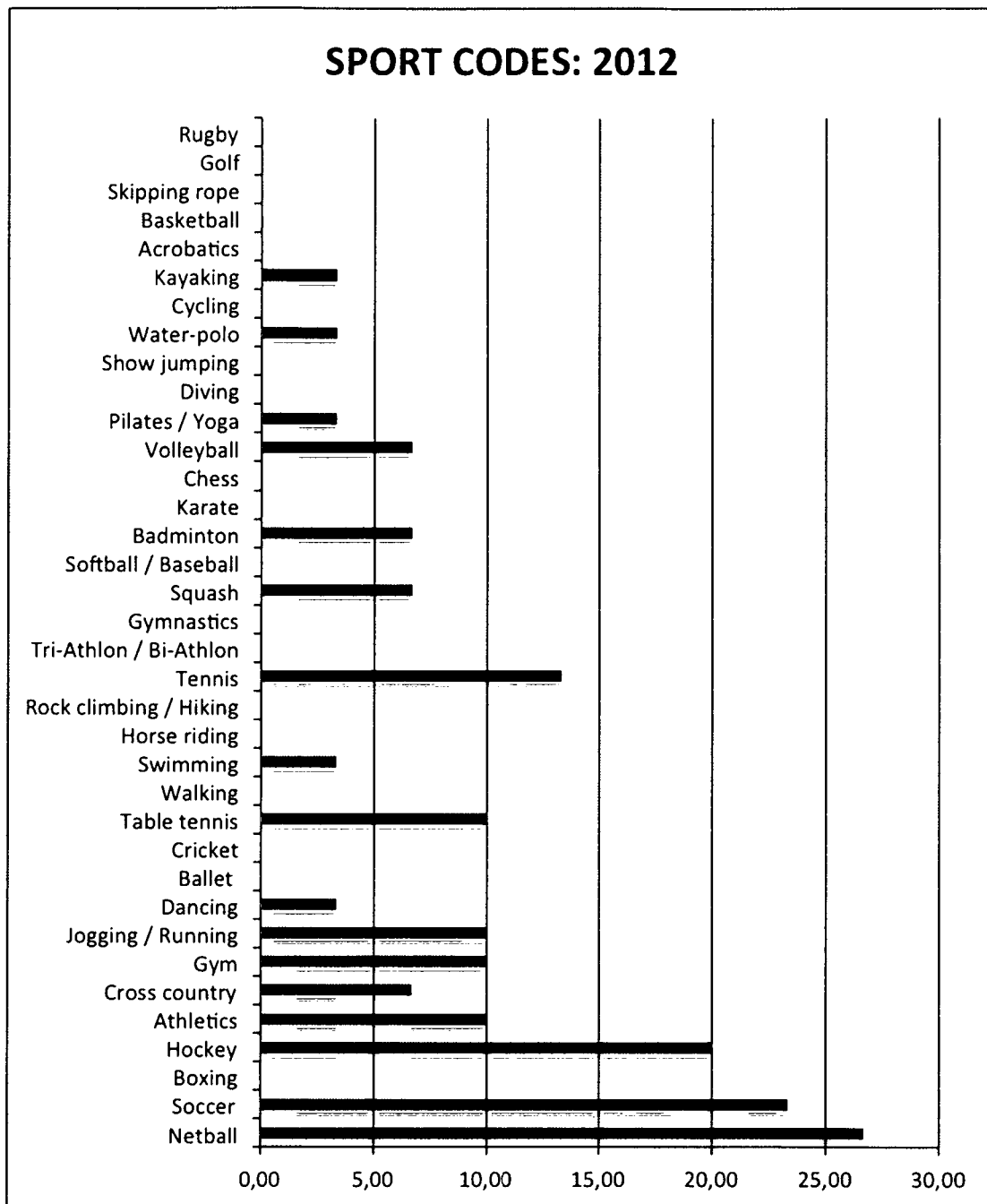
Figure 4.22: Sport code dispersion by 3rd year+ students (X: Sport codes; Y: Percentages)

4.5.5 Days spent on physical activity by 3rd year+ students

The 3rd year+ group, similarly to that of the 1st and 2nd year groups also indicated that they walk 7 days a week (57.35%).The days the 3rd years spent on vigorous and moderate activity is illustrated in Figure 4.23.
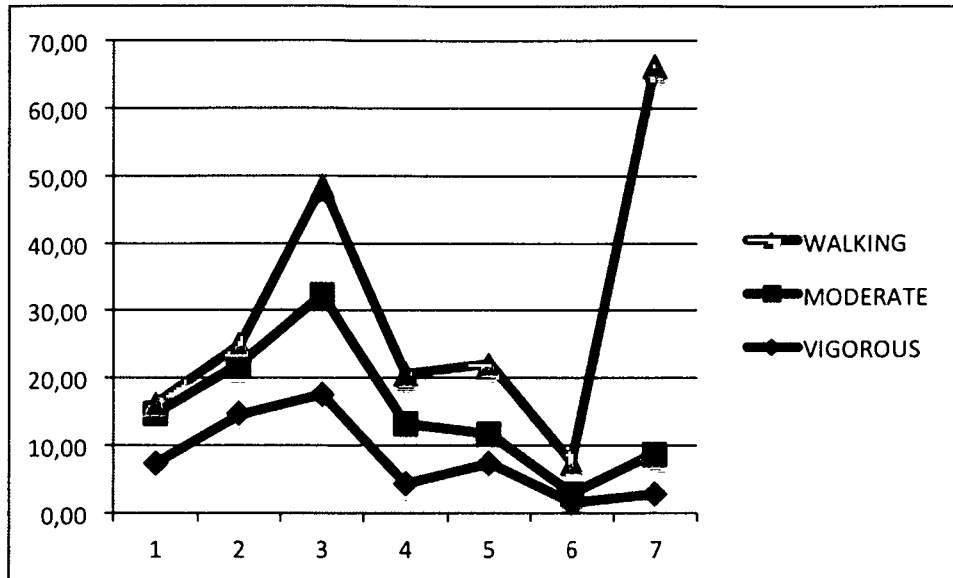
Figure 4.23: Days spent doing PA by 3rd year+ students (X: Percentages; Y: Number of days)

Figure 4.24 indicates the time spent by 3rd year+ students doing vigorous (52.5min), moderate (30min) and walking activity (40min) respectively. It is interesting to note that the 3rd year+ students spent almost an hour on vigorous activity.
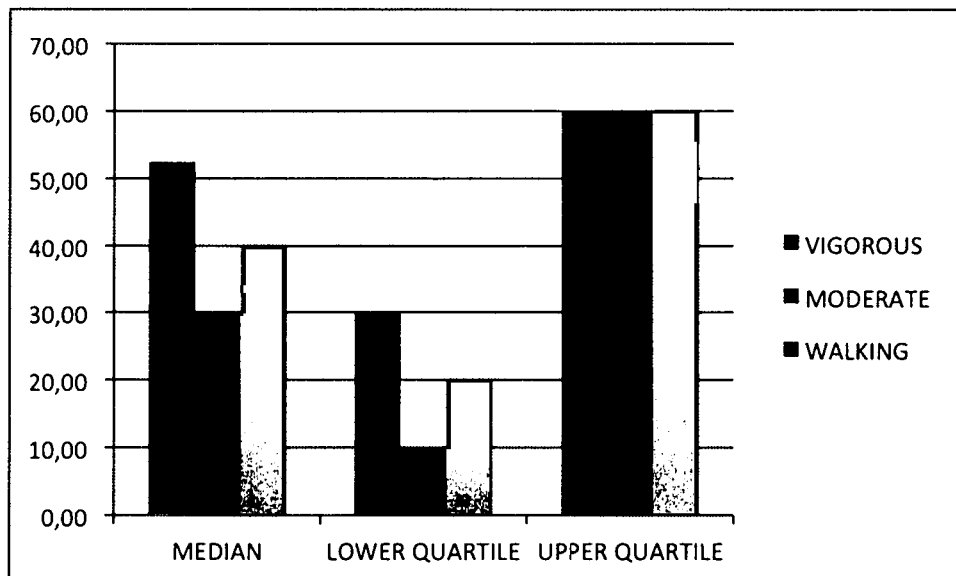
Figure 4.24: Time spent doing PA by 3rd year+ students (X: Percentages; Y: Quartiles)

4.5.7 Lifestyle habits of 3rd year+ students

The lifestyle habits of the 3rd year+ group was classified according to Belloc and Breslow's lifestyle index as a "moderately healthy lifestyle"(4-5 lifestyle habits) for maintaining 4 of the 7 lifestyle habits. The lifestyle habits they maintained were namely: exercising at least 3 times a week (51.47%), maintaining a healthy body weight (86.76%), 70.59% are non-smokers, and 73.53% consumed little to no alcohol. It is also clear from Figure 4.25 that the 3rd years+ eating habits are poor.
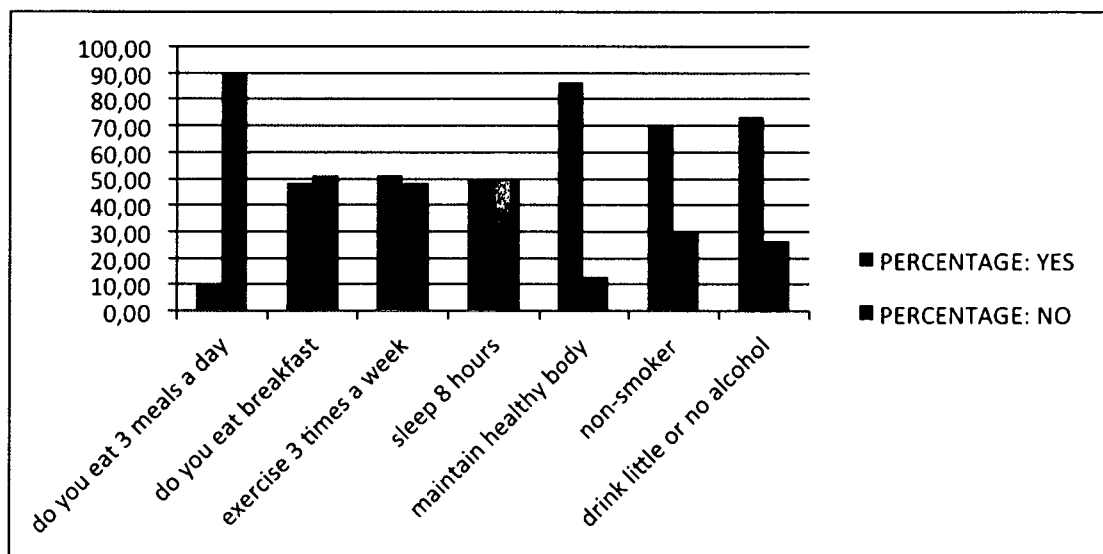
Figure 4.25: Lifestyle habits of 3rd year+ students (X: Percentages; Y: Lifestyle habits)

4.5.8 Anthropometric profile of 3rd year+ students

The average 3rd year+ female student at the University of the Free State is 163cm tall and weighing 60kg. The skinfold measurements are respectively; triceps (19mm), subscapular (15.60mm), suprailiac (18.90mm), abdomen (24.10mm), anterior medial thigh (38.50mm) and medial calf (19.70mm), which results in a body fat percentage of 25%, similarly to those of the 1st and 2nd year students. This is also classified as fair according to the ACSM (2010:72). The 3rd years, similar to the 1st and 2ndyear groups have a BMI of 22% which aaccording to the International Classification of Adult underweight,

96

Overweight and Obesity, is within the normal BMI range (WHO, 2006; ACSM, 2010:63). The average waist and hip circumferences are 71.50cm and 100.50cm respectively, which indicate a waist to hip ratio of 0.70. This ratio is also within the norm (<0.75), therefore the average 3rd year female student is classified as having an excellent waist-to-hip ratio. They also have a lean body mass of 44kg, which indicates a fat mass of 16kg. The anthropometric profile of 3rd year+ female students is shown below in Table 4.8.

Table 4.8: Anthropometric profile of 3rd year+ students

Table 4.8: Anthropometric profile of 3rd year+ students

STATURE			
Weight (kg)	60.00	54.00	65.50
Height (cm)	163.00	159.00	167.00
SKINFOLD MEASUREMENTS (mm)			
Triceps	19.00	14.20	25.90
Subscapular	15.60	12.40	26.00
Suprailiac	18.90	12.80	26.00
Abdomen	24.10	17.20	29.80
Anterior Mid Thigh	38.50	30.20	44.90
Medial Calf	19.70	17.10	25.40
GIRTH MEASUREMENTS (cm)			
Waist	71.50	66.00	75.50
Hip	100.50	97.00	107.00
Calf (Maximum)	35.00	33.00	37.00
Arm (Relaxed)	27.00	25.50	29.50
Arm (Flexed and Tensed)	29.00	27.00	30.50
BONE BREADTHS (cm)			
Bi-epicondylar Humerus	6.00	5.50	6.00
Femur	9.00	8.50	9.00
SUMMARY			
Fat Percentage (%)	25.00	20.00	31.00
Lean Body Mass (LBM) (kg)	44.00	40.50	50.00
Body Mass Index (BMI) (%)	22.00	20.50	24.00
Waist to Hip Ratio (W:H Ratio)	0.70	0.66	0.73

4.6 Differences among the year groups

The Fischer-Exact test and/or the Kruskal-Wallis test were used to determine the differences among the year groups regarding the variables that were tested.

4.6.1 Differences in ethnicity among the year groups

The results obtained with the Fischer-Exact test indicated on the one percent (p < 0.01) level a highly significant difference in the mean frequency scores between black, coloured and white students tested (Table 4.9).

Table 4.9: Ethnicity according to year group

1	Black	
2	Coloured	0.0003
3	White	

4.6.2 Differences in age among the year groups

The majority of the students in the University of the Free State are between 19 and 21 years old. The results obtained with the Kruskal-Wallis test indicate a highly significant (p = 0.0001) difference in the mean median age scores between the ethnic year groups (Table 4.10).

Table 4.10: Difference in age among the year groups

21	<0.0001

4.6.3 Differences in sport participation among the year groups

The results obtained with the Fischer-Exact test indicated a non significant(p = > 0.05) difference in sport participation between the 3 ethnic groups (Tables 4.11 and 4.12).

Table 4.11: Took part in sport during 2012

1	YES	0.2359
2	NO	

Table 4.12: Sport codes participation of the 3 year groups

1	Netball	0.6476
2	Soccer	0.1099
3	Hockey	0.2688
4	Athletics	0.0644
5	Cross country	0.6424
6	Gym	0.7441
7	Jogging / Running	0.7948
8	Dancing	0.7296
9	Table tennis	0.3423
10	Swimming	1.0000
11	Tennis	1.0000
12	Tri-Athlon / Bi-Athlon	1.0000
13	Squash	1.0000
14	Badminton	0.8496
15	Chess	1.0000
16	Volleyball	0.2679
17	Pilates / Yoga	0.7296
18	Water-polo	0.3855
19	Kayaking	0.2679
20	Basketball	0.1114
21	Rugby	1.0000

4.6.4 Differences in time spent on physical activity among the year groups

The results obtained with the Kruskal-Wallis test indicated a non-significant difference in the mean median time spent doing PA, vigorous activity ($p = 0.1590$), moderate activity ($p = 0.3144$) or walking ($p = 0.6136$) (Table 4.13 - 4.15).

Table 4.13: Time spent doing vigorous activity

Days	0.1590
Minutes	

Table 4.14: Time spent doing moderate activity

Days	0.3144
Minutes	

Table 4.15: Time spent doing walking

Days	
Minutes	0.6136
Pace	

4.6.5 Lifestyle habits among the different year groups

The results obtained with the Fischer-Exact test indicate on the five percent level a non significant($p = > 0.05$) difference in the mean frequency scores between lifestyle habits amongst the different year groups, except for exercising 3 times a day ($p = 0.0140$). These results are shown in Table 4.16.

Table 4.16: Lifestyle habits among the different year groups

1	Do you eat 3 meals a day	0.8658
2	Do you eat breakfast	0.1768
3	Exercise 3 times a week	0.0140
4	Sleep 8 hours a day	0.3503
5	Maintain healthy body weight	0.1258
6	Non-smoker	0.0586
7	Drink little or no alcohol	0.6669

4.6.6 Differences in anthropometric profile among the year groups

Similarly, the 3rd year group's anthropometric profile was not significantly different ($p \leq 0.05$). The Kruskal-Wallis test indicate only a significant ($p = 0.0350$) difference in the mean median anterior mid thigh and a significant ($p = 0.0303$) difference in the mean median waist-to-hip ratio scores among the year groups (Table 4.17).

Table 4.17: Anthropometric profile among the year groups

STATURE	
Weight (kg)	0.0930
Height (cm)	0.2278
SKINFOLD MEASUREMENTS (mm)	
Triceps	0.2840
Subscapular	0.1451
Suprailiac	0.7578
Abdomen	0.6734
Anterior Mid Thigh	0.0350
Medial Calf	0.2398
GIRTH MEASUREMENTS (cm)	
Waist	0.7281
Hip	0.0970
Calf (Maximum)	0.0618
Arm (Relaxed)	0.5272
Arm (Flexed and Tensed)	0.3783
BONE BREADTHS (cm)	
Bi-epicondylar Humerus	0.1979
Femur	0.1351
SUMMARY	
Fat Percentage (%)	0.2780
Lean Body Mass (LBM) (kg)	0.0628
Body Mass Index (BMI)	0.0802
Waist to Hip Ratio (W:H Ratio)	0.0303

4.7 Profile of black female students

4.7.1 Age of black female students

The average age of the black female group was 20 years old over the year groups. The average range was between 19 and 21 years old. These results are illustrated in Table 4.18 below (n = 139).

Table 4.18: Average age of black female students

20	19	21

4.7.2 Year of study dispersion of black female students

The majority of the Black students were 2nd year students (46.76%) with the least of the black students being 1st year (22.30%)(Figure 4.42).
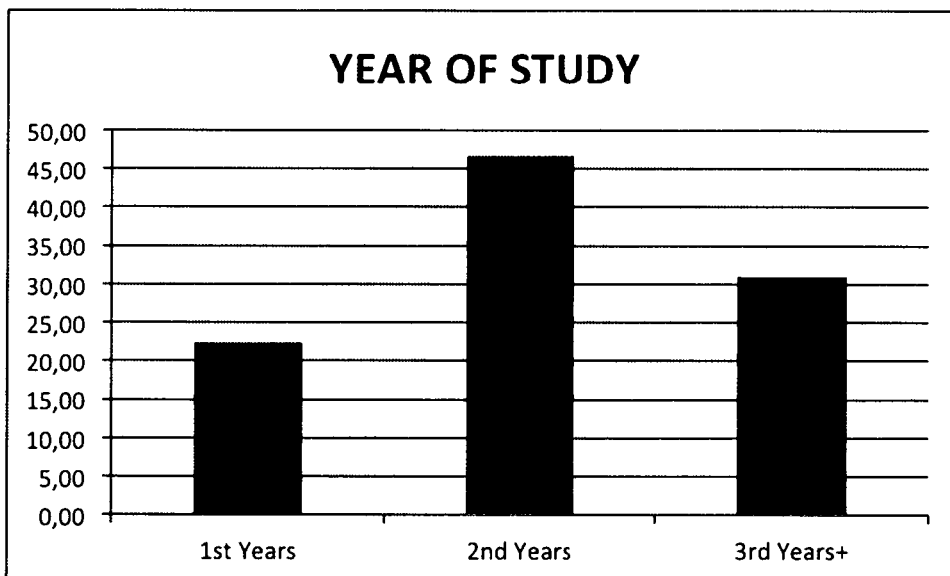
Figure 4.26: Year of study dispersion of black female students (X: Percentages; Y: Year groups)

4.7.3 Physical activity of black female students

The Black students indicated that only 35.97%participate in PA (Figure 4.27).

PA PARTICIPATION: 2012

■ YES
■ NO

Figure 4.27: Physical activity participation of black female students

4.7.4 Sport codes participation of black female students

The sport codes that the black female students were participated in are indicated in Figure 4.28. It is important to note that majority of the black students play soccer or netball.
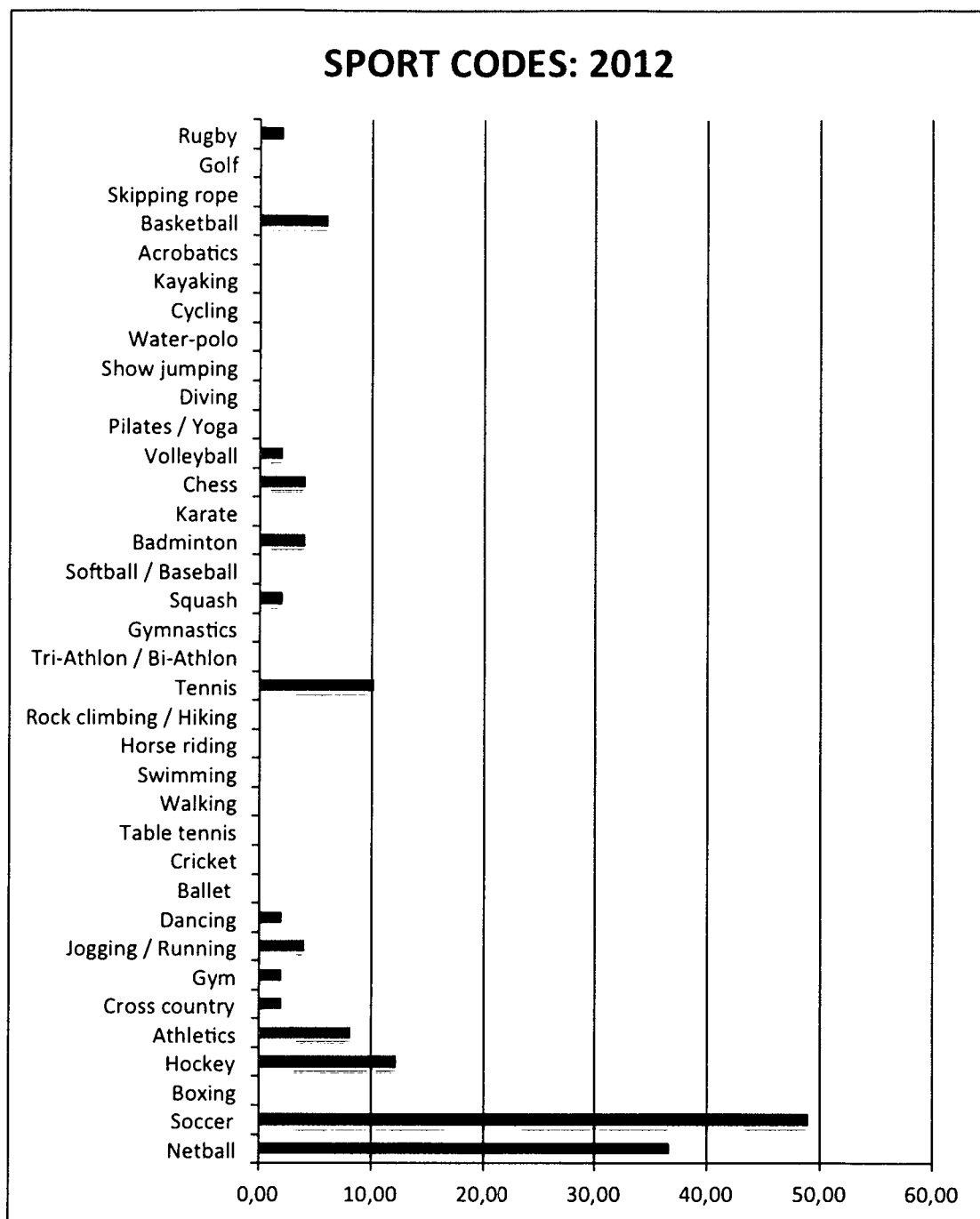
Figure 4.28: Sport code dispersion of black female students (X: Sport codes; Y: Percentages)

4.7.5 Days spent on physical activity by black female students

The black female students (59.27%) walk 7 days a week. They also spent 2 to 3 days doing moderate (14.39%) and vigorous (13.67%) PA(Figure 4.29).
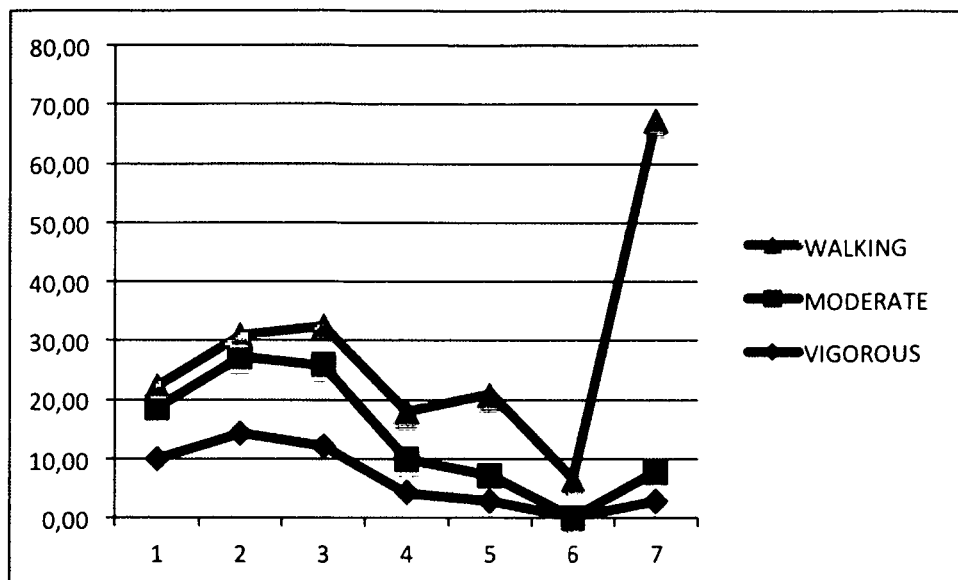
Figure 4.29: Amount of days spent doing PA by black female students

(X: Percentages; Y: Number of days)

The black students also indicated that they are doing vigorous and moderate PA for 30min and walk 40min as indicated in Figure 4.30.
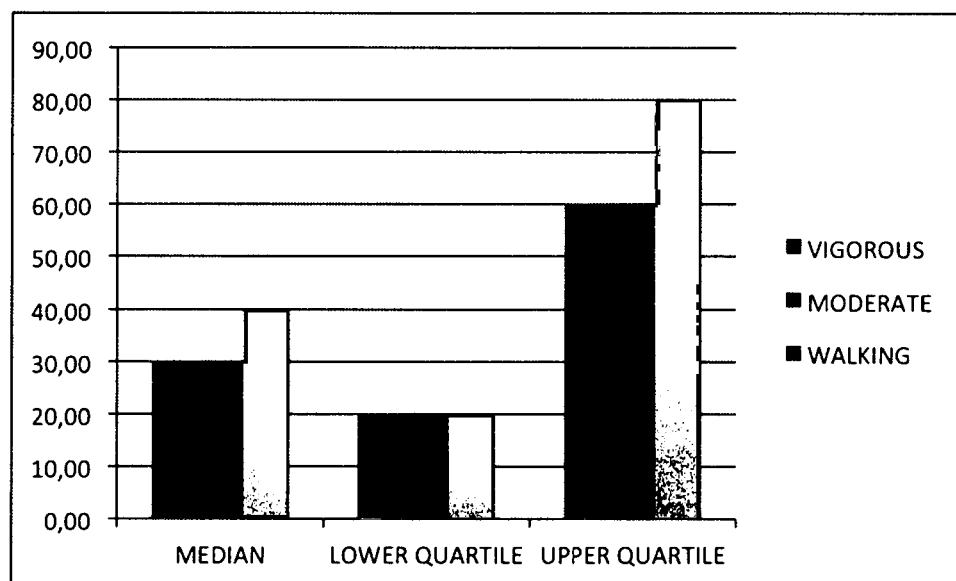
Figure 4.30: Amount of time spent doing PA by black female students

(X: Percentages; Quartiles)

4.7.7 Lifestyle habits of black female students

An average of 3 out the 7 habits is being followed by the majority of black female students which could be classified according to the lifestyle index of Beloc&Breslow as a poor lifestyle (≤3 life style habits). Fifty six (56.83%) of the black students are non-smokers, with 72.66%of the respondents consuming little to no alcohol, and at least 89.21% of the group maintains a healthy body weight. Unfortunately, all the other lifestyle habits which are also important for a healthy lifestyle is not adhered to (Figure 4.31).
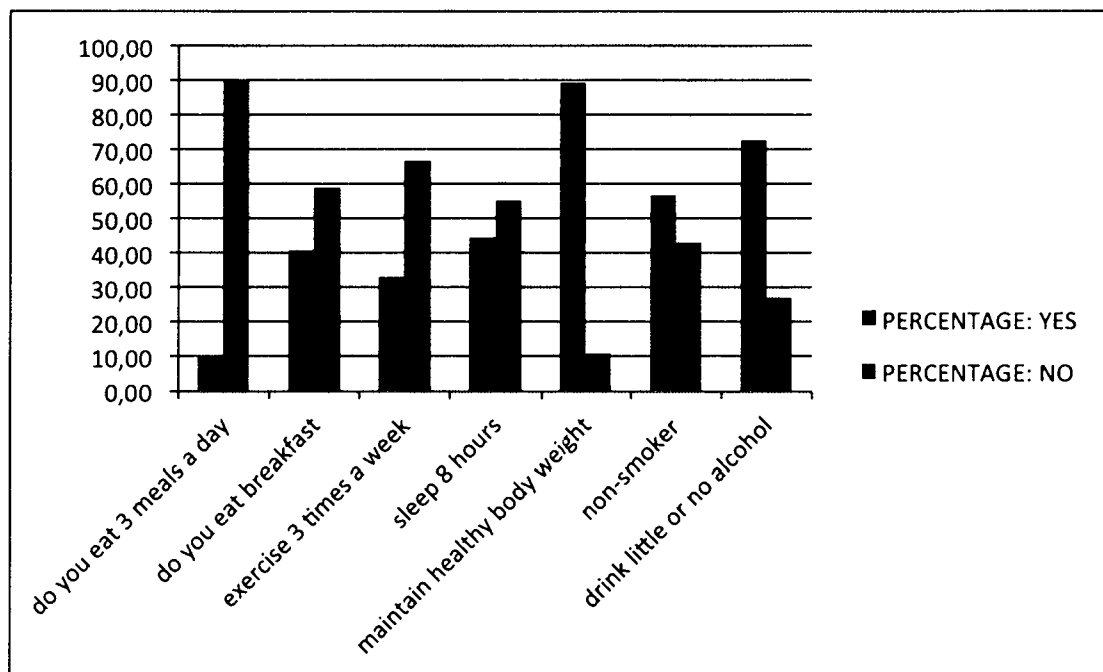
Figure 4.31: Lifestyle habits of black female students (X: Percentages; Y: Lifestyle habits)

4.7.8 Anthropometric profile of black female students

The average black female student at the University of the Free State is 163cm tall and weighing 61kg. The skinfold measurement are respectively ;triceps (20.40mm), subscapular (17.60mm), suprailiac (18.60mm), abdomen (24.20mm), anterior medial thigh (39.40mm) and medial calf (21.20mm), which results in a body fat percentage of 25% for black students. According to the ACSM (2010:72) this is classified as fair. The black female student also

has a BMI of 23.According to the International Classification of Adult Underweight, Overweight and Obesity, the average BMI, of the black female student falls within the normal range (18.5 – 24.9 kg.m^{-2}),(WHO, 2006; ACSM, 2010:63). The Black female students also have an average waist and hip circumferences of 71cm and 102cm respectively, which results in a waist-to-hip ratio of 0.69 (the norm is <0.75), therefore the average female black student is classified as having an excellent waist-to-hip ratio. The black female students also have an average lean body mass of 44kg, with a fat mass of 17kg (Table 4.19).

Table 4.19: Anthropometric profile of black female students

STATURE			
Weight (kg)	61.00	54.00	68.00
Height (cm)	163.00	157.00	166.00
SKINFOLD MEASUREMENTS (mm)			
Triceps	20.40	15.80	28.60
Subscapular	17.60	12.80	27.80
Suprailiac	18.60	13.20	26.20
Abdomen	24.20	18.00	30.40
Anterior Mid Thigh	39.40	30.60	49.60
Medial Calf	21.20	16.80	27.60
GIRTH MEASUREMENTS (cm)			
Waist	71.00	66.00	76.00
Hip	102.00	97.00	110.00
Calf (Maximum)	35.00	33.00	38.00
Arm (Relaxed)	27.00	25.00	30.00
Arm (Flexed and Tensed)	28.00	26.00	31.00
BONE BREADTHS (cm)			
Bi-epicondylar Humerus	6.00	5.50	6.00
Femur	8.50	8.50	9.50
SUMMARY			
Fat Percentage (%)	25.00	21.00	33.00
Lean Body Mass (LBM) (kg)	44.00	41.00	49.00
Body Mass Index (BMI)	23.00	21.00	26.00
Waist to Hip Ratio (W:H Ratio)	0.69	0.66	0.73

4.8 Profile of coloured female students

4.8.1 Age of coloured female students

The average age amongst coloured female students is similar to the black students, namely 20 years, with the upper and lower quartiles being 20 and 21 years respectively. Table 4.20 illustrates the average age.

Table 4.20:   Average age of coloured female students

20	20	21

4.8.2 Year of study dispersion of coloured female students

Of the coloured female respondents 42.86% were 3rd year+ students and the minority of the group was 1st year female students (23.81%). Figure 4.32illustrates the dispersion of the distribution in the year groups amongst coloured female students at the University of the Free State.
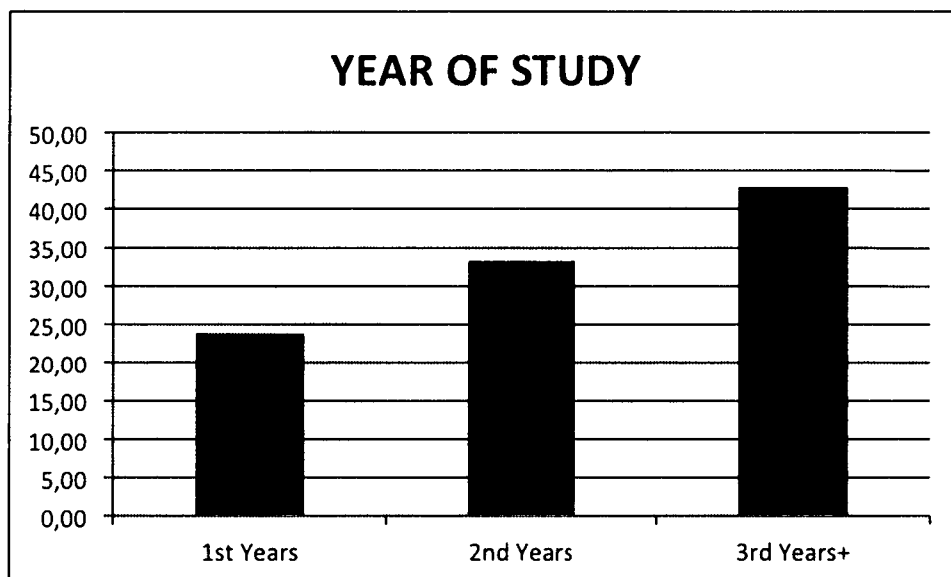
YEAR OF STUDY

Figure 4.32: Year of study dispersion of coloured female students (X: Percentages; Y: Year groups)

4.8.3 Physical activity participation of coloured female students

The coloured female students PA participation profile indicated that only 38.10% took part in PA during 2012 (Figure 4.33).
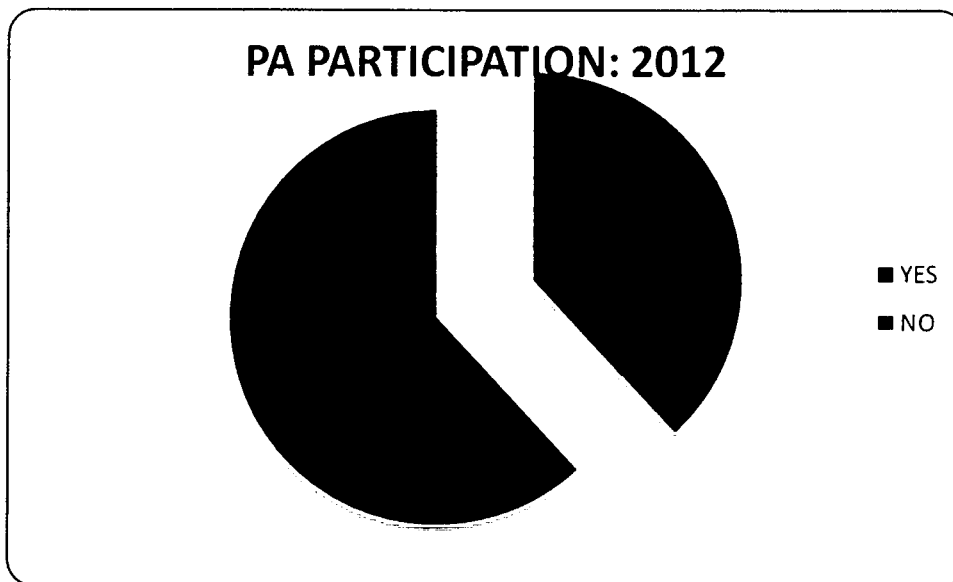
Figure 4.33: Physical activity participation of coloured female students

4.8.4 Sport codes participation of coloured female students

During 2012, netball (42.86%) was the most popular sport code for coloured female students with athletics, tennis, squash, volleyball and pilates/yoga all being 2nd with 14.29% (Figure 4.34).
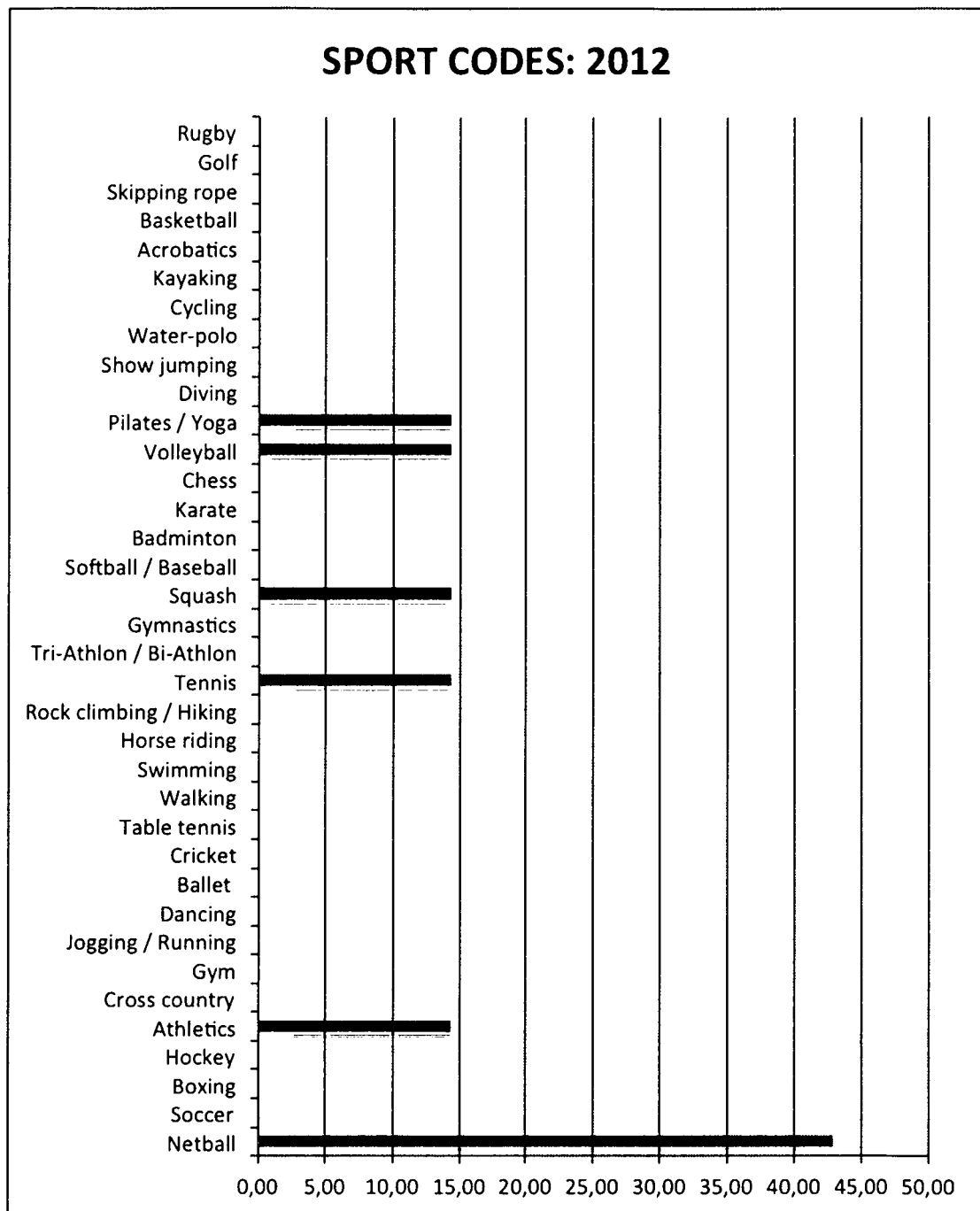
Figure 4.34: Sport code dispersion of coloured female students (X: Sport codes; Y: Percentages)

4.8.5 Time spent on physical activity by coloured female students

The coloured female students at the University of the Free State similar to that of the black female students also indicated that the walked for the majority of the days (47.62%). The vigorous and moderate activities of coloured female students are illustrated in Figure 4.35.
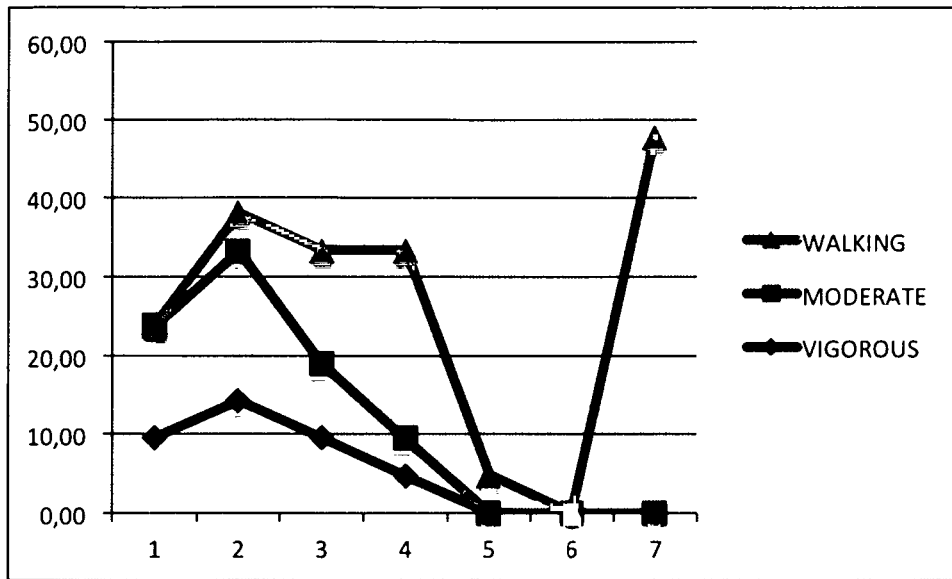
Figure 4.35: Amount of days spent doing PA by coloured female students (X: Percentages; Y: Number of days)

The average time coloured female students spent doing vigorous, moderate and walking activity was 60min, 30min and 60min respectively (Figure 4.36).
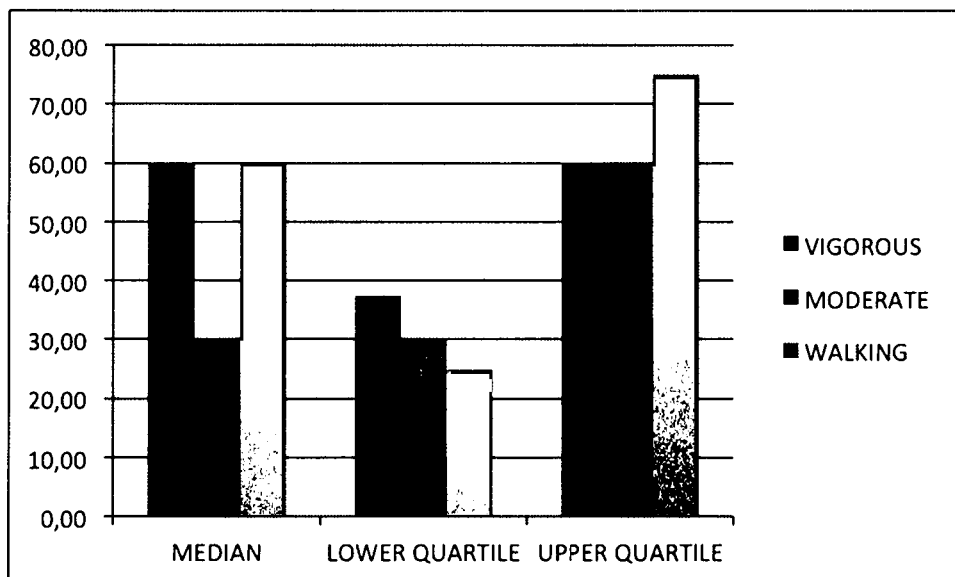
Figure 4.36: Amount of time spent doing PA by coloured female students (X: Percentages; Y: Quartiles)

4.8.6 Lifestyle habits of coloured female students

The lifestyle of the coloured female students were classified according to the lifestyle index of Beloc & Breslow as "poor" (≤ 3 lifestyle habits), for maintaining only 3 of the 7 lifestyle habits. These habits included maintaining a healthy body weight (80.95%), 71.43% being non-smokers and 76.19% consuming little to no alcohol. Unfortunately, as with the black students, their eating, sleeping and exercise habits are not satisfactory (Figure 4.37).
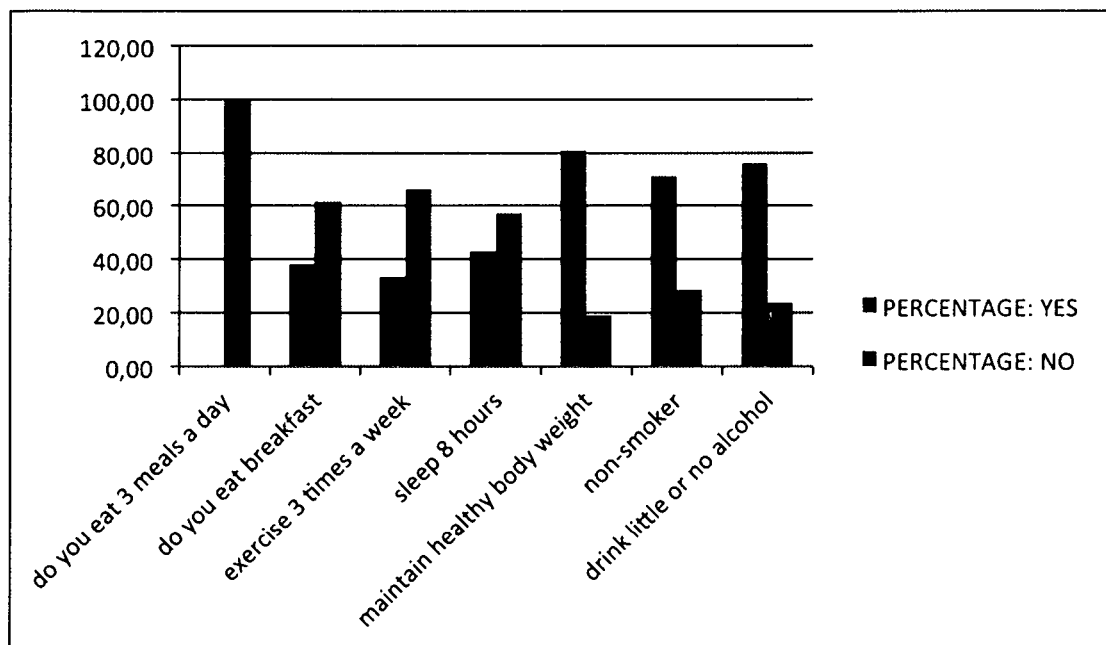

Figure 4.37: Lifestyle habits of coloured students (X: Percentages; Y: Lifestyle habits)

4.8.7 Anthropometric profile of coloured female students

The average coloured female student at the University of the Free State is 163cm tall and weighing 57kg. Their skinfold measurements are; triceps (19.80mm), subscapular (18.60mm), suprailiac (18.20mm), abdomen (25.40mm), anterior medial thigh (39.20mm) and medial calf (21.60mm), which results in a body fat percentage of 27%. According to ACSM (2010:72) norms this is classified as poor. However, the BMI of 21 is aaccording to the International Classification of Adult Underweight, Overweight and Obesity within the normal range (18.5-24.9 kg.m^{-2}), (WHO, 2006; ACSM, 2010:63).The average waist and hip circumferences of 70cm and 100cm

respectively, results in a waist-to-hip ratio of 0.70 which is also within the norm of <0.75. Therefore, the average coloured female student is classified as having an excellent waist-to-hip ratio with a lean body mass of 40kg, and a fat mass of 17kg (Table 4.21).

Table 4.21: Anthropometric profile of a coloured female student

STATURE			
Weight (kg)	57.00	52.00	62.00
Height (cm)	163.00	159.00	164.00
SKINFOLD MEASUREMENTS (mm)			
Triceps	19.80	17.80	24.00
Subscapular	18.60	12.60	26.80
Suprailiac	18.20	14.40	26.80
Abdomen	25.40	17.40	30.80
Anterior Mid Thigh	39.20	33.60	42.40
Medial Calf	21.60	19.20	25.40
GIRTH MEASUREMENTS (cm)			
Waist	71.00	66.00	80.00
Hip	100.00	97.00	106.00
Calf (Maximum)	35.00	34.00	36.00
Arm (Relaxed)	26.00	26.00	28.00
Arm (Flexed and Tensed)	28.00	27.00	30.00
BONE BREADTHS (cm)			
Bi-epicondylar Humerus	6.00	5.50	6.00
Femur	8.50	8.50	9.00
SUMMARY			
Fat Percentage (%)	27.00	22.00	30.00
Lean Body Mass (LBM) (kg)	40.00	39.00	48.00
Body Mass Index (BMI)	21.00	20.00	24.00
Waist to Hip Ratio (W:H Ratio)	0.70	0.67	0.74

4.9 Profile of white female students

4.9.1 Age of white female students

Similarly to the black and coloured female students, the average age of the white female students is also 20 years. The average range is also between 19 and 20 years. These results are illustrated in table 4.22below.

Table 4.22: Average age of white female student

20	19	20

4.9.2 Year of study dispersion of white female students

The majority of the white female students were 1st year students (50%) with the least of the students being 3rd year+ (19.05%). The distribution of the white female students is shown in Figure 4.38.
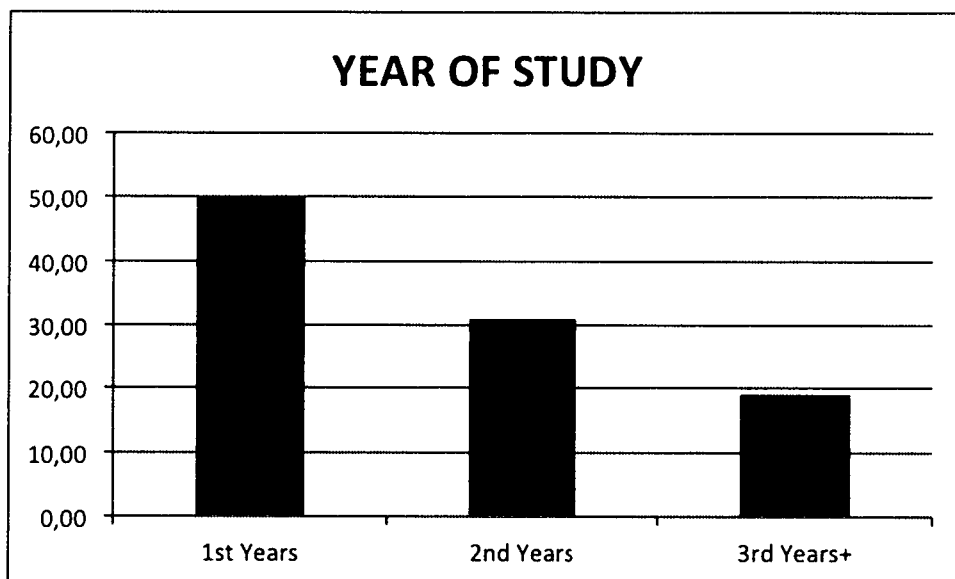
YEAR OF STUDY

Figure 4.38: Year of study dispersion of white female students (X: Percentages; Y: Year groups)

4.9.3 Physical activity of white female students

Figure 4.39 indicates that 67.86% of the white female students participate in PA.

PA PARTICIPATION: 2012

- YES
- NO

Figure 4.39: Physical activity participation of white female students

4.9.4 Sport codes participation of white female students

The variety of sport codes the white female students chose to participate in, differ slightly from these of the black and coloured female student. Thirty five point seven percent(35.71%) of the white female students indicated that they played soccer, and hockey, with netball and cross country were together at 19.64%. The complete results of the white female student participation in 2012 is illustrate in Figure 4.40.
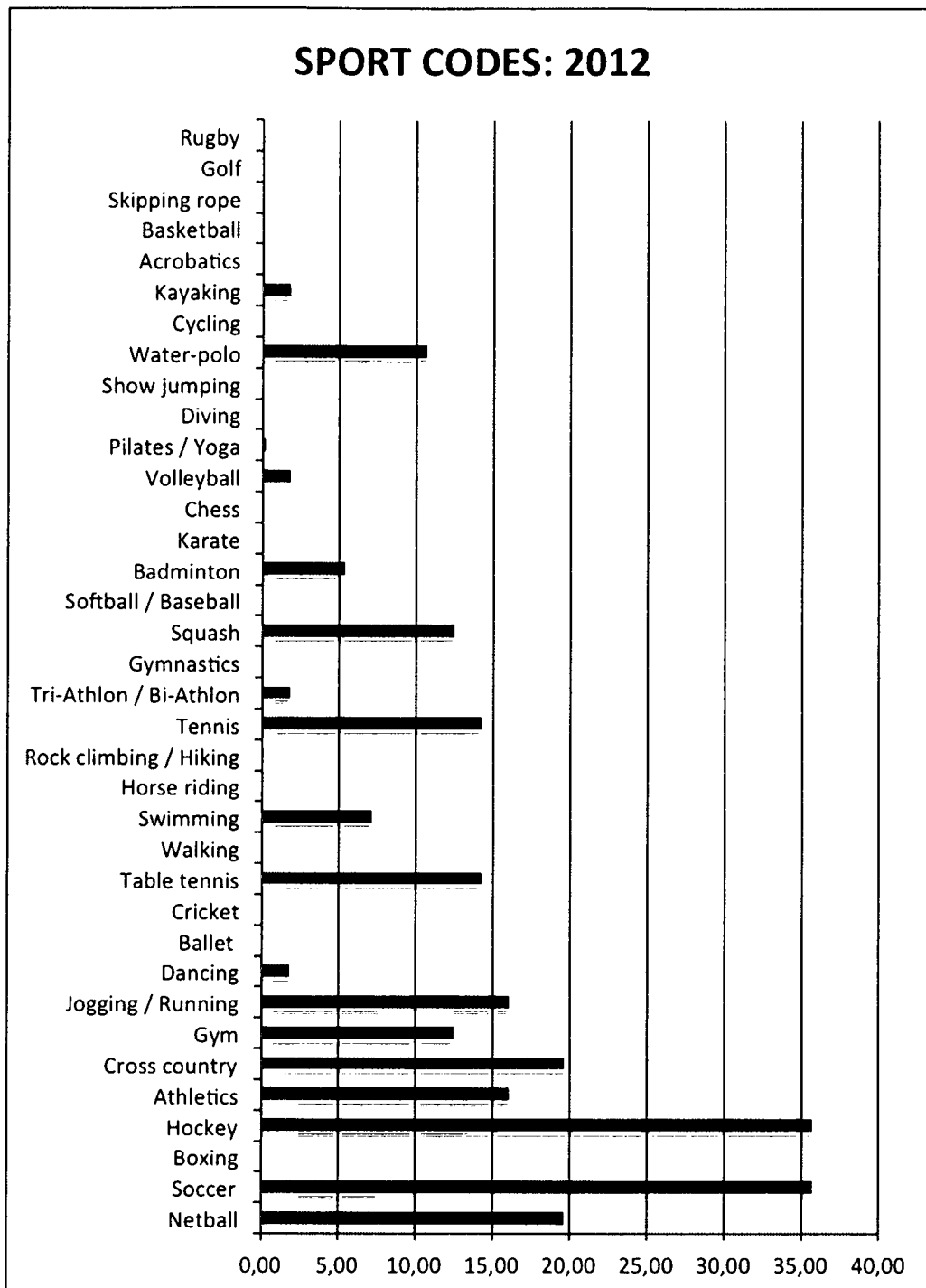
Figure 4.40: Sport code dispersion of white female students (X: Sport codes; Y: Percentages)

4.9.5 Days spent on physical activity by white female students

Similarly to the black and coloured female students, the majority of the white female students (44.05%) walk 7 days a week. These participants alsospent2 to 3 days doing moderate (14.29%) and vigorous (16.67%) PA (Figure 4.41).
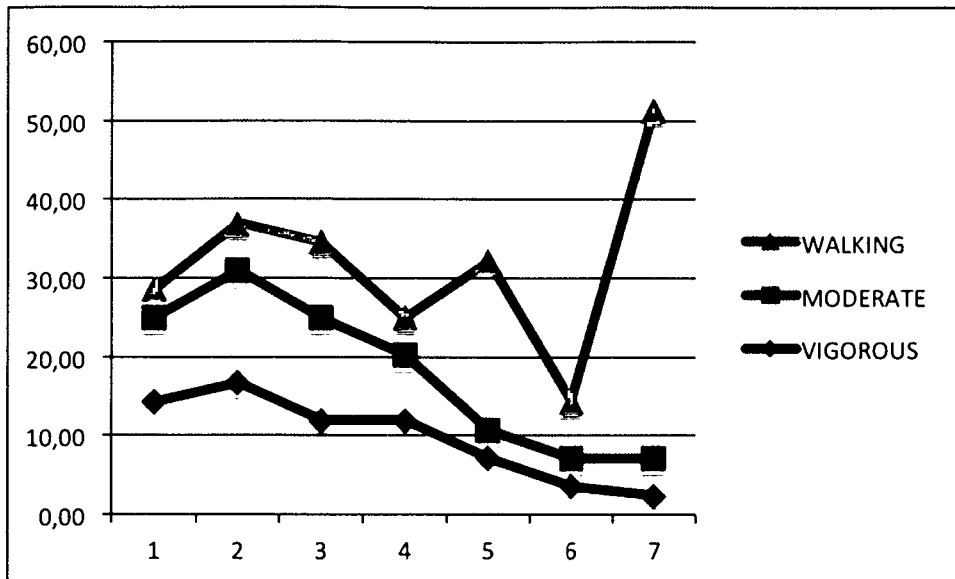
Figure 4.41: Amount of days spent doing PA by white female students

(X: Percentages; Y: Number of days)

The white female students indicated the amount of time they spent doing PA, is for vigorous (42.5min), moderate (30min) and walking (30min), respectively. Interestingly, the three ethnic groups PA profiles are very similar. These results are also presented in Figure 4.42 below.
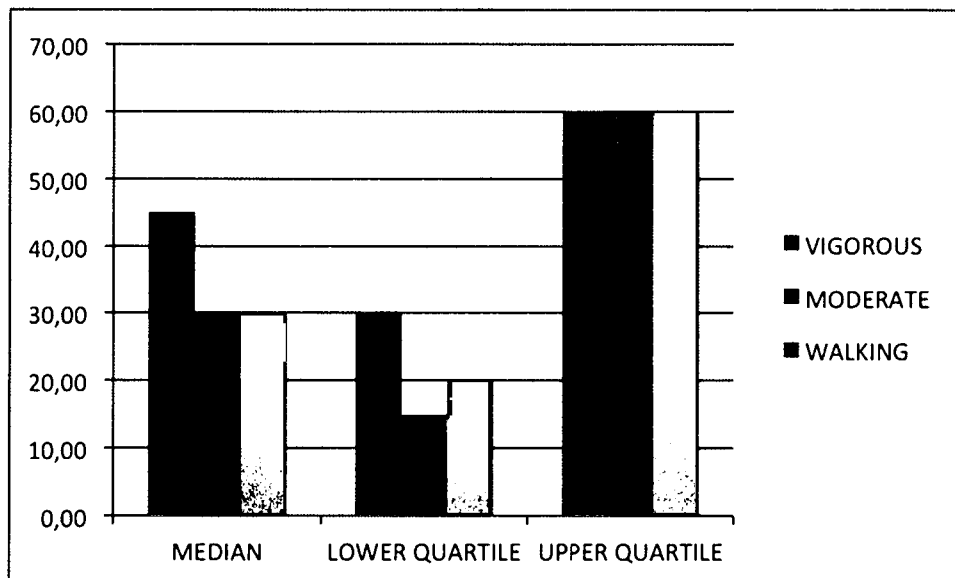
Figure 4.42: Amount of time spent doing PA by white female students

(X: Percentages; Y: Quartiles)

4.9.6 Lifestyle habits of white female students

The white female student's lifestyle habits are illustrated in Figure 4.43.Averages of 5 out of the 7 habits are followed by the majority of the white female participants. Their lifestyle is classified according to the lifestyle index of Belloc and Breslow, (1972: 409) as a moderate healthy lifestyle (4-5 lifestyle habits). These habits included: eating breakfast daily (72.62%), exercising at least 3 times a week (70.24%), 82.14% being non-smokers, 84.52% consuming little to no alcohol, and at least 86.90% of the group maintained a healthy body weight. Unfortunately, as for the other student populations, the eating and sleeping habits of the white female students were also not optimal.
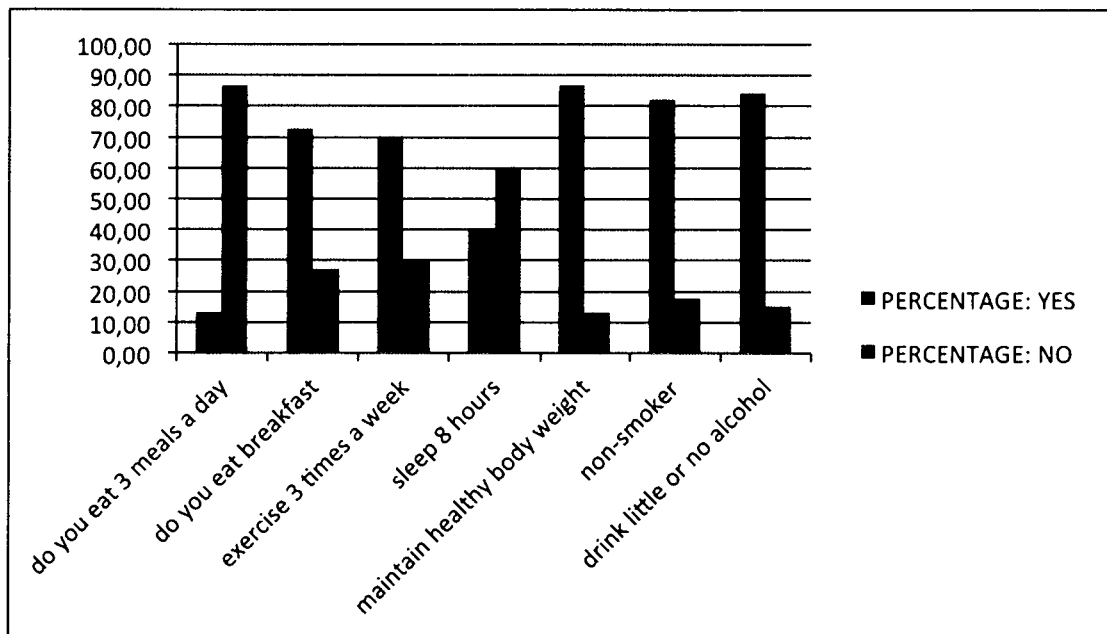

Figure 4.43: Lifestyle habits of white female students (X: Percentages; Y: Lifestyle habits)

4.9.7 Anthropometric profile of white female student

The average white female student at the University of the Free State is taller (167cm) than the other two ethnic groups with a body mass of 62.50kg. There skinfold measurements are respectively: triceps (18.90mm), subscapular (14.90mm), suprailiac (19mm), abdomen (22.80mm), anterior medial thigh (31.80mm) and medial calf (16.50mm), which results in a body

fat percentage of 23%. According to ACSM (2010:72) this is also classified as fair. The BMI of 22% is also very similar to the BMI of black and coloured female students. According to the International Classification of Adult Underweight, Overweight and Obesity classification, the average white female student falls within the normal BMI range (18.5-24.9 kg.m^{-2}), (WHO, 2006; ACSM, 2010:63). The average waist and hip circumferences of 73cm and 101cm respectively, gives the white female student a waist-to-hip ratio of 0.72, which is also within the norm of <0.75. The lean body mass of the white female student is 48kg, which results in a fat mass of 14.50kg (Table 4.23).

Table 4.23: Anthropometric profile of white female student

STATURE			
Weight (kg)	62.50	55.50	68.50
Height (cm)	167.00	162.50	171.00
SKINFOLD MEASUREMENTS (mm)			
Triceps	18.90	14.00	23.80
Subscapular	14.90	11.20	22.10
Suprailiac	19.00	14.20	25.40
Abdomen	22.80	16.60	29.90
Anterior Mid Thigh	31.80	22.30	39.00
Medial Calf	16.50	12.90	20.80
GIRTH MEASUREMENTS (cm)			
Waist	73.00	68.00	78.00
Hip	101.00	96.00	105.00
Calf (Maximum)	36.50	34.00	38.00
Arm (Relaxed)	27.50	25.00	29.00
Arm (Flexed and Tensed)	29.00	27.00	31.00
BONE BREADTHS (cm)			
Bi-epicondylar Humerus	6.00	5.50	6.00
Femur	9.00	8.50	9.50
SUMMARY			
Fat Percentage (%)	23.00	19.00	27.00
Lean Body Mass (LBM) (kg)	48.00	44.00	50.50
Body Mass Index (BMI)	22.00	20.00	24.00
Waist to Hip Ratio (W:H Ratio)	0.72	0.69	0.75

4.10 Discussion of results

The Fischer-Exact test and/or either the Kruskal-Wallis test were used to determine the differences among the ethnic groups regarding the variables that were tested.

4.10.1 Differences in ethnicity among the year groups

The Fischer-Exact test indicated a highly significant (p = 0.0003) difference in the mean frequency of the ethnic year groups tested (1st years, 2nd years and 3rd years, black, coloured and white female students) (Table 4.24).

Table 4.24: Differences in year groups according to ethnicity

1	1st years	
2	2nd years	0.0003
3	3rd years	

4.10.2 Differences in sport participation between the ethnic groups

The results obtained with the Fischer-Exact indicated a non-significant (p=≥ 0.05) (p= 1.336) difference in the mean frequency scores for sport participation between the different ethnic groups. The similarity of sport participation between the different ethnic groups indicates that previously disadvantaged groups' sport participation is progressively increasing (Table 4.25).

4.10.3 Differences in sport code participation between the ethnic groups

The Fischer-Exact test was also performed to test for possible mean differences in sport participation of the three ethnic groups in 2012. The Fischer-Exact test indicated a significant (p = ≤ 0.05) difference in four sport codes participation, that is; soccer (p = 0.0278), hockey (p = 0.0059), cross country (p = 0.0081) and table tennis (0.0147), these results are illustrated in Table 4.26.

Table 4.25: Sport participation of the three ethnic groups

1	YES	1.336
2	NO	

Table 4.26: Sport codes participation of the three ethnic groups

1	Netball	0.0835
2	Soccer	0.0278
3	Hockey	0.0059
4	Athletics	0.4085
5	Cross country	0.0081
6	Gym	0.1561
7	Jogging / Running	0.1000
8	Dancing	0.1000
9	Table tennis	0.0147
10	Swimming	0.1643
11	Tennis	0.6587
12	Tri-Athlon / Bi-Athlon	1.0000
13	Squash	0.0744
14	Badminton	1.0000
15	Chess	0.3108
16	Volleyball	0.2584
17	Pilates / Yoga	0.1216
18	Water-polo	0.0651
19	Kayaking	1.0000
33	Basketball	0.1741
36	Rugby	0.5000

The results reflect a preference for specific sport codes by the different ethnic groups. This may be attributed to the different cultures.

4.10.4 Physical activity levels of the different ethnic groups

Tables 4.27, 4.28 and 4.29 illustrate the results obtained with the Kruskal-Wallis test. Similarly, the results obtained with the Kruskal-Wallis test indicated a non-significant (p = 0.5027) difference for vigorous activity, moderate activity (p = 0.9984) or walking (p = 0.1378) between the three ethnic groups tested.

Table 4.27: Time spent doing vigorous activity

Days	0.5027
Minutes	

Table 4.28: Time spent doing moderate activity

Days	0.9984
Minutes	

Table 4.29: Time spent doing walking

Days	
Minutes	0.1378
Pace	

The similarity of participation in the three activity levels (vigorous, moderate and walking) by the different ethnic groups, confirms the argument that that previously disadvantaged groups sport participation and or PA levels are progressively increasing to be similar if not better than the Caucasian students.

4.10.5 Lifestyle habits of the different ethnic groups

The results obtained with the Fischer-Exact test indicated a non-significant (p = $\geq$ 0.5) difference in the mean frequency scores among the lifestyle habits (Table 4.30).

Table 4.30: Lifestyle habits of the different ethnic groups

1	Do you eat 3 meals a day	0.2044
2	Do you eat breakfast	8.882E-06
3	Exercise 3 times a week	1.628E-07
4	Sleep 8 hours	0.8343
5	Maintain healthy body weight	0.4569
6	Non-smoker	3.358E-04
7	Drink little or no alcohol	0.1275

The 1st year group has a "moderate healthy lifestyle" classification for maintaining a healthy lifestyle in 5 of the 7 lifestyle habits (Belloc & Breslow, 1972: 409). These habits include: eating breakfast daily (60.26%), exercising at least 3 times a week (55.13%), maintaining a healthy body weight (93.59%), being non-smokers (74.36%) and 76.92% consumed little to no alcohol. Unfortunately, the eating and sleeping habits of the 1st year students are not satisfactory. The results of the lifestyle habits of the 1st year female students at the University of the Free State are illustrated in Figure 4.13.

It is important to note that the 2nd year group has according to the classification of Belloc and Breslow (1972:409) lifestyle index a "poor lifestyle"($\leq$ 3 lifestyle habits) for maintaining only 3 of the 7 lifestyle habits being namely, maintaining a healthy body weight (83.67%), 58.16% being non-smokers and 79.59% consume little to no alcohol. Unfortunately, the 2ndyear students do not eat regularly, sleep enough, or train regularly enough to maintain a healthy lifestyle. The lifestyle habits of the 2nd year students compare worse to that of the 1stand 3rd year female students. The lifestyle habits of the 2nd year students are illustrated in Figure 4.19.

The lifestyle habits of the 3rd year+ group was classified according to Belloc and Breslow's (1972: 409) lifestyle index as a "moderate healthy lifestyle"(4-5 lifestyle habits) for maintaining 4 of the 7 lifestyle habits. The lifestyle habits they maintained were namely: exercising at least 3 times a week (51.47%), maintaining a healthy body weight (86.76%), 70.59% being non-smokers, and 73.53% consumed little to no alcohol. It is also clear from Figure 4.25 that the 3rd years+ eating and sleeping habits are unfortunately not satisfactory. The lifestyle habits of the 3rd year+ are similar to that of the 1st year group, but compared to the 2nd year group, the 3rd year maintain a better lifestyle.

The common weak link with regard to all the lifestyle habits of the 1st, 2nd and 3rd year group is insufficient eating and sleeping habits which correlate with the research done by Al-Rethaiaa *et al.*(2010:39) who stated in a study done on college students in Saudi Arabia that although irregular meals consumption was reported in 63.3% of students, the vast majority of them (88.6%) have breakfast at least three times per week. Most of the participants (55.7%) eat two meals per day, while 31.4% of them eat three meals.

Most people need 7-8 hours of sleep per night and according to Sharkey and Gaskill (2007:351), too little sleep can have a negative effect on one's health. Nadolski (2005:168) further states that individuals with insomnia have a four times bigger risk developing depression as well as an increased risk for the development of diseases such as heart diseases.

- **Eating habits**

The similarity of the lifestyle habits of the different ethnic groups, confirms the argument that previously disadvantaged groups were affected by westernisation.

Szabo and Hollands (1997:531) as well as Le Grange *et al.* (1998:250) have both shown that eating disorder pathology is at least as common among black females as it is among Caucasian females. A study by Le Grange, Louw,

Russell and Silkstone (2006:401) indicated that 11.9% of the black respondents showed anorexia nervosa habits while 5.6% of the group showed bulimia or binge eating habits. These studies could possibly be supported by the results reported in this study as only 10.07% black female students indicated that they consume 3 meals a day and 41.01% indicated that they consume breakfast.

In a similar study, Le Grange et al. (2006:401) indicated that 8.7% of the coloured respondents have a anorexia nervosa behavior in their eating habits and 2.8% binge eating or have bulimia habits. This is similar to the results reported in this study due to the fact that 0% of the coloured students eat 3 meals a day and only 38.10% eat breakfast. Several surveys of disordered eating among South Africans over the past decade have shown black Africans to score as "high" (Caradas, Lambert & Charlton, 2001:111; Senekal et al., 2001:45; Szabo & Hollands, 1997:531; Wassenaar, Le Grange, Winship & Lachenicht, 2000:225), or in some instances "higher" (Le Grange et al., 1998:250; Marais, Wassenaar & Kramers, 2003:44), than their white counterparts on measures of disordered eating. In this study it was found that more white students eat breakfast (72.62%) and have 3 meals a day (13.10%). It should be mentioned that even though the results of 3 meals a day is higher than that of black students, it still remains a risk for eating disorders.

These findings are quite similar to the first South African survey of eating attitudes among young adults done in 1998 by Le Grange et al. (1998:250). The prevalence of similar eating disorders in the different ethnicity groups is thus obvious.

- **Physical activity**

The participants were asked to provide information about their PA participation during 2012. Figure 4.9 indicate that only 55.13% of 1st year students participate in PA, while only 42.86% of the 2nd year students participated in PA. The PA participation of the 2nd year students are therefore less compared to that of the 1st year students (42.86% vs. 55.13% respectively).

The 3rd year+ female students were also asked to provide information with regard to their PA participation in 2012.Similarly as the 2nd years only 44.12% of the 3rd years participated in PA during 2012 (Figure 4.21). The 3rd year female students were less physically active compared to the first years (55.13), but a little bit more physically active compared to the 2nd years (42.86).

A study by Bloemhoff (2010:30), comparing physical activity levels of different ethnic groups at a South African university, indicated that black female students predominantly participated in low intensity (38.5), and moderate intensity (36.7) exercises. This coincides with the results that were found in this study where (59.27%) black female students do walking (low intensity exercise) and 14.39%, moderate intensity exercise. Of the 38.10% coloured female students that participated in PA the majority did walking (47.62%). Steyn *et al.* (2004:74) confirmed in a follow-up study that coloured females aged 15-24 years reported the highest amount of participation in PA (53.4%). White females was the most physically active (67.86%), but interestingly enough the majority of their time was spent walking (44.05%), and 16.67% did vigorous activity for 2-3 days per week. Similarly, in the study done by Bloemhoff (2010:30), 42.4% of white female students participated in low exercise intensities, whereas 30.5% participated in moderate exercise intensities. Although participation frequencies differ between the different ethnic groups, the relative low participation levels in moderate and high intensity activities, is unacceptable.

- **Sleeping habits**

Using objective data on a group of 38- to 50-year-olds in the CARDIA study, Lauderdale *et al.* (2006:5) found that blacks have lower average sleep duration, lower sleep efficiency, and higher sleep latency than their white counterparts, even after controlling for various socioeconomic and demographic factors. During this study, only 44.60% of the black female respondents indicated that they slept 8 hours a day during the week. Szalontai (2006:863) found that coloured females sleep an average of 9.47 hours per day in a 7-day week. In this study only 42.86% indicated that they sleep at least 8 hours a day during the week. Hale and Do (2007:1096) stated that 23.5% of the white participants in their study slept ≤6 hours which is seen as a short duration and 8.9% slept for ≥9 hours which is a long duration. These are low sleep duration figures compared to the results reported in this study where 40.48% of the white female students indicated that they sleep at least 8 hours a day during the week. It therefore seems that between 40% and 45% of the respondents, depending on the ethnic group, sleep on average at least 8 hours per night. The similarity of the sleeping habits between the different ethnic groups is once again obvious.

- **Ideal body weight**

In females, there is little ethnic difference in being overweight, however the obesity rates were highest in blacks (Reddy *et al.,* 2008:204). According to Kuczmarski et al. (1994:205) black women are also at high risk for obesity. Nearly 49% are overweight compared to 33% of white women. Black women are also at increased risk for obesity-related health problems, such as cardiovascular disease, stroke and diabetes (Kumanyika, 1993:158). These results are contradictory to the results reported during this study, because 89.21% of the black students indicated that they maintain a healthy body weight. The NHFSC rates of overweight and obesity were higher for black children and children of mixed descent (i.e. 'coloured')compared to white and children of Indian descent (Reddy *et al.,* 2008:204). Although the above mentioned research was on children and adolescents, it is interesting to note that 80.95% of the coloured respondents indicated that they maintain a

healthy body weight.Reddy *et al.* (2008:204) found the highest rates of obesity among whites during the study that they conducted on South African adolescents, even though this study was on students, the results do not support the findings of the study in which 86.90% of the white students indicated that they maintain a healthy body weight. The similarity of the frequency of perceptions regarding ideal body weight between the different ethnic groups is evident and requires further research.

- **Smoking**

Steyn *et al.* (2004?:229) compares the percentage smokers of urban black females from the Cape Peninsula with rural black females from QwaQwa. Ten point three percent (10.3%) of urban black females reported that they were smokers compared to the 4% reported by the rural group. The percentage smokers amongst urban black females in Durban were 6.7% where only 3.4% smoke more than 10 cigarettes per day (Seedat *et al.,* 1992:253). However the results reported in this study indicate that 43.17% of the black females are smokers, which is noticeable higher than the study of Steyn *et al.* (2004?:229) and Seedat *et al.* (1992:253).

The CRISIC-study indicated that 41.4% of coloured females in the Cape Peninsula are users of tobacco en that all the respondents were cigarette smokers (Steyn *et al.,* ??:147). It is evident from this study that especially coloured females aged 25 to 34 years are the most prominent users of tobacco and cigarettes (Steyn *et al.,* ???:147). However, the results in this study indicate that 28.57% of the coloured students reported that they are smokers, which is a noticeable less compared to the research of Steyn *et al.,* (???:147).According to Steyn *et al.* (???:229) the percentage of white female smokers in the rural areas decreased from 17.5% in 1979 to 12.1% in 1991. The biggest decrease came about with the ladies that smoked more than 10 cigarettes a day, from 12.6% to 8.8% (Steyn *et al.,* ???:29). In the study by Joubert (1995: 90), 23.6% of the urban white females between the ages of 35 and 49 years were smokers. In this study 17.86% of white female students reported that they are smokers. It is therefore clear that smoking has decreased among white females and coloured female students. It is evident

that the prevalence of smoking is declining amongst some of the ethnic groups. This may be attributed to legislation and anti-smoking campaigns.

- **Alcohol consumption**

Similarly, 72.66% of the black female students who were part of the study indicated that they do not consume alcohol which is supported by Levitt et al. (1993: 603), who reported that 82% of the urban black females that where surveyed in Cape Town, do not use alcohol. Of those that do use alcohol, 13% indicated that they drink less than 2 drinks per day during the week and less than 8 drinks during weekends. Vorster *et al.,* (1997:116) also indicated that ±75% of South African black females are non-drinkers and that this number stayed relatively constant since 1975. The majority of coloured females (73%) reported that they do not make use of alcohol (Vorster *et al.,* 1997:116). These results are supported by the results in this study where 76.19% of coloured female students indicated that they do not consume alcohol. The white female students indicated that 84.52% of them do not consume alcohol.

It is evident that the prevalence of alcohol consumption is declining amongst the ethnic groups. This may be attributed to legislation and anti-drinking campaigns.

4.10.6 Anthropometric profile of the different ethnic groups

The results obtained with the Kruskal-Wallis test indicated a significant difference in the median height ($p = \leq 0.0001$), anterior mid thigh ($p = \leq 0.0001$), medial calf ($p = \leq 0.0001$), bi-epicondylarhumerus ($p = 0.0468$), fat percentage ($p = 0.0143$), lean body mass ($p = 0.0002$) and the waist-to-hip ratio ($p = 0.0002$), between the different ethnic groups.

Table 4.31: Anthropometric profile of the different ethnic groups

STATURE	
Weight (kg)	0.1895
Height (cm)	<0.0001
SKINFOLD MEASUREMENTS (mm)	
Triceps	0.1135
Subscapular	0.1190
Suprailiac	0.8987
Abdomen	0.6174
Anterior Mid Thigh	<0.0001
Medial Calf	<0.0001
GIRTH MEASUREMENTS (cm)	
Waist	0.2297
Hip	0.3924
Calf (Maximum)	0.1183
Arm (Relaxed)	0.9083
Arm (Flexed and Tensed)	0.8114
BONE BREADTHS (cm)	
Bi-epicondylarHumerus	0.0468
Femur	0.3830
SUMMARY	
Fat Percentage (%)	0.0143
Lean Body Mass (LBM) (kg)	0.0002
Body Mass Index (BMI)	0.1416
Waist to Hip Ratio (W:H Ratio)	0.0002

The average 1st year female student at the University of the Free State is 164cm tall with a body weight of 60kg. The skinfold measurement were respectively; triceps (20.80mm), subscapular (16.10mm), suprailiac (18.40mm), abdomen (23.80mm), anterior medial thigh (34mm) and medial calf (18.60mm), which results in a body fat percentage of 25%. According to the classification of ACSM (2010:72), 25% body fat is classified as fair.

However, the average BMI of the 1st year students was 22. According to the International Classification of Adult underweight, Overweight and Obesity, the average female student falls within the normal BMI range (18.5-24.9), (WHO, 2006; ACSM 2010:63).

The average waist and hip circumferences were 72cm and 100cm respectively, which results in a waist-to-hip ratio of 0.71 (the norm is <0.75,) Therefore the average female student is classified as having an excellent waist-to-hip ratio, with a lean body mass off 45kg, and a fat mass of 15kg. The results are shown Table 4.4. The table includes the lower and upper quartile.

The average 2nd year female student is 164.5cm tall, with a body weight of 63kg. The skin fold measurements were; triceps (20.30mm), subscapular (18.60mm), suprailiac (18.70mm), abdomen (24.20mm), anterior medial thigh (38mm) and medial calf (20mm), which results in a body fat percentage of 25%.This is classified as fair according to ACSM (2010:72). The 2nd year students have a BMI of 23 which according to the International Classification of Adult underweight, Overweight and Obesity, is within the normal BMI range (18.5-24.9) (WHO, 2006; ACSM 2010:63). The average waist and hip circumferences were 71cm and 103cm respectively, which results in a waist-to-hip ratio of 0.70. The norm is <0.75, and therefore the average 2nd year female student is classified as having an excellent waist-to-hip ratio, with a lean body mass of 46kg, with a fat mass of 17kg. The results are similar to those of the 1st year students. The anthropometric data are presented in Table 4.6, which includes the lower and upper quartile range of the results.

The average 3rd year+ female student is 163cm tall and weighing 60kg. The skin fold measurements are respectively: triceps (19mm), subscapular (15.60mm), suprailiac (18.90mm), abdomen (24.10mm), anterior medial thigh (38.50mm) and medial calf (19.70mm), which results in a body fat percentage of 25%, similarly to those of the 1st and 2nd year students. This is also classified as fair according to the ACSM (2010:72). The 3rd years, similar to the 1st and 2nd year groups have a BMI of 22% which according to the Classification of Adult underweight, Overweight and Obesity, is within the

normal BMI range (18.5-24.9), (WHO, 2006; ACSM, 2010:63). The average waist and hip circumferences are 71.50cm and 100.50cm respectively, which results in a waist-to-hip ratio of 0.70. This ratio is also within the norm (<0.75), therefore the average 3rd year female student is classified as having an excellent waist-to-hip ratio. They also have a lean body mass of 44kg, which indicates a fat mass of 16kg. The anthropometric profile of 3rd year+ female students is shown in Table 4.8.

The anthropometric profile of 1st, 2nd and 3rd year student with regard to body fat percentage is classified as fair, according to the ACSM (2010:72), BMI as normal (ACSM, 2010:63), and the WHR as excellent respectively.

Individuals with a percentage body fat above the upper limit of their gender specific norm are deemed to be obese, with an increased risk of cardiovascular disease (Corbin & Lindsay, 1994: 160; Nakanishi *et al.*, 2000:276).

Although the BMI fails to distinguish between body fat, muscle mass or bone, an increased risk of hypertension, total cholesterol/high-density lipoprotein (HDL) cholesterol ratio, coronary disease, and mortality are associated with a BMI bigger than 30.0 kg•m². A BMI of less than 18.5kg•m² also increases the risk of cardiovascular disease.

Significant relationships have been found to exist between WHR and cardiovascular disease (CVD) (Hodgson *et al.*, 1994:43). In several studies the WHR has been found to be the best index for determining risk and disease, associated with fat and weight distribution (Silventoinen *et al.*, 2003: 289; Snijder *et al.*, 2003:1195).

As an entity the anthropometric profile of 1st, 2nd and 3rd year students in this study is therefore within normal ranges and not indicative of any cardiovascular disease risk or mortality.

In conclusion the health of students plays an important role in the optimal functioning at a tertiary institution. It is evident from all the information discussed that there is a positive correlation between physical activity, lifestyle habits and health. In view of the fact that the current student population tends to be inactive (sedentary) and tend to exercise poor lifestyle, their health may be compromised.

CHAPTER 5:

SUMMARY, CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

5.1 Summary

5.2 Conclusions

5.3 Recommendations

5.4 Future Research

5.1 Summary

There is an extensive body of empirical evidence, which demonstrates the physical and psychological health benefits of physical activity (PA), (Craike *et al.*, 2010:20). These prophylactic benefits have been extolled throughout Western history (Cheng *et al.*, 2000:116).

Young adults attending universities gain increased control over their lifestyles. However, they may not necessarily develop positive behaviours like regular PA (Bray & Born, 2004:181). It is also well known and documented that secular modernisation has enhanced sedentary lifestyles (Rode & Shephard, 1994:516; Spence & Lee, 2002:7). A sedentary lifestyle, being overweight and obese are major health, clinical, and economical challenges in modern societies.

The WHO (2002) reports that about 60% of the global population do not adhere to the daily minimum recommendation of 30 minutes of moderate intensity PA. Insufficient PA in turn increases the risk of cardiovascular disease, coronary heart disease (CHD), congestive heart failure, cerebral

stroke, high content of triglycerides (TG) and low-density lipoproteins in the blood (LDL), obesity, post- meal postprandial hyperinsulinaemia and carbohydrate intolerance, type-two diabetes mellitus, osteoporosis, malignantneoplasms, depression, and others (Eriksson 1986:982; Kohl *et al.*, 1992:184; Kampert *et al.*, 1996:452; Wei *et al.*, 1999:1547).

The aim of this study was to establish whether female students on the campus of the University of the Free State, have adapted to student life while still leading a healthy lifestyle. Therefore the objectives were:

1. To identify physical activity levels of undergraduate female students in different ethnic groups in a South African university campus using a validated self-report measurement instrument; (International Physical Activity Questionnaire- IPAQ), and

2. To establish the lifestyle profile and body composition of female students in different ethnic groups in a South African university campus. (Belloc and Breslow's 7 lifestyle habits, and Heath and Carter Anthropometrical Assessment), (Chapter 1).

Chapter 2 focused on an overview of the relevant literature available on the various components that influence physical activity and lifestyle habits of young females in South Africa and around the world. The chapter introduced the reader to the research topic by means of an introduction. The introduction was followed by common terminology and definitions, which was followed by three main sections.

The first section describes the components of physical activity, exercise and physical fitness and it also depicts the possible differences that ethnic groups can have. The second section contains the components that influence lifestyle and what differences can occur in the three ethnic groups focused on. The last section describes health, and how physical activity and a healthy lifestyle can affect health.

In chapter 3 the equipment used during testing as well as the procedures of testing were explained. The method of data collection and statistical analysis was also addressed.

The results of the investigation and discussion thereof were included in Chapter 4. Results of each category of variables, which were obtained, were presented in tables and discussed accordingly. A summary of the main findings concluded the chapter. Chapter 5 presents a summary, conclusions and recommendations for future research.

5.2 Conclusion

The conclusions that were drawn from this research were presented in accordance with the aims and objectives set in Chapter 1.

Objective 1:
To identify physical activity levels of undergraduate female students in different ethnic groups in a South African university campus using a validated self-report measurement instrument; (International Physical Activity Questionnaire- IPAQ) and

Objective 2:
To establish the lifestyle profile and body composition of female students in different ethnic groups in a South African university campus; (Belloc and Breslow's 7 lifestyle habits, and Heath and Carter Anthropometrical Assessment).

5.2.1 Conclusions with regard to objective one.

By comparing the 1st, 2nd and 3rd year groups it is evident that 40.16% of the group as a whole (all ethnic groups) did take part in some form of physical activity. Fifty five point one percent (55.13%) of 1st year female students, 42.86% of the 2nd year and 44.12% of the 3rd year female students participated in PA.

The White female students had the highest physical activity participation rate (67.86%), followed by the coloured students (38.10%). The black students' physical activity participation (35.97%) was the lowest.

5.2.2 Conclusions with regard to objective two.

The majority of the participants are following an average of 4 out of the 7-lifestyle habits. The majority of participants eat breakfast daily (51.64%) but they do not eat 3 meals per day. Eighty-seven present (87.70%) of the sample are non-smokers, with 77.05% of the respondents consuming little to no alcohol, and at least 66.80% of the group maintains a healthy body weight. Unfortunately their eating, sleeping and exercise habits are not optimal.

It is evident that the lifestyle habits of the students decrease from the 1st to the 2nd year, but that by the time they progress to the 3rd year+, they start trying to change their lifestyles habits to a certain extent. The ethnic groups do not show a significant difference among their lifestyle habits but white female students do have a more positive profile.

5.3 Recommendations

Students should be informed and motivated to take part in some form of physical activity and recreational activities. The implementation of a wellness program for students at tertiary institutions will not only enhance the students' lifestyle but also their optimal functionality. If students can adopt a culture of practicing a healthy lifestyle and being more physically active, the development of possible chronic disease risk will also decrease accordingly.

Orientation about what a healthy lifestyle entails and what can be changed to lead a healthy lifestyle can be offered to the students. The students can be taught how to cope with the workload that awaits them while still being able to eat healthily, get enough sleep, exercise often etc.

Priority should be given to the provision of healthy and affordable breakfast outlets on campus.

5.4 Future Research

The population sample consisted only of female students from the University of the Free State.

Research can also be done at other Universities to determine if there are any significant similarities and/or differences in lifestyle habits and physical activity between males and females as well as among different ethnic groups.

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PHYSICAL ACTIVITY QUESTIONNAIRE

1. Gender

Male	
Female	

2. Age (in years):_____

3. Home language: _____

4. Field of study (e.g. Human Movement Science) _____

5. When you were at school in grade 12, did you regularly participate in organised sport or physical recreation?

YES	
NO	

6. If YES, please (a) list the sport codes and (b) indicate with a cross (X) whether the sport is organised through your school, a club, a provincial organisation or through a recreation organisation.

Sport Code	School	Club	Provincial organisation	Recreation organisation
1.				
2.				
3.				
4.				
5.				

7. Did you experience any barriers/constraints inhibiting your participation in sport in Grade 12?

YES	
NO	

8. If YES, please indicate the barriers/constraints:

   1 Lack of motivation to participate.................................____
   2 Lack of knowledge about sport.....................................____
   3 Social responsibilities...____
   4 Study responsibilities...____
   5 Lack of sport facilities...____
   6 Lack of effective sport administration.............................____
   7 Lack of financial resources...____
   8 Lack of time to participate..____
   9 Injuries...____
   Other, please list...
   10 _____
   11 _____
   12 _____

9. During 2013, did you regularly participate in organised sport or

YES	
NO	

171

Physical recreation?

10. If YES, please (a) list the sport codes and (b) indicate with a (X) whether the sport is organised through a hostel, a club, a provincial organisation, or through a recreational organisation.

Sport Code	Hostel	Club	Provincial organisation	Recreation organisation
1.				
2.				
3.				
4.				
5.				

11. Do you experience at present any barriers/constraints inhibiting your participation in sport?

YES	
NO	

12. If YES, please indicate the constraints:

1 Lack of motivation to participate............................____
2 Lack of knowledge about sport............................____
3 Social responsibilities......................................____
4 Study responsibilities......................................____
5 Lack of sport facilities....................................____
6 Lack of effective sport administration....................____
7 Lack of financial resources...............................____
8 Lack of time to participate................................____
9 Injuries..____
Other, please list.
10 _____
11 _____
12 _____

13. Do you intent to participate in sport or physical recreation after completing your studies?

YES	
NO	

14. If YES, please list the sport codes or activities:
1 _____
2 _____
3 _____
4 _____
5 _____

15. If NO, please motivate why not.

_____
_____
_____
_____

172

YOUR PHYSICAL ACTIVITY LEVEL

A. VIGOROUS ACTIVITIES

1. During the last 7 days, on how many days did you do
   vigorous physical activities (for at least 10 minutes)?   Days:_____

   ⌊⌋ 107

2. How much time in total did you usually spend on one of those days doing
   vigorous physical activities (average time per day)?
   Average minutes per day:_____

   ⌊⌊⌋⌋ 108 - 110

B. MODERATE ACTIVITIES

3. During the last 7 days, on how many days did you do
   moderate physical activities (for at least 10 minutes)?   Days:_____

   ⌊⌋ 111

4. How much time in total did you usually spend on one of those days doing
   moderate physical activities (average time per day)?
   Average minutes per day:_____

   ⌊⌊⌋⌋ 112 - 114

C. WALKING (for recreation, exercise, sport or leisure)

5. During the last 7 days, on how many days did you walk
   for at least 10 minutes at a time?   Days:_____

   ⌊⌋ 115

6. How much time in total did you usually spend walking on one of those days
   (average time per day)?
   Average minutes per day:_____

   ⌊⌊⌋⌋ 116 - 118

7. At what pace did you usually walk?
   - A vigorous pace, that makes you breath much harder than normal......___
   - A moderate pace that makes you breath somewhat
     harder than normal...___
   - A slower pace where there is no change in your breathing................___

   ⌊⌋ 119

D. SITTING (work or leisure)

8. During the last 7 days, how much time in total did you usually spend sitting on a
   WEEKDAY (average minutes sitting per day)?
   Average minutes sitting per day:_____

   ⌊⌊⌋⌋ 120 - 122

9. During the last 7 days, how much time in total did you usually spend sitting on a
   WEEKEND DAY (average minutes sitting per day)?
   Average minutes sitting per day:_____

   ⌊⌊⌋⌋ 123 - 125

Belloc & Breslow Lifestyle habits

For each of the following statements mark the applicable space with an X (Yes or No) that indicates your current lifestyle habits.

For office use only

	YES	NO
Do you eat three meals a day at regular times with no sncaks in-between		
Do you eat breakfast everyday? *		
Do you participate in moderate exercise two or three times a week?		
Do you get 7 to 8 hours sleep a night?		
Are you a non-smoker?		
Do you maintain a moderate body weight?		
Do you consume little or no alcohol?		

L__| 168

L__| 169

L__| 170

L__| 171

L__| 172

L__| 173

L__| 174

*Coffee or tea with a rusk and/or toast is, for the purpose of this study, not accepted as a breakfast

HEATH & CARTER ANTHROPOMETRIC ASSESSMENT FOR FEMALES

Date: _____

Student no: _____

Ethnicity: _____

Year of study: _____

Weight: _____kg

Height: _____cm

| 1 | 2 |

| 3 | - | 12 |

| 13 |

| 14 |

| 15 | - | 17 |

| 18 | - | 20 |

6 Skinfold measurements	mm	mm	mm
Triceps			
Subscapular			
Suprailiac			
Abdomen			
Medial thigh			
Medial calf			

21	-	29
30	-	38
39	-	47
48	-	56
57	-	65
66	-	74

Girths	mm	mm	mm
Waist			
Hip			
Calf (maximum)			
Arm (relaxed)			
Arm (flexed & tensed)			

75	-	86
87	-	98
99	-	110
111	-	122
123	-	134

Breadths	mm	mm	mm
Biepicondylar Humerus			
Femur			

| 135 | - | 146 |
| 147 | - | 158 |

Summary of Calculations	%
Fat Percentage	
Lean Body Mass (LBM)	
Body Mass Index (BMI)	

159	-	161
162	-	164
165	-	167

INFORMATION LETTER

Research has been done whether students abroad are leading a healthy lifestyle, however with available literature, we have seen that these studies have not been done on South African students.

The aim of this study is to determine whether female students at the UFS are leading a healthy lifestyle, regarding physical activity and lifestyle habits that need to be followed.

1st, 2nd and 3rd year female students that are residing on campus are asked to take part in this study, confidentiality is assured and no information gathered will be used for other purposes. You as the participant can decide at any stage to withdraw from the study, but is encouraged to take part till the end.

During assessment skinfold measurements, physical activity index, and lifestyle habits will be measured. The assessment will take about 25min and assessment will be done in your room at your convenience.

Your participation in this study will be highly appreciated and valued. I thank you in advance for taking part

Contact details of researcher:

T'Neil Losper: 0769676100

_____

Signature

UFS·UV
H. IMANITIES
:STESWETENSKAPPE

INFORMED CONSENT

Physical activity and lifestyle aspects assessment of senior female students at the University of the Free State

I, _____, hereby grant consent that the information about my physical activity and lifestyle may be used for the accumulation of data in this particular study. It is my understanding that the information gathered through the completion of the questionnaire will be evaluated to determine the final result to the research questions given.

The researcher will take precautions to preserve the confidentiality of the research data and that all reports of the research will be devoid of identifiers.

_____   _____

Participant's signature   **Date**

_____   _____

Researcher's signature   **Date**