BODY MASS INDEX AND ITS ASSOCIATION WITH ENERGY INTAKE AND EXPENDITURE AMONG UNIVERSITY STUDENTS IN NAIROBI COUNTY

BY

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JULY 2014
DECLARATION

“This Thesis is my Original Work and has not been presented for a Degree in any other University.”

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DEDICATION

I dedicate this work especially to my family, Wife, daughters, brother, sisters, nieces, nephews, and friends with love and respect.
AKNOWLEDGEMENT

With a lot of gratitude, I acknowledge the immense contribution of my research supervisors; Dr. J. W. Kamau and Dr. V. O. Onywera both of whom guided and supported me in numerous ways throughout the study. I appreciate the support from the Catholic University of East Africa, United States University of Africa, University of Nairobi, Kenya College of Accountancy University, Pan African University, Inoorero University, Multimedia University of Kenya, and Kenyatta University, without which this study would not have been successful. I also express my gratitude to the University students who volunteered to take part in this study. Lastly but not least, I thank my family, relatives, friends and well-wishers, for their understanding, support and encouragement which enabled me to accomplish this study in the specified period of time.
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</thead>
<tbody>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>CHE</td>
<td>Commission of Higher Education</td>
</tr>
<tr>
<td>CMS</td>
<td>Centres for Medicare and Medicaid Services</td>
</tr>
<tr>
<td>FDAA</td>
<td>Food and Drug Administration Agency</td>
</tr>
<tr>
<td>FDE</td>
<td>Food and Drugs Administration</td>
</tr>
<tr>
<td>MMU</td>
<td>Multimedia University of Kenya</td>
</tr>
<tr>
<td>NIH</td>
<td>National Institute of Health</td>
</tr>
<tr>
<td>PA</td>
<td>Physical Activity</td>
</tr>
<tr>
<td>MMU</td>
<td>Multimedia University of Kenya</td>
</tr>
<tr>
<td>RDAs</td>
<td>Recommended Daily Allowances</td>
</tr>
<tr>
<td>REE</td>
<td>Resting Energy Expenditure</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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<td>TEE</td>
<td>Total Energy Expenditure</td>
</tr>
<tr>
<td>USDHHS</td>
<td>United States Department of Health and Human Services</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
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</table>
OPERATIONAL DEFINITION OF TERMS

The following terms were defined in the context of the study as:

**BMI- (Body Mass Index)**  Refers to a measure of determining whether a university student is overweight or obese and it is calculated by dividing the weight in kilograms by the square of the height in meters. \( \text{BMI} = \frac{\text{weight (kgs)}}{\text{height (m}^2\text{)}}, \)

**Normal weight**  Refers to a Body Mass Index measuring from 18.5 to 24.9.

**Obese**  Refers to a Body Mass Index measuring 30 and above

**Overweight**  Refers to a Body Mass Index measuring from 25 to 29.9

**Physical Activity**  Refers to any bodily movement produced by skeletal muscles that will result in physical activity by university students in Nairobi County.

**Prevalence**  Refers to existence of overweight and obesity amongst the university students in Nairobi County, Kenya.

**Underweight**  Refers to a Body Mass Index measuring below 18.5.

**University Student**  Refers to a male or female person enrolled for degree courses in a public or private university in Nairobi County.
ABSTRACT

Overweight and obesity in all populations are now realised as worldwide epidemic health problems. The aetiology of these conditions suggests a disruption in regulation of energy at the population level, leading to a positive energy balance and excess adiposity among others. Overweight and obesity can be defined in terms of Body Mass Index (BMI), which is the weight in kilograms divided by the square of the height in meters (kg/m\(^2\)). The aim of this study was, therefore, to measure the BMI and find out its association with physical activity and energy intake among university students in Nairobi County, Kenya. The target population comprised full-time students in selected public and private universities in Nairobi County. The population data was divided into two strata: public universities and private universities with a sample of 384 respondents obtained through stratified random sampling. Data management and analyses were done using the Statistical Package for Social Sciences (SPSS) program version 17.0. BMI was categorised into underweight, normal, overweight and obese. The association among energy intake and expenditure and BMI was determined by Spearman’s rho and Pearson correlation coefficients. The results were presented in tables and figures. The findings of this study indicated that overweight and obesity status was 6.5% and 1.0% respectively. The prevalence of overweight and obesity among public university students was 3.8% and 0.7% respectively compared to the private university students (2.7% and 0.3% respectively). In the study, 91.2% of the males’ energy intake was less than the recommended daily allowances (RDAs), and 8.8% had an energy intake above the RDAs as compared to 93.4% of females who had energy intake below RDAs and 6.6% above RDAs. Correlation analysis of the association between energy intake through dieting and BMI score of the university students was significant ($P < .01$). The study findings also indicated that 40.5% of the students had a high score of participation in physical activity while 8.6% had a low physical activity level. However, the analysis of the association between physical activity and BMI of the university students was not significant ($P = .608$).
1.1 Background to the study

Overweight and obesity is defined as abnormal or excessive fat accumulation that may impair health (WHO, 2010). Obesity is a medical condition in which excess body fat has accumulated to the point that it may affect individual’s health, leading to reduced life expectancy and/or increased health problems (Kushner & Robert, 2007). According to WHO (2003), overweight and obesity can be defined in terms of Body Mass Index (BMI), which is the weight in kilograms divided by the square of the height in meters (kg/m²). A BMI less than 18.5 indicates that the person is underweight, a BMI ranging between 18.5 and 24.9 represents normal weight, BMI ranging between 25.0 and 29.9 represents underweight while a BMI greater than or equal to 30.0 represents obesity among the Caucasians population (WHO, 2003).

Obesity is a top preventable cause of death globally, with increasing prevalence in adults and children, and it is one of the most severe public health problems of the twenty-first century (Barness, Opitz, & Gilbert, 2007). The health consequences of BMI include the most common chronic diseases in the society such as heart diseases, Type II diabetes mellitus, hypertension, osteoarthritis, and sleep apnoea (Pi-Sunyer, 1996; Eckel & Krauss, 1998; WHO, 2009).

Several studies have been conducted on the prevalence of overweight and obesity among university students. A study conducted by Yahia, Achnar and Rizk(2008) among university students at Lebanese American University indicated that 37% and 13.6% of
the males and females respectively were overweight, while 3.2% and 13.6% of the male and female students were obese. A similar study by Sakamaki, Toyama, Amamoto, Chuan-Jun Liu and Shinfuku (2002) at Beijing University, found that 80.5% of the students had normal BMI. The students with prevalence rate of BMI greater than 30 were very few in this sample (0.1%). Cilliers (2004) conducted a study among female students in a South African University and found out that the average BMI was 21.8 with 10.0% being overweight and 0.8% being obese. A study by Oghagban, Odili, Nwangwa & Pender (2009) at a Nigerian University found out that obesity prevalence was 3.4%. The female students’ prevalence, however, was higher (4.0%). There is however not documented studies that have been conducted among the university students in Kenya.

Since overweight and obesity are products of a positive energy imbalance that highly relate to dietary energy intake and expenditure, it is not unexpected that healthy weight management almost continuously involves the successful regulation of energy intake (Eliana, 2011). Several studies indicate that eating-related behaviours such as high flexible restraint, high eating self-efficacy, emotional eating, and low hunger predict good outcomes in obesity treatment (Foster, 1998; Teixeira, 2010). However, a study by Doucet et al. (2000) found out that subjects who successfully underwent a weight-loss program consisting of energy intake control plus exercise reported an increase in increased desire to eat, as well as a more intense feeling of hunger, coupled with greater food consumption. This cannot, however, lead to overweight and obesity so long as the energy restriction and exercise continued as a lifestyle (Doucet et al., 2000).
A study among university students in Europe by Bellisle, Monneuse, Steptoe and Wardle (1995) revealed that 44% of female and 17% of male students regulated energy intake and expenditure. Similarly, a study among Iranian University students found out that 90% of the students’ energy intake was lower than the recommended daily allowances (RDA) due to regulation of energy intake (Ali, 2012). This study aimed at measuring the BMI and finding out its association with physical activity and energy intake among university students in Nairobi County.

1.2 Problem Statement

Obesity has become a global epidemic health hazard, with more than 1 billion adults being overweight and at least 300 million of them suffering from obesity related chronic diseases (WHO, 2010). There is strong evidence that low levels of exercise are associated with many health problems (WHO, 2004). In spite of this evidence, people in both industrialized and developing nations do not take part in adequate physical activity to gain health benefits (Martin, 2000). This reduced physical activity arises from many factors such as overdependence on technologies, ignorance of the importance of physical exercises, and denial.

As obesity is becoming more prevalent, weight loss practices are growing increasingly popular in developed and developing countries. Many students engage in regular exercise and dieting behaviours, some of which may be extreme and unsound, such as self-induced vomiting, dieting, fasting, diet pills and laxatives in order to lose weight (Martin,
2000). A lot of these practices are driven by media images that saturate the internet, television programmes, magazines, radio talk shows, and daily conversations.

Despite the visible signs of overweight and obesity among many Kenyans, there is no documented research on these problems among university students. Additionally, there is scarcity of data on the methods that the university students in Kenya could be using to prevent and manage overweight and obesity. Thus, there is need to provide information on the BMI among the university students in Nairobi County.

1.3 Purpose of the Study

The purpose of this study was to measure BMI among university students in Nairobi County, Kenya and to determine if BMI is affected by physical activity and energy intake. The study took into account the students' gender and whether they are in public or private university.

1.4 Objectives of Study

This study was guided by the following objectives:

i. To measure BMI of university students in Nairobi county.

ii. To assess the association between energy intake and BMI of university students in Nairobi County.

iii. To determine the association between physical activity through exercise and BMI of university students in Nairobi county.
1.5 Research Questions and Hypothesis

This study sought to answer the following questions:

i. What is the BMI of the university students in Nairobi County?

ii. What is the association between energy intake and BMI of university students in Nairobi County?

iii. What is the association between physical activity through exercise and BMI of university students in Nairobi County?

The following hypotheses were tested in the study;

H01 There is no significant association between energy intake through diet, and BMI of university students in Nairobi County.

H02 There is no significant association between physical activity through exercise and BMI of university students in Nairobi County.

1.6 Significance of the Study

The findings of this study may guide universities curriculum developers to come up with physical fitness related university common units with a view to creating awareness in management of overweight and obesity in the universities in Nairobi County. The study recognizes that good physical health helps to boost the self-esteem and productivity levels in people.

Universities may provide an ultimate forum for reaching out to a large number of young adults through education programs that may positively influence students' eating habits and advocating for regular exercise and healthy lifestyles. If all university students are
well informed about the dangers of overweight and obesity, they can help disseminate this health knowledge in the villages, work places and residential areas. This study will also add to scholarly input in research in the area of BMI among other universities situated in other counties in Kenya.

1.7 Delimitation of the Study

The study was delimited to university students enrolled for degree courses in public and private universities in Nairobi County. The study was also confined to measuring BMI and its association with, physical activity and energy intake among university students in Nairobi County.

1.8 Limitations of the Study

In the context of this study, the researcher did not have control over other weight management strategies such as us pharmacological methods, slimming products (creams, tea pills among others) and alternative medicine among other weight control methods the university students could have been using by the time of the study. This study was only confined to measuring of BMI and its association with physical activity and energy intake, among university students in Nairobi County.

1.9 Assumptions of the Study

This study assumed that although there could be many overweight and obesity management strategies, the overweight and obesity status of the students was as a result of energy balance or imbalance attributed to energy intake or physical activity.
1.10 Theoretical Framework

There are various theories that explain the occurrence of overweight and obesity. Among them, is the set point theory which has two models; physiological model and cognitive model (Powers & Howley, 2001). The Physiological model of body weight set point shows that physical activity is regulated by autonomic nervous system and numerous endocrine hormones, the most prominent of which are the thyroid hormone systems (Rosenbaum & Leibel, 1999).

According to Rosenbaum and Leibel (1999), the biological signals with regard to blood glucose (glucostatic signal), lipid stores (lipostatic signal), or weight on feet (penderostatic signal), provide input to the hypothalamus. If the collective signal indicates low energy stores, food intake is stimulated until the source of the signal is diminished and energy stores equal the set point. Like any biological control system, if the set point were to be increased body weight would increase to meet this new value.

However, according to Rosenbaum and Leibel (1999), people using physiological model can successfully lose weight in the short term, but majority of them cannot sustain the reduced body weight in the long run. This is because body weight is maintained at a set level, and deviations from the preferred set point are resisted and minimized by a feedback control system. A study by Doucet et al. (2000) found that subjects who successfully underwent a weight-loss program consisting of energy restriction plus exercise reported an increase in the fasting desire to eat, as well as a more intense feeling
of hunger, coupled with greater food consumption. This means that the model cannot be relied on for a sustained weight loss.

In contrast to this physiological model, Powers and Howley (2001) observed that cognitive set-point model deals with the role the environment (culture, socioeconomic class among others) has on body weight. Relative to a personally selected "ideal" body weight set point, people are constantly receiving a variety of cognitive signals about weight, clothing size, perception of effort and concerns about health. A mismatch between the "ideal" set point and these perceptions leads to appropriate eating behaviour as shown in figure 1. Exercise can modify signals and the type of diet can influence the feeding behaviour (Powers & Howley, 2001). These cognitive structures "reflect one's core, affect-laden assumptions or beliefs about the importance and influence of one's appearance in life, including the centrality of appearance to one's sense of self" (Cash, 2002).

Figure 1 shows that overweight and obesity are as a result of high energy intake and low energy expenditure. It further shows that through regulating cognitive process, the students engage in low energy intake through dieting and high physical activity by involvement in exercise resulting in attainment of ideal body weight.
Figure 1.1. Conceptual framework of the cognitive model set point theory by Powers and Howley (2001).

University students have the knowledge about the consequences of overweight and obesity and therefore, they are likely to set their ideal body weight set point through cognitive signals. The study, therefore, sought to find out the extent to which the cognitive model of the set point theory applies in prevention and management of overweight and obesity among the university students in Nairobi County.
CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The chapter presents a review of related literature on BMI, diet, energy intake and expenditure and physical activity.

2.2 Body Mass Index (BMI)

Although body fat levels and distribution are important predictors for health risk factors, for purposes of defining overweight and obesity trends, BMI (weight in kilograms/ height in m$^2$) has been recommended as being the most applicable measurement in young people (Wells, 2000). A person with a BMI of 30 or more is considered obese whereas a person with a BMI equal to or more than 25 is considered overweight (WHO, 2010). Overweight and obesity are the main risk factors for a number of chronic diseases such as diabetes, cardiovascular diseases and cancer (WHO, 2009).

Once considered a problem in high income countries, overweight and obesity are now dramatically on the rise in low and middle income countries, particularly in urban settings (WHO, 2010). This is due to the nutrition evolution in developing countries, or shift from traditional diets and lifestyles to western diets high in animal products, sugar and refined foods, and a combination of reduced levels of activity and increased stress particularly in the rapidly growing urban populations (Popkin, 2002).

According to WHO (2010), current overweight and obesity levels range from 5% in China, Japan and certain Africa nations to over 75% in urban Samoa. In a survey carried
out on urban and rural women in 7 Sub-Saharan countries (Burkina Faso, Ghana, Kenya, Malawi, Niger and Tanzania) from 1992 to 2005, the findings indicated that prevalence of urban overweight and obesity increased by 35% (Abdhah et al., 2009). The prevalence in urban areas was found to be 23% in Malawi, 35% in Niger and Ghana, and 38% in Kenya. The increase of overweight and obesity among the non-educated women was 45 – 50% and a drop of 10% among the educated women of secondary education and above.

2.3 Prevalence of overweight and obesity among University Students

Studies from Arab and developed countries draw a worrying image of the prevalence of overweight and obesity, which in turn could be a pointer to an increase in the manifestation of other chronic diseases (El-Hazmi & Warsy, 2000). In a study conducted in Jordan in 2009, the prevalence rates of overweight and obesity among Jordan University students were 28.5% and 10.2% respectively (Alboqai et al., 2009). Another study conducted among 233 female students from Jordan North Badia University showed that the prevalence of overweight and obesity was 27.0% and 6.9% respectively (Tukan, Ahmad & Takrori, 2006). However, a study conducted by Bassan (2011) among the students in An-Najah National University and Nojomi & Najamabadi (2005) among university students in Iran to assess the frequency of obesity, found that obesity prevalence among the university students was lower. The study in Iran University involved a sample size of 1150 students. The results showed that the mean BMI for all subjects was 21.7%. Almost 88% of the subjects were classified as non-obese (BMI < 25) while 12.4% of the student had a BMI of more than 25kg/m².
In Africa, the studies which have been done among the university show that the prevalence is slightly lower than the rest of the world. In a study done in Nigerian University among 646 students by Oghagban et al. (2009) found out that obesity prevalence was 3.4%. Overweight was found to be more common in male students (26.78%) than in female students (20.98%).

A study conducted in Kampala, Uganda by Baalwa et al. (2011) among young adults indicated that the prevalence of overweight and obesity was 10.4% and 2.3% respectively. A study in South Africa among university students indicated that 8.9% and 2.5% of Indian students and 19.7% and 4.6% of black students were overweight and obese respectively (Morar et al., 1998). Another study among young female students at a South African university, found out that the average BMI was 21.8 with 7.2% being under weight, 81.9% normal weight, 10.0% overweight and 0.8% obese (Cilliers et al., 2005). The research also indicated that the students with normal weight were more physically active than the underweight and the overweight students.

2.3.0 Management of Overweight and Obesity

Several management options of overweight and obesity that are available include the following: (1) pharmacological treatment, (2) Bariatric surgery treatment, and (3) behaviour modification habits which involve diet restriction and physical activity.
2.4 Physical activity

According to U.S Department of Health and Human Services, Physical Activity and Health, (1998), regular physical activity is also important for health of muscles and joints and reduces symptoms of depression and anxiety, improve mood, and enhance one's ability to perform daily tasks and it also helps to maintain high quality of life. Physical activity makes many contributions to weight loss and maintenance (Whitney, 2001).

A study among the university students in Lebanon indicated that only 26.4% engaged in physical activity, (Musharrafieh et al., 2008). A study by Kahan (2009) among American middle Eastern University students found that 69.2% of participants reported no weekly engagement in physical activity (PA) while 68.7% reported that they engaged in physical activity only once a week. A similar study done by Abdullah (2005) among Hong Kong university students also indicated that most of the students were physically inactive. Physical activity is the most variable component of energy expenditure, varying both from individual to individual and from one day to the next (Olivier, 2012). Physical activity can lead to a steep increase in total energy expenditure (TEE) because of the energy cost to perform the exercise and recover from the exercise, or in the long term, by changing the resting energy expenditure (REE) by increasing the amount of lean mass (Hill et al., 1995). The level of physical activity is commonly described as the ratio between TEE and REE (TEE: REE).

Overweight and obesity come as a result of high intake of calories and low energy expenditure, also referred to as positive energy balance (Hagger et al., 2010). According
to WHO (2010), the fundamental cause of overweight and obesity is an energy imbalance between calories consumed on one hand, and calories expended on the other hand. Global increases in overweight and obesity are attributable to a number of factors including a global shift in diet towards increased intake of energy-dense foods that are high in fat and sugars but low in vitamins, minerals and other micronutrients (WHO, 2010). Observational studies by Fogelholm in 2000 suggested that exercise leads to successful weight loss maintenance.

A study by McTigue et al. (2003) reported that counselling in diet or physical exercise and behavioral interventions resulted in small to moderate degree of sustained weight loss (3-5 kg) over at least one year. In a related study by Miller et al. (1997) initial weight loss of 11% of the baseline weight loss of 7% to 9% after one year of follow up was reported. However, it seems that even losing weight with these approaches, most individuals do not maintain the loss for long periods (Wadden, 1993).

2.5 Energy Intake

Diets that promote weight loss are generally divided into four categories: low fat, low carbohydrate, low calorie, and very low calorie (Strychar, 2006). Very low calorie diets provide 200–800 kcal/day, maintaining protein intake but controlling calories from both fat and carbohydrates. Previous studies reported an emerging tendency of dieting among college students (Malinaukas et al., 2006). A study by Malinaukas et al. (2006) to identify dieting practice among 185 American female college students aged between 18 to 20
years reported that 83% of their participants used dieting for weight loss, while 32% of them skipped breakfast as a weight loss strategy.

According to the Food and Drug Administration Agency (FDAA) an agency in United States Department of Health and Human Services (USDHHS), healthy individuals seeking to maintain their weight, should have 2,000 calories per day (Klei & Daniel, 2008). Obese individuals, however, may need to restrict their daily calorie intake to 800 or even 500 (Klei & Daniel, 2008). The WHO global strategy on diet, physical activity and health describes the actions needed to support the adoption of healthy diets and regular physical activity. The strategy called upon all stakeholders to take action at global, regional and local levels and aims to lead to a significant decrease in the prevalence of chronic diseases and their common risk factors, primarily unhealthy diet and physical inactivity (WHO, 2006).

2.6 Summary

From the review of literature as well as studies that have been conducted on the area of overweight and obesity, there are distinct gaps that the present study drew out and attempted to fill up. The reviewed literature indicates that the prevalence of BMI among the university students is lower in developing countries but it is steadily increasing. Majority of the reviewed studies with examples of those conducted by Nojomi and Najamabadi (2005), Alboqai et al. (2009), Tukan et al. (2006), and El-Hazam & Warsay (2000) also indicate that more focus has been given to the western and Middle East countries.
Some studies have been conducted in Africa among the university with examples of the studies by Cillier et al., (2005), Oghaban et al.(2009) and Baalwa et al. (2011) conducted in South Africa, Nigeria and Uganda respectively. However, there are no records of studies on prevalence of overweight and obesity that have been conducted on the university students in Kenya. The studies by Oghaban et al. (2009) and Cillier et al. (2009) focussed on first year students only and therefore it did not cater for the students in the other three levels of study.

The study by Cillier et al.(2009) focused on female first year students only. It is, therefore, evident that this study did not account for the gender differences. The study in Kampala by Baalwa et al.(2011) focused on young adults who were not necessarily university students.

The current study, however, sought to fill these research gaps by focusing on gender differences as well as four undergraduate levels of study among the university students in Nairobi County.
CHAPTER THREE: METHODOLOGY

3.1 Research Design

This study was conducted using a cross-sectional survey research design to measure the BMI scores of the university students and to establish whether there is association of energy intake and expenditure and the BMI scores among university students in Nairobi County. According to Mugenda and Mugenda (2003), a cross-sectional survey is applicable in collecting data from members of a population in order to determine the current status of that population with respect to one or more variables.

3.2 Research Variables

The dependent variables in the study was BMI. The independent variables were energy intake, physical activity, type of university, gender and level of study.

3.3 Location of the Study

The study was located among the public and private universities in Nairobi County, Kenya. This location was chosen because there are many universities in Kenya are in Nairobi County and the admission includes students from all parts of the country. Therefore, the study population was deemed a good representation of the university students in Kenya.

3.4 Target Population

The target population comprised the public and private university students in Nairobi County in full time under graduate degree programme. According to the Commission for
Higher Education 2010 records, the chosen universities have 20,297 male and 15,682 female students.

3.5 Sample Size and Sampling Procedures

Stratified random sampling method was used to sample the study participants. Stratified random sampling involves dividing the population into two or more relevant and significant strata based on one or a number of attributes. The population was divided into two strata, which are public and private universities. The number of the respondents in each university was proportional to the universities' total population.

The sample size was obtained using the formula by Fisher et al. (1998)

\[ n = \frac{Z^2 \cdot p \cdot q}{d^2} \]

Where \( n \) is the desired sample size (if target population is > 10000)

\( z \)- Is the standard normal deviation = 1.96 which corresponds to 95% confidence interval

\( p \)= proportion of the target population estimated to have the desired characteristics (0.5)

\( q \)=1-p (proportion without the characteristic)

\( d \)= the level of statistical significant set at 0.05 degrees of freedom

\[ n = \frac{1.96^2 \cdot 0.5 \times 0.5}{0.05^2} \]

= 384 respondents

3.6 Instrumentation

The International Physical Activity Questionnaire (IPAQ) which is a validated tool and the 24 hours dietary recall recording sheet were used to gather data from the respondents.
The weight and height measurements were taken by the researcher. Body weight was measured to the nearest 0.1 kg with a medical grade bathroom scale model PD300DHR manufactured by Detecto. The scale had a digital weight measurement for accurate calculation of BMI. The scale also had a rod display of a participant's height.

3.7 Data Collection Procedures

The participants height was taken while they were bare footed. They stood with heels together, arms to the side, legs straight, shoulders relaxed and the head looking straight ahead. Heels, buttocks, shoulder blades and back of the head were against the vertical board of the height measuring rod. The height measurement was taken to the nearest 0.1cm and the eye level with the head board to avoid error due to parallax.

The weight was measured using the bathroom that was placed on a flat, hard surface. The participant would stand on the middle of the scale's platform without touching anything, with the body weight equally distributed on both feet. The weight was read to the nearest 0.1kg. BMI was calculated as a ratio of weight (kg) to height(m$^2$) and categorized according to the WHO 2004 categories as follows: underweight <18.5 kg/m$^2$, normal weight 18.5 — 24.9 kg/m$^2$, overweight 25-29.9 kg/m$^2$, and obese > 30 kg/m$^2$. The energy intake data was collected using the 24 hour diet recall questionnaire over 3 days one of which was a weekend.
3.8 Pre-testing

The questionnaire was pre-tested at Multimedia University of Kenya (MMU) using 38 respondents, to improve the tools and standardize the administration procedures and to determine its effectiveness. The MMU students were not involved in the final study.

3.8.1 Validity

Validity refers to whether or not an indicator that is designed to judge a concept really measures that concept (Brayman & Bell, 2009). The questionnaire was pre-tested using purposively selected participants in order to ensure validity of the information.

3.8.2 Reliability

Reliability is a measure of degree to which a research instrument yields consistent results or data after repeated trials (Mugenda and Mugenda, 2003). In this study, the reliability was 0.912 cronbach alpha, determined using the test-retest method.

3.9 Data Analysis and Presentation

The Statistical Package for Social Sciences (SPSS) version 17.0 was used for the analysis of data. Frequency and range checks were performed initially to detect errors in data entry. BMI was categorized into underweight, normal weight, overweight and obese. The association between those who energy intake and expenditure and BMI were determined using Pearson Product Moment formular at 0.5 level of significance. The results were presented in tables and charts. Dietary intake was analysed by using a nutri-survey windows software program which has been modified by adding Kenyan food composition.
3.10 Logistical and Ethical Considerations

Participants were not coerced into participating in the research but were impressed upon to participate in the study and give honest responses to the questionnaire items. The researcher assured the respondents of confidentiality in their responses and their use for the purposes of the study only.
CHAPTER FOUR: FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the research findings and discussion of the study on the following research objectives;

i. To measure BMI of University students in Nairobi county.

ii. To find out the association between energy intake through dieting, and BMI of university students in Nairobi county.

iii. To determine the association between physical activity through exercise and BMI of university students in Nairobi county.

4.2 The Instrument Return Rate

Two questionnaires were used as the sole instruments for data collection among the university in Nairobi County. The questionnaires were the International Physical Activity Questionnaire (IPAQ) and a 24-hour recall recording sheet. Out of the researcher’s target population of 384, only 291 respondents returned their questionnaires. This number represents 75.78% return rate. At return rate of 70% is sufficient for cross-sectional survey research (Mugenda and Mugenda 2003).

4.3 Demographic Characteristics of respondents.

Table 4.1. below shows that 58.4% of the students were males and 41.6% were females. Students from public universities constituted 72.5% while as students from private universities were 27.5%. Twenty three percent (23.7%) of the students were in first year, 44% second year, 27.5% third year and 2.4% fourth year of study. There was almost
equal number of students aged between 18 - 20 years (45.7%) and those aged between 21 - 24 years (46.4%). Only 0.7% of the students were aged below 18 years and the same percentage above 25 years.

**Table 4.1. Demographic Characteristics of the Respondents**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>58.4</td>
</tr>
<tr>
<td>Female</td>
<td>41.6</td>
</tr>
<tr>
<td>Type of university</td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>72.5</td>
</tr>
<tr>
<td>Private</td>
<td>27.5</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>17 yrs and below</td>
<td>0.7</td>
</tr>
<tr>
<td>18-20 yrs</td>
<td>45.7</td>
</tr>
<tr>
<td>21-24 yrs</td>
<td>46.4</td>
</tr>
<tr>
<td>25 yrs and above</td>
<td>0.7</td>
</tr>
<tr>
<td>Year of study</td>
<td></td>
</tr>
<tr>
<td>First</td>
<td>23.7</td>
</tr>
<tr>
<td>Second</td>
<td>44.0</td>
</tr>
<tr>
<td>Third</td>
<td>27.5</td>
</tr>
<tr>
<td>Fourth</td>
<td>2.4</td>
</tr>
</tbody>
</table>

**4.4 BMI scores of University Students in Nairobi County**

Figure 4.1. shows the percentage number of participants in the various BMI categories. The overall prevalence of overweight and obesity among the students was 6.53% and 1.03% respectively. Majority of the students (89%) were in the normal BMI range. The
average BMI was 21.9 kg/m² which according to WHO classification is in the normal category.

Findings in Table 4.2. above shows the prevalence of overweight and obesity was higher among private university students (10% and 1.3%) compared to the public university students (5.2% and 0.9%). The difference between the private and the public universities was however not statistically significant, \((p=0.172)\). The percentage of the underweight students among the public university was 3.8% and 2.5% among the private university students. The findings also showed that 90% of the students in public universities and 86.3% in private universities were in normal category.

*Figure 4.1.* Percentage number of participants in the various BMI categories.
Table 4.1. Percentage number of participants in public and private universities in the various BMI categories.

<table>
<thead>
<tr>
<th>CURRENT BMI STATUS</th>
<th>18 and below (underweight)</th>
<th>18 to 24.9 (normal)</th>
<th>25 to 29.9 (overweight)</th>
<th>30 and above (overweight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Universities</td>
<td>3.8%</td>
<td>90%</td>
<td>5.2%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Private Universities</td>
<td>2.5%</td>
<td>86.3%</td>
<td>10.8%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Total</td>
<td>3.4%</td>
<td>89.9%</td>
<td>6.5%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

Data in Table 4.3. below indicates that the prevalence of overweight and obesity among the female students was higher (9.1% and 1.7%) compared to the male students (4.7% and 0.6%). The study indicated that a higher proportion of the female students who were underweight (4.1%) as compared to the male students (2.9%). Findings of this study also showed that 91.8% of the males and 85.1% of the females were in the normal BMI category. The mean BMI was $21.9\pm3.4 \text{ kg/m}^2$ and $21.8\pm2.9 \text{ kg/m}^2$ for males and females respectively. The difference between the BMI status among the males and females was however not statistically significant ($p=0.230$).
Table 4.2. Percentage number of participants by gender in the various BMI categories.

<table>
<thead>
<tr>
<th>CURRENT BMI STATUS</th>
<th>18 and below (underweight)</th>
<th>18 to 24.9 (normal)</th>
<th>25 to 29.9 (overweight)</th>
<th>30 and above (overweight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>2.9%</td>
<td>91.8%</td>
<td>4.7%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Female</td>
<td>4.1%</td>
<td>85.1%</td>
<td>9.1%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Total</td>
<td>3.4%</td>
<td>89.9%</td>
<td>6.5%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

The findings in Table 4.4. indicate that the overweight and obesity prevalence among the male students was higher in private (12.2% and 2.0%) respectively as compared to public (1.7% and 0%) respectively. There was significant statistical differences between BMI status of the male students in public and private universities, ($p=0.003$). The prevalence of overweight and obesity among the female students in public universities was higher (10.0% and 2.2%) respectively compared to the female students in private universities (6.5% and 0%) respectively. There was, however, no statistical difference between the BMI score among the females in public and private universities ($p=0.461$).
Table 3.4. Percentage number of participants of different gender in the various BMI categories per university category.

<table>
<thead>
<tr>
<th>Gender</th>
<th>University type</th>
<th>CURRENT BMI STATUS</th>
<th>18 and below (underweight)</th>
<th>18 to 24.9 (normal)</th>
<th>25 to 29.9 (overweight)</th>
<th>30 and above (overweight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Public</td>
<td></td>
<td>3.3%</td>
<td>95%</td>
<td>1.7%</td>
<td>0%</td>
</tr>
<tr>
<td>Male</td>
<td>Private</td>
<td></td>
<td>2.0%</td>
<td>83.7%</td>
<td>10.0%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Female</td>
<td>Public</td>
<td></td>
<td>4.4%</td>
<td>83.3%</td>
<td>10.0%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Female</td>
<td>Private</td>
<td></td>
<td>3.2%</td>
<td>90%</td>
<td>6.5%</td>
<td>0%</td>
</tr>
</tbody>
</table>

According to the findings in Table 4.5., the overall results showed that BMI was more common among the first years (7.8% and 1.6%) as compared to the fourth years who did not record any cases of BMI. For males, overweight was more common among the 2nd year students (4.3%) respectively, followed by 3rd year males (2.5%). The study found out that the mean BMI was normal category for all the year groups at 22kg/m^2 for first year students, 21kg/m^2 for second years and 24kg/m^2 and 22 kg/m^2 for third and for fourth year students respectively. One way ANOVA for dependent variable showed a significant difference between the year groups (p=0.039).
Table 4.4. Percentage number of participants in various BMI categories by year of study.

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Current BMI Status</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Year</td>
<td>Underweight</td>
<td>2.3%</td>
<td>0%</td>
<td>2.3%</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>55%</td>
<td>33.3%</td>
<td>88.4%</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>2.3%</td>
<td>5.4%</td>
<td>7.8%</td>
</tr>
<tr>
<td></td>
<td>Obese</td>
<td>0.8%</td>
<td>0.8%</td>
<td>1.6%</td>
</tr>
<tr>
<td>2nd Year</td>
<td>Underweight</td>
<td>2.9%</td>
<td>0%</td>
<td>2.9%</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>53.6%</td>
<td>36.2%</td>
<td>89.8%</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>4.3%</td>
<td>2.9%</td>
<td>7.2%</td>
</tr>
<tr>
<td>3rd Year</td>
<td>Underweight</td>
<td>0%</td>
<td>6.3%</td>
<td>6.3%</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>53.8%</td>
<td>33.8%</td>
<td>87.5%</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>2.5%</td>
<td>2.5%</td>
<td>5.0%</td>
</tr>
<tr>
<td></td>
<td>Obese</td>
<td>0%</td>
<td>1.3%</td>
<td>1.3%</td>
</tr>
<tr>
<td>4th Year</td>
<td>Normal</td>
<td>38.5%</td>
<td>61.5%</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.5 Association between Energy Intake through Dieting and BMI of University Students in Nairobi County.

Data presented in Table 4.6., as per the nutri-survey windows software analysis, shows that most of the students (92.1%) had an energy intake below the recommended daily allowances (RDAs). Seven point nine percent (7.9%) of the students recorded an intake above the RDAs. The findings showed that 91.2% of the males’ energy intake was less
than RDAs where as 8.8% had an energy intake more the RDAs. The female students on the other hand had 93.4% below RDAs and 6.6% above RDAs. The findings of this study indicated that the mean energy intake was 1934 kcal for males and 1665 kcal for females, which is below the RDAs. The mean caloric intake for all the students was 1823 kcal. The difference between the energy intake among the female and male students was statistically significant ($p<0.0000$).

**Table 4.5. Energy intake between male and female students.**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Status of Caloric intake</th>
<th>Less than recommended</th>
<th>More than recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>91.2%</td>
<td>8.8%</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>93.4%</td>
<td>6.6%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>92.1%</td>
<td>7.9%</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.7. below shows that 93.0% of the 1st year students had an energy intake below RDAs compared to the 2nd years 91.3%, 3rd years 91.3% and fourth years 92.1%. on the other hand the 3rd years had a slightly higher percentage of students with higher RDAs intake than recommended (8.8%), as compared to the 1st years 7.0%. 2nd years 8.7% and 4th years 7.7%. The mean caloric intake for 1st year students was 1814 kcal, while the mean caloric intake for 2nd year was 1780 kcal. The mean caloric intake for 3rd and fourth year students was 1846 kcal and 1994 kcal respectively. However the difference in the energy intake between the year groups was not statistically significant ($p=0.614$).
Table 4.6 Energy levels of the university students by year of study

<table>
<thead>
<tr>
<th>Academic year</th>
<th>Status of caloric intake</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than recommended</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1</td>
<td>93.0%</td>
<td></td>
<td>7.0%</td>
</tr>
<tr>
<td>Year 2</td>
<td>91.3%</td>
<td></td>
<td>8.7%</td>
</tr>
<tr>
<td>Year 3</td>
<td>91.3%</td>
<td></td>
<td>8.8%</td>
</tr>
<tr>
<td>Year 4</td>
<td>92.3%</td>
<td></td>
<td>7.7%</td>
</tr>
<tr>
<td>Total</td>
<td>92.1%</td>
<td></td>
<td>7.9%</td>
</tr>
</tbody>
</table>

According to the findings in Table 4.8., 93.8% and 87.5% students in public and private universities respectively had an energy intake lower than RDAs. The study results also indicate that 6.2% and 12.4% of the public and private students respectively had an intake above the RDAs. The study findings indicate that the mean energy intake among the public university students was 1783 kcal and 1924 kcal for private university students. However the difference between the energy intake among the students in public and private was not statistically significant ($p= 0.056$).
Table 4.7 Caloric intake status of university students

<table>
<thead>
<tr>
<th>Academic year</th>
<th>Status of caloric intake</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than recommended</td>
</tr>
<tr>
<td>Public</td>
<td>93.8%</td>
</tr>
<tr>
<td>Private</td>
<td>87.5%</td>
</tr>
<tr>
<td>Year 3</td>
<td>92.8%</td>
</tr>
</tbody>
</table>

The Pearson correlation coefficient analysis indicated that there was a significant association \( r=0.323; \ p<0.01 \) between energy intake through dieting and overweight and obesity status of university students in Nairobi county. Therefore, the null hypothesis \( \text{H0}_1 \) that there is no significant association between energy through dieting, and BMI, was rejected.

4.6 Association between Physical activity and BMI score of University Students in Nairobi County.

Figure 4.2 shows the percentage of university students involved in various physical activity levels. According to the IPAQ guidelines for data processing and analysis, a high physical activity score indicates 7 days of a combination of walking, moderate- intensity or vigorous activities achieving intensity of a minimum of at least 3000 met/minutes/week. Moderate physical activity level indicates 3 or more days of vigorous activity of at least 20 minutes per day and the low physical activity level indicates a
category of physical activity not meeting the other two either the high or the moderate physical activity level.

The findings of this study indicated that the only 8.6% of the university students were involved in low physical activity level. Majority of the student (50.86%) recorded moderate physical activity level. The study indicated that 40.6% of the students recorded high level of physical activity.

Findings in Table 4.9 indicates that 11.4% of the student in public universities had a low physical activity level score, 47.4% moderate level score, and 41.2% high physical activity level score. The study indicated that 1.3% of the students in private universities had low level of physical activity score, 60% moderate level score and 38.8% high level of physical activity score. There was however no significant statistical difference between the public and private university students ($p=0.353$).

*Figure 4.2. Percentage number of participants in the various physical activity categories*
Table 4.8. Physical activity level by type of university.

<table>
<thead>
<tr>
<th>University category</th>
<th>Subjects physical activity status</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Public</td>
<td>11.4%</td>
<td>47.7%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Private</td>
<td>1.3%</td>
<td>60.0%</td>
<td>38.8%</td>
</tr>
<tr>
<td>Total</td>
<td>8.6%</td>
<td>50.9%</td>
<td>40.5%</td>
</tr>
</tbody>
</table>

Table 4.10. shows 15.9% of the male participants in private universities were in the high activity level, whereas in the public universities there was 38.8% who were in the high activity level. Among the female participants in private universities, 60% were in the moderate physical activity level and 38.8% in the high physical activity status. About 42% of the female students in the public universities were in the moderate physical activity level while 23.3% were in the high activity level. The physical activity was more concentrated on moderate in females (56.7% in public and 83.9% in private universities) in contrast to high (54.5% in public and 55.1% in private universities). There was no significant difference however in physical activity status between females in private and public universities.
Table 4.9. Different levels of physical activities by gender and type of university

<table>
<thead>
<tr>
<th>Gender</th>
<th>University type</th>
<th>Subjects physical activity status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Male</td>
<td>Public</td>
<td>3.5%</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>0%</td>
</tr>
<tr>
<td>Female</td>
<td>Public</td>
<td>14.9%</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>1.3%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>8.6%</td>
</tr>
</tbody>
</table>

In this study, the results indicated that there was no significant association between physical activity level and BMI score of the participants \( r=0.030, \ p=0.608 \). Therefore the null hypothesis that there is no significant relation between energy intake and expenditure through exercise and BMI scores of the university students in Nairobi County was accepted.
CHAPTER FIVE: DISCUSSION

Based on BMI classification status, findings of this study indicate that majority of the students (89%) had normal weight. This was in agreement with the findings of a study conducted among university students in An-Najah National University which indicated that 70.4% were within normal range (Basam, 2011). Similar results were found in a study conducted among university students in Tai Solarin University of Education, in Nigeria, the results indicated higher percentage (67.7%) among the normal BMI weight category (Olusunya & Omutoyo, 2011).

The study findings indicate that overweight and obesity prevalence of the university students in Nairobi County was 6.5% and 1.0% respectively. A study in Uganda among the young adults indicated almost similar results where by the prevalence rate of BMI was 10.4% and 2.3% respectively (Baalwa et al., 2011). In agreement with these results the study in a South African University by Cilliers et al. (2005), among young female students, found out that the average 10.0 % overweight and 0.8% obese.

The study findings among university students in some of Arab countries was much higher such as: Kuwait (32% and 8.9% respectively) (Al-Isa, 1999); in Saudi Arabia (30% and 19% respectively) (Al-Maki et al., 2003) and (31% and 23.3% respectively) (Al-Turki, 2007) in Lebanon. This indicates that there is a high risk of the students in the overweight category tilting over to the obese category if appropriate measures are not taken.

The overall prevalence of overweight and obesity among the public university students was 5.2% and 0.9% respectively, while among the private university students, it was 10%
and 1.3% respectively. This indicates that there is a higher awareness of the risks associated with being overweight and obese among the students in public universities than those in private universities.

The findings of this study also indicated that overweight and obesity were more common among the females than male students. Prevalence of overweight and obesity among the female students was 9.1% and 1.7% respectively as compared to 4.7% and 0.6% respectively among the male students. These findings are consistent with the findings of a study among students in Nigeria University (Olusanya & Omutoyo, 2011).

In contrast, 4.1% female students were underweight as compared to 2.9% of the male students. This higher rate of underweight students is expected since female students are more cautious about their weight status than males due to the new societal perceptions which encourage females to slender. Obvious pictures of movie stars and models in fashion magazines and mass media have a strong impact on girls’ body shape and image perception (Field, et al., 1999). University girls see the shapes and weight of fashion models as the ideal body shape and figure to attain. Girls with such strong body weight perceptions can be at the risk of developing eating disorders (Aroyo, et al., 2006).

In this study the findings on the students’ energy intake indicate that majority (92.1%) had an intake below the RDAs and only 7.9% had an intake above the RDAs. The mean energy intake was 1934 kcal for men and 1665 kcal for females. These findings are consistent with findings in a study conducted among the Iranian university students,
which indicated that 90% of the students had an intake lower than RDAs (Ali, 2012). The mean energy intake among the Iranian University students was 1769 kcal. A similar study among the UK University students to investigate the state of their energy balance of university also found out that the energy intake among the students was lower (Ellis, 2012).

The low energy intake rates might be attributed to a better awareness of the dangers associated with obesity among the university students. A study conducted among college students reported in US reported that increased knowledge of dietary guidance appeared to be positively related to more healthy eating patterns thus better eaters had a higher level of knowledge about nutrition (Kolodisky et al., 2007).

Results obtained from this study indicated that there was a significant association between energy intake and overweight and obesity status of university students in Nairobi county (Pearson correlation $r = 0.323$).

In this study, 54.7% of the male students had higher physical activity level compared to female students (20.7%). 15.7% of the female were in the low level category of physical activity as compared to male students who had only 3.5% in the low level. A study conducted in Kuwait of 787 students indicated higher score whereby, 48% of the males and 52% of the females reported that they were physically inactive (Al-Isa et al., 2011). In this study however there was no significant association between physical activity level and BMI of the participants ($r = 0.030, p=0.608$).
CHAPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This section presents a summary of the study, conclusions made, as well as recommendations for further research.

6.2 Summary

This study sought to establish the BMI score among the university students in Nairobi County. The study also aimed at determining the extent to which these university students manipulate either physical activity or diet to prevent or manage overweight and obesity. It was postulated that controlled energy intake and expenditure could reduce the occurrence of overweight and obesity among the university students.

The study adopted a cross sectional survey research design to determine the BMI score and to establish whether there is association between of energy intake and expenditure and BMI score.

The findings of this study indicated that the prevalence of overweight and obesity was 6.5% and 1.0% respectively. The energy intake results indicated that 91.2% of the male student’s energy intake was below the RDAs while 8.8% had an intake above the RDAs. 93.4% of the female students had an intake above the RDAs and 6.6% had an intake below RDAs.
The results also indicated that the association between energy intake and BMI score of the university students was significant ($p<.01$). However, there was no significant association found between physical activity and BMI score of the university students ($p = 0.608$).

### 6.3 Conclusions

From the findings of this study, it can be concluded that overweight and obesity is still a problem among the university students despite the low prevalence rate. Overweight and obesity was more common among the female as compared to the male student.

Therefore awareness among university students should be increased through physical health education and nutritional programs that encourage increased healthy eating and physical activities; which is recommended for good health and targeting the impact of overweight and obesity on mobility and mortality. Dietary and exercise counselling are also required as a preventive strategy against overweight and obesity among university students.

### 6.4 Recommendations for Policy and Practice

Policy makers should address the problem of overweight and obesity and focus on prevention strategies especially among university students. Furthermore, public demand for nutritional and physical exercise information should be taken into consideration when implementing strategies aimed at improving the nutritional well-being of individuals.
Daily physical activities for university students should be encouraged in all universities as it plays protective role against obesity as well as its importance in the regulatory system controlling the storage, distribution and utilization of calories in order to increase muscle mass and decrease fat mass.

6.5 Recommendation for Further Research

Further research is needed to investigate other methods that the university students may be using to prevent or manage Overweight and obesity. The findings of this study are limited to a sample of students from Nairobi County only. It is, therefore, highly recommended that an investigation of the prevalence of factors associated with overweight and obesity among a larger sample representing all university students be conducted.
REFERENCES


Appendix A:

24-HOUR RECALL RECORDING SHEET

Tick the Day of the Week Which You are Recalling (It Should be the Day Before the Interview)

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
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**Step 1**: Please think back to when you woke up yesterday morning to the time you went to sleep in the evening. Now, I want you to try and remember what you ate or drank yesterday from the moment you got up until you went to sleep again last night. Run through the whole day in your mind and try to remember everything that you ate or drank. (THE INTERVIEWER MUST GIVE THE RESPONDENT A LITTLE TIME TO DO THIS). Now I would like to you tell me what you ate and drank in the morning after you got up. AFTER THE PARTICIPANT MENTIONS AN ITEM, THE INTERVIEWER SHOULD PROMPT THE RESPONDENT BY SAYING “AND THEN?” ENTER THE INFORMATION IN COLUMN 1)

<table>
<thead>
<tr>
<th><strong>STEP 1</strong>: Food/drink eaten/drank during the</th>
<th><strong>STEP 2</strong>: Forgotten foods (PROMPTED)</th>
</tr>
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**STEP 2**: NOW ASK THE FOLLOWING QUESTIONS ON FORGOTTEN FOODS AND ENTER THEM IN COLUMN 2.

Did (name) have any cold drinks or soda yesterday?
Did (name) have any sweets and or chocolate yesterday?
Did (name) have any cake and or cookies yesterday?
Did (name) have any snacks like chips, samosa, yesterday?
Did (name) have any (other) fruit yesterday?
Did (name) have any (other) vegetable yesterday?
Did (name) have any bread and or rolls yesterday?
Did (name) have any mandazi yesterday?
Did (name) have anything else yesterday?

Q. What [NAME] ate/ drank yesterday; was it same as, more than or less than usual? (MARK X WHERE APPROPRIATE)

<table>
<thead>
<tr>
<th>Same as usual</th>
<th>More than usual</th>
<th>Less than usual</th>
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</table>

FOR THOSE WHO ATE

Q. Was the lunch served/ eaten at university dining hall, university room, home or elsewhere?

1 At home □
2 At university dining □
3 Elsewhere □

Q. Was the lunch adequate in terms of quantity?

1 Yes □
2 No □

Step 3: TO FIND OUT MORE DETAIL ABOUT EACH ITEM THAT WAS EATEN OR DRUNK, THE FOLLOWING CAN BE SAID AND ASKED: “Now I am going to ask you more about each food or drink that you ate/drank yesterday. Let us start with the first item on the list. At what time did you eat... (= item 1 on the list)”. (DO NOT SPEND TOO MUCH TIME TRYING TO FIND OUT THE EXACT TIME. ANY COMMENTS ON THE TIME CAN BE ENTERED IN COLUMN 2). Now I want you to tell me more about this food item....” (THIS WILL INCLUDE A DESCRIPTION OF THE FOOD AS WELL AS THE PREPARATION. ENTER THIS INFORMATION IN COLUMN 4). “Now we are going to find out how much of this item you ate/drank.” (THE INTERVIEWER NOW USES THE DIFFERENT AIDS TO HELP THE SUBJECT TO IDENTIFY THE PORTION SIZE. A DESCRIPTION OF THE PORTION SIZE IN TERMS OF CUPS, SPOONS, BOWLS, GLASSES, MATCHBOXES, MANUAL
PICTURE SIZE OR CENTIMETERS (USING THE RULER) IS THEN ENTERED IN COLUMN 5. IF THE FOOD CODE AND THE PORTION SIZE IN GRAMS OF THIS PARTICULAR ITEM IS EASY TO FIND, IT CAN BE ENTERED COLUMN 6. IF IT IS NOT CLEAR OR EASY, THE CODE AND GRAM WEIGHT CAN BE LEFT OUT TO BE COMPLETED AFTER THE INTERVIEW. THIS PROCESS IS REPEATED FOR EACH FOOD ITEM THAT WAS ENTERED ON FORM 1.

**STEP 4: RECORDING SHEET FOR INFORMATION COLLECTED IN STEP 3 OF THE 24-HOUR RECALL**

<table>
<thead>
<tr>
<th>Time (1)</th>
<th>Comment on time (2)</th>
<th>Food item carried from step 1 and 2 (3)</th>
<th>Detailed description of the item (ingredients and cooking method) (4)</th>
<th>Detailed description of Portion Size (household measures) (5)</th>
<th>Weight (g) (6)</th>
</tr>
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Appendix B:

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (IPAQ)

The purpose of this questionnaire is for academic purposes only and the information gathered was treated with strict confidentiality.

Demographic information

1. Age: 18 years and below ☐ 18-20 yrs ☐ 21-24 yrs ☐ 25 and above ☐
2. Gender: Male ☐ Female ☐
3. Academic Year: 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐ 6th ☐
4. (a) Weight: (weighing to be administered by a research assistant): ------------ kgs
   (b) How often do you weigh yourself?
      i. Every day or more ☐
      ii. 2-6 times a week ☐
      iii. About once a week ☐
      iv. About once a month ☐
      v. Never ☐
5. Height: (measuring was administered by a research assistant): -------------- Meters

We are interested in finding out about the kinds of physical activities that university students do to enhance or maintain physical fitness and overall health and wellbeing. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do as part of your studies and in your spare time recreation, exercise or sport.

Think about all the vigorous activity that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   ___________ days per week
   ☐ No vigorous physical activities → skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

   ___________ hours per day
   ___________ minutes per day
   ☐ Don’t know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did at least 10 minutes at a time.
3. During the last 7 days, on how many days did you do moderate physical activities like carrying light load, bicycling at a regular pace, or doubles tennis? Do not include walking.

______________days per week
☐ No moderate physical activity skip to question 5.

4. How much time did you usually spend doing moderate physical activity on one of those days?

______________hours per day
______________minutes per day
☐ Don’t know/Not sure

Think about the time you spent walking in the last 7 days. This includes walking to travel from place to place and any other walking that you might do solely for recreation, sport, exercise or leisure.

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

______________days per week
☐ No walking skip to question 7

6. How much time did you usually spend walking on one of those days?

______________hour per day
______________Minutes per day
☐ Don’t know/Not sure.

The last question is about the time you spent sitting on weekdays during the last 7 days. Include the time spent at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, sitting or lying down to watch TV.

7. During the last 7 days, how much time did you spend sitting on a week day?

______________hours per day
______________minutes per day
☐ Don’t know/Not sure.

This is the end of the questionnaire, thank you for participating.
Appendix C:

INFORMED CONSENT FOR PARTICIPANTS

Title of study: prevalence, management and prevention of BMI, through self-regulation of energy intake and expenditure among university students in Nairobi County

Location of study: universities within Nairobi County

Researcher: Francis Njeru Karugu

Purpose of this research:

The purpose of this study was to assess the prevalence of overweight and obesity among the university students in Nairobi County, Kenya and to determine whether self-regulation is a factor in prevention of overweight and obesity among the students.

Procedures:

The participant height will be taken while they were bare footed. He will stand with heels together, arms to the side, legs straight, shoulders relaxed and the head looking straight ahead. Heels, buttocks, shoulder blades and back of the head were against the vertical board of the height measuring rod. The height measurement will be taken to the nearest 0.1cm and the eye level with the head board to avoid error due to parallax.

The weight will be measured using a bathroom scale series vr that is placed on a flat, hard surface. The participant will stand on the middle of the scale's platform without touching anything, with the body weight equally distributed on both feet. The participant will also be required through help of a research assistant to fill a 24-hour.

Benefits:

1. The information which will be gathered from this study may help popularize physical education programs amongst all students in other departments in the universities.
2. The findings of this study may also guide universities curriculum developers to come up with physical fitness related university common units with a view to creating awareness in management of overweight and obesity in the universities in Nairobi County.
3. Universities may provide an ideal forum for reaching out to a large number of young adults through education programs that may positively influence students' eating habits and advocating for regular exercise and healthy lifestyles.
4. This study may also add scholarly input in research in the area of overweight and obesity among other universities located in other counties in Kenya.

Risks:

There are no risks associated with this research
**Extent of anonymity and confidentiality:**

The results of this study will be kept strictly confidential. At no time will the researchers release your individual results to anyone other than the researchers working on the project without your written consent.

**CERTIFICATE OF CONSENT**

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

Name of participant ________________________________
Signature of participant ____________________________
Date ____________________________
   Day/month/year

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Researcher/person taking the consent ____________________________
Researcher/person taking the consent ____________________________
Date ____________________________
   Day/month/year