PREDICTORS OF OBESITY AMONG THE MEDICAL STUDENTS OF THE INTERNATIONAL UNIVERSITY OF AFRICA, JULY 2017

Submitted by:-

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In partial fulfillment of requirements for the degree of MSc in human physiology

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DEDICATION

I dedicate this research to Islam our religion, my family and my husband who stood by me through all the hardships, my teachers who provided me with the necessary knowledge and encouraged me to do my best.
ACKNOWLEDGEMENT

I express my sincere gratitude to my supervisor
Dr. Humeda Suekit for his full support and help in conducting this research, and thanks to all the students who willingly participated and played a major role in completion of this research. I would also like to thank the staff in the department of physiology at Alneelain University for their great help.
LIST OF ABREVIATIONS

**WHO:** World Health Organization

**BMI:** Body Mass Index

**LTPA:** Leisure Time Physical Activity

**IPAQ:** International Physical Activity Questionnaire

**UAE:** United Arab Emirates

**METs:** Metabolic Equivalent of Task

**IUA:** International University of Africa
ABSTRACT

Introduction: Obesity is a leading preventable cause of death worldwide, and the prevalence of obesity is increasing in adults and children. The world health organization (WHO) formally recognized obesity as a global epidemic. Several risk factors are recognized as causatives of obesity but some are still controversial. Few attempts were made to study the prevalence of obesity among medical students especially in Sudan; the aim of this study was to determine the relationship of birth weight, parental BMI and physical activity to obesity among the medical students of the International University of Africa.

Methods: This was cross section descriptive observational study conducted among 200 medical students at IUA selected by stratified random sampling. Data was collected by self-administered questionnaire which included sociodemographic data, birth weight, mother and father weight and height, physical activity level was determined using short form International Physical Activity Questionnaire and anthropometric measurements were taken for each participant. Data was analyzed using SPSS version 23 program. Descriptive data was presented as means +/- SD and percentages. Pearson correlation was done between BMI with birth weight, mother BMI, father BMI and overall physical activity per week. Linear regression was performed to predict BMI from different variables. P value <0.05 was considered statistically significant.

Results: The prevalence of obesity among students was 6.5% being higher in males 9.4% than females 3.8%. There were no significant differences in prevalence of obesity between age groups or study levels. Family history with either one or both parents being obese was significantly related to
obesity. Birth weight and physical activity level were insignificantly related to obesity in this study, although most of students did not perform much physical activity (24.5% inactive and 48.5% moderately active).

**Conclusion:** Promotion of daily physical activity in the form of outdoor games and walking are recommended. Proper behavioral practices and lifestyle change should be built in as supporting educational activity during study years.
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CHAPTER ONE
INTRODUCTION

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health(1). Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnea, certain types of cancer, osteoarthritis and asthma. As a result, obesity has been found to reduce life expectancy by six to seven years(2). Obesity is a leading preventable cause of death worldwide, with increasing prevalence among adults and children(1). In 1997 the WHO formally recognized obesity as a global epidemic(1) and in 2013, the American Medical Association classified obesity as a disease(3). Obesity is most commonly caused by a combination of excessive food intake, lack of physical activity, and genetic susceptibility(1). A sedentary lifestyle plays a significant role in obesity. Worldwide there has been a large shift towards less physically demanding work, and currently at least 30% of the world's population gets insufficient exercise. This is primarily due to increasing use of mechanized transportation and a greater prevalence of labor-saving technology in the home(4). The World Health Organization indicates people worldwide are taking up less active recreational pursuits, while a study from Finland(5) found an increase and a study from the United States found leisure-time physical activity (LTPA) has not changed significantly(6). A 2011 review of physical activity in children found that it may not be a significant contributor(7). On the contrary, a reverse tendency was present, namely that among the more active subjects there were more obese later and findings indicate that BMI is a strong determinant of later LTPA; the greater the BMI the greater the risk of being physically inactive 10 years later (8). A longitudinal Finnish study stated that maintaining physical activity from youth to adulthood was inversely associated with
adult obesity, with a conclusion that being obese in youth increases the probability of being obese and less physically active in adulthood. In both children and adults, there is an association between television viewing time and the risk of obesity. A review found 63 of 73 studies (86%) showed an increased rate of childhood obesity with increased media exposure, with rates increasing proportionally to time spent watching television.

There has been an association between Birth weight and the weight status of prepubertal children. Children who were overweight at the age of 5–7 years often had already a high birth weight, whereas others could show that a low birth weight is only a risk factor in children who had a so called ‘catch-up growth; a high weight gain within the first 2 years of life. Observations have suggested that there are three critical periods during childhood for the development of obesity: the prenatal period, the period of adiposity rebound (4–6 years) and adolescence. Studies that have focused on inheritance patterns have found that 80% of the offspring of two obese parents were also obese, in contrast to less than 10% of the offspring of two parents who were of normal weight. Also in another retrospective study conducted among low-income children, maternal obesity in early pregnancy more than doubles the risk of obesity in 2 to 4 year olds.

Medical students are more prone to obesity due to their lifestyle with less physical activity and disordered eating habits and thereby are prone to obesity related health hazards. Stress can influence eating patterns in humans and it alters overall food intake resulting in under- or over eating. Evidence from longitudinal studies suggested that chronic life stress may be causally linked to weight gain with preference for energy and nutrient-dense foods that are high in sugar and fat, with a greater effect seen in men. Stress induced eating may be one of the factors that contribute to the
development of obesity in medical students precisely due to their hectic schedules(15). Medical student was the target group of particular interest for this study as they are future physicians and if they are overweight or obese they would carry wrong impression on general population(16). Although several studies had been conducted worldwide to determine the etiological factors of obesity most concluded that the busy schedule of college hours with less time for regular meals like breakfast and lunch contributes to wrong dietary habits and with lack of physical activity have collectively contributed to development of obesity amongst these students(16)(17). Other studies have showed that physical exercise and outdoor sports did not have a significant influence on body weight(16). Also positive family history played a role for obesity development(17). A study conducted on medical students in Ribat University, Sudan revealed that more than quarter of the medical students were overweight and obese with a higher prevalence in males than females. This was attributed to stress and poor dietary habits(18).

**Justification:**

medical students are our future doctors and will lead our country into lights of better health, but when they themselves are at stake of developing diseases due to poor health related choices, it becomes a matter of great concern. To the best of my knowledge few attempts were made to identify the predictors of obesity among Sudanese medical students, therefore; the aim of this study is to determine the relationship between birth weight, parental BMI, and physical activity with obesity among the medical students of the International University of Africa in Khartoum, Sudan.
OBJECTIVES

➢ General objective:

To determine the relationship of birth weight, parental BMI and physical activity to obesity among the medical students of the International University of Africa

➢ Specific objectives:

1. To determine the prevalence of obesity among the medical students of the International University of Africa
2. To determine the birth weight of the medical students of the International University of Africa
3. To measure the physical activity level among the medical students of the International University of Africa
4. To determine the parental BMI of the medical students of the International University of Africa
CHAPTER TWO
**LITRETURE REVIEW**

**Definition of obesity:**

Obesity is a multifactorial chronic disease that is so complex which develops from an interaction of social, behavioral, culture, psychological, metabolic and genetic factors(19). Overweight and obesity in an increasing number of countries represent a rapidly growing threat to the health of populations. This increase is now replacing the more traditional problems such as under nutrition and infectious diseases as the most significant causes of ill-health(20).

People are generally considered obese when their body mass index (BMI), a measurement obtained by dividing a person's weight by the square of the person's height, is over 30 kg/m², with the range 25–30 kg/m² defined as overweight(1). It is also further evaluated in terms of fat distribution via the waist–hip ratio and total cardiovascular risk factors(1).

**Classification of obesity:**

**BMI (kg/m²) Classification** (20)

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<tr>
<td>18.5</td>
<td>Underweight</td>
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<tr>
<td>18.5–25.0</td>
<td>normal weight</td>
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<tr>
<td>25.0–30.0</td>
<td>Overweight</td>
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<td>30.0–35.0</td>
<td>class I obesity</td>
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<td>35.0–40.0</td>
<td>class II obesity</td>
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<td>40.0</td>
<td>class III obesity</td>
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In addition, the obese suffer from social bias and discrimination from the general public as well as health professionals, and this may make them
unwilling and hesitated in seeking medical advice and assistance (20).

**Prevalence of obesity:**

According to the World Health Organization in 2014, more than 1.9 billion adults were overweight and over 600 million were obese; thus the total number of overweight & obesity was 2.1 billion, which was almost one-third of the world’s population and globally at least 2.8 million people each year die as a result of being overweight or obese (1). Obesity is more common in women than men (1).

The MONICA (Multinational MONItoring of trends and determinants in CArdiovascular disease) Project, sponsored by the World Health Organization, discovered that 30% of the Arab World’s population is overweight or obese, including adolescents and adults. Qatar, Saudi Arabia and Egypt were in the lead with > 40% in women and a range of 25-35% in men, followed by Bahrain, UAE, and Lebanon with slightly declined figures and the least being in Turkey and Israel. This percentage is smaller for North African countries than oil-producing countries (21). In a cross-sectional study conducted in Sudanese basic academic schoolgirl levels in Omdurman to find the prevalence of overweight and obesity, results showed high values of combined overweight and obesity of 37.5% (18.75% in each case), which significantly changed according to age 26.32%, 39.47%, and 43.48% in age groups of 5-7 years, 8-10 years, and 11-13 years respectively (22).

Parental BMI, social factors, birth weight, physical inactivity and dietary factors have been linked directly to childhood obesity as risk factors.

**Obesity and birth weight:**

Obesity in children has a specific period for development and has been divided into 3; the prenatal period, the period of adiposity rebound (between the ages of 5-7 years) and the period of adolescence, and there has been an
association between BMI in childhood or adolescence to adulthood obesity and it is predictive for adult morbidity and mortality (11). In a cross-sectional study conducted on primary schools among children of the age group 5-7 and their parents in north west Germany in 2004, they concluded that birth weight has an association with the weight status of these children and that those who were overweight or obese at the age of 5-7 years were born with high birth weight.

A Canadian review done in 2011 to evaluate early markers of adult obesity which were predictors from early childhood towards adulthood. This review included 135 studies, and they concluded that extremes of birth weight (both low and high) have been suggested to predispose to the development of obesity later in adulthood. Some studies reported an increase risk of obesity in low birth weight infants, were as others found no association between low birth weight and risk of adult obesity with studies going further to conclude that it decreases the risk. When considering the overall birth weight data, a high birth weight was positively associated with overweight and obesity or increased adult BMI, with no association in a number of other studies. Mainly there was no clear tendency in the birth weight data (23). There was also no relevant association between birth weight and childhood obesity in the Swedish study conducted in 2011 (12).

**Parental BMI and obesity:**

In the above mentioned German study as well; they emphasized that parental overweight is a strong risk factor for the development of childhood obesity and this is partly genetic which accounts for up to 90% and partly due to behavioral factors such as similarities in eating patterns, dietary composition and physical activity due to sharing of the same environment at home (11).

In a similar longitudinal cohort Swedish study to find out the relationship
between the severity of obesity in childhood and adolescents and its age of onset to parental BMI, they concluded that parental BMI has a great impact on the severity of obesity in childhood which grows towards adolescence and adulthood. Also children with two obese parents are more prone to obesity than a single or no obese parent, with maternal obesity predominating where as the age of onset is probably of less importance (12).

In the Canadian review mentioned earlier, maternal BMI and maternal weight gain during pregnancy where addressed as positively associated with overweight or obesity of offspring (23). This was also supported by the Ohio study which concluded that maternal weight gain in early pregnancy more than doubles the risk of childhood obesity as well as large birth weight for gestational age, being first born, and having a mother who smoked during pregnancy all were independently associated with higher obesity risk (14).

**Physical activity and obesity:**

Physical activity is an important determinant of body weight and recent evidence suggest that regular physical activity is protective against unhealthy weight gain, but recent industrialization, urbanization and mechanization have led to sedentary lifestyle choices and inactive recreation such as watching television, contributed to weight gain and obesity (24). The world health organization recommended engagement in at least 30 minutes of moderate-intensity physical activity on most days to reduce the overall morbidity and mortality, and an hour of moderate-intensity physical activity on most days of the week to maintain a healthy body weight (25).

A longitudinal study in Denmark in 2004 to assess the long-term relation between physical activity and obesity in adults found no evidence that physical inactivity promotes the development of obesity, on the contrary BMI is a strong determinant of later leisure time physical activity; which
means that the greater the BMI (being overweight and obese) the greater the risk of being physically inactive 10 years later, with an insignificant gender difference (8).

And another prospective case-control study, done on young Swedish adults in 2007 to predict the association between physical activity and gain in fat mass among obese and non-obese. In conclusion of the study there was an independent association between physical activity and fat mass. In both groups (case and control) there was a significant gain in fat mass and body weight despite unchanged physical activity which suggests that dietary intake may be a major contributor to the long term positive energy balance. It has been proposed that low and stable activity levels among the obese group might be due to their obesity rendering them physically inactive (26).

Physical activity was also a parameter in the north west Germany study, with children spending most of their leisure time being inactive watching television indoor and not engaging in outdoor activities putting them at risk for childhood obesity which continues to adulthood(11).

**Obesity in medical students:**

A number of studies have been performed in medical schools to assess the prevalence of overweight and obesity among students. A Greek study conducted on medical students in Crete (2003), relating overweight and obesity to cardiovascular disease risk factors. It was performed on third year medical students with their anthropometric measurements and blood chemistries obtained. A great proportion of these students were overweight or obese with approximately 40% of males and 23% of females being overweight and central obesity was found to be 33.4% in males and 21.7% in female participants. Obese subjects had a significantly higher values of cardiovascular disease risk factor variables namely blood pressure, serum
lipids and lipoproteins. BMI was the strongest predictor of hypertension, were as waist circumference in females and weight to height ratio in males were also strong indicators for abnormal serum lipids and lipoproteins (27).

A study conducted in Malaysia among medical students in Ipoh (2014), underweight student were 17.2%, overweight 11.2% and obesity 2.8%, which was significantly higher among males compared to females. Although 80% of respondents were physically active (60-100 minutes/week), none were meeting the recommended physical activity level which is 150 minutes/week or more of moderate or vigorous physical activity. They concluded that physical activity and nutritional practices among these students need to be improved, although it was not correlated to obesity and overweight (28).

In a similar Malaysian study in AIMST University in 2012, the combined overweight and obesity was 30.7% among the medical students with the prevalence of obesity being only 5.2%. Though the proportion of overweight is higher among females (15.7%), proportion of pre-obese and obesity was higher in males (18.3% and 9.2% respectively) (29). Similarly in another Malaysian medical school in 2010, the prevalence of obesity and overweight were 16.1% according to the WHO classification and 30% according to the Asian-Pacific guidelines, males were more obese and overweight (68.1%) than females (49.2%). They also found that physical activity level was irrelevant to development of overweight and obesity (30).

In southern Thailand a study done to assess the physical activity among medical students in 2016 concluded that, the combined overweight and obesity among participants was 12.5% and clinical students were less active than preclinical students (49.5% and 50.5% respectively) due to their tight schedule. There was no relation between physical activity level and
On the same track a pilot study done in south India among students of azeezia medical college in 2014 for the prevalence of overweight and obesity which was high, 31.3% and 6.3% respectively, with figures of overweight higher in females and that of obesity higher in males. Relation with increased frequency of meals, increased sleep duration and regular exercise were found to be significant(19).

In a similar Indian cross-sectional study done in grant medical college Mumbai in 2015 for the prevalence of overweight and obesity among medical students and their knowledge, attitude and practices about obesity; overweight was14.3% and obesity 3.3% according to the WHO classification and it was 9.6% and 17.6% respectively according to Asia-specific guidelines. They also concluded that when assessed about their knowledge about obesity, majority of students were aware about its risk factors and have a positive attitude but lack of appropriate behavior and practice. This was supported by the evidence of 91.3% of students being physically inactive and not participating in any outdoor activity and only 8.7% of them engaging in activities like walking, swimming, sports or gymnasium. Also BMI was significantly correlated to bad food habits(16).

In another two similar Indian studies done in west Bengal Kolkata(2016) and in Kanchipuram (2013), among medical students in both districts, the prevalence of overweight and obesity were of almost similar figures to the above study especially the WHO classification, and slightly higher figures according to the Indian scale (Asia-pacific guidelines). The significant factors were positive family history with 65% of the overweight and obese students giving a history of either or of both parents being obese; poor dietary habits and physical inactivity(17)(32).
In an Arabian study of a similar kind done in Ajman, UAE in 2015 among medical students of the Gulf Medical University, almost a quarter of the participants were found to be overweight (17.6%) and obese (6.9%). This study showed high prevalence of obesity in males 34.6% than females 21.5%, with physical activity being significantly associated with BMI (33). In the national Ribat University Sudan, across-sectional study done on medical students in 2008 revealed that, more than quarter of the candidates were overweight (17.8%) and obese (9.2%), with also higher figures in males (28.2%) than females (26.5%) as in the Ajman study. This was mainly contributed by stress and poor dietary habits especially soft drinks. Another parameter in the study was the use of private cars and public transport as a measuring variable for physical inactivity, and results showed that 30.9% overweight and 23% obese students were among this category (18). Most of the above mentioned studies have revealed that overweight and obesity among medical students is on the high, reinforcing the need to encourage these adolescents and youth towards a healthier lifestyle by promoting healthier food choices and encouraging regular physical activity.
CHAPTER THREE
METHODOLOGY

**Study design:**
Observational descriptive cross-sectional facility based study design

**Study area:**
The premises of the faculty of medicine in the International University of Africa in al-mujahedeen sector in the crossroad between Soba Street and Al-salama Street, Khartoum district, Khartoum city, Sudan. The faculty includes a total number of 929 students from different African and Asian countries with different ethnic, social and cultural background.

**Study population:**
All medical students at the university were included in the study
Exclusion criteria: chronic diseases like chronic renal failure, liver failure, tuberculosis and endocrine disorders

**Sampling technique:**
Probability sampling technique: stratified sampling between batches and systematic random sampling inside batches.

**Sample size:**
The population estimate =929
Sample size was calculated using the following equation:
\[
n = \frac{N}{1 + N(d)^2}
\]
\[
929/1+929 \times (0.05) \times (0.05) = 280
\]
Where;
\[
n = \text{Sample size}
\]
\[
N = \text{population}
\]
\[
d = \text{level of significance}
\]
Sampling of the students proportional to student’s size in each study level:

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Out of the expected sample size only 200 respondents have agreed to fill in the questionnaire and their refusal was due to personal issues.

**Data collection methods and tools:**

Data collection was done for each batch separately and a brief introduction was given and the objective of the project was explained in the beginning of the questionnaire.

Self administered questionnaire containing sociodemographic data (name, age and gender) and information about batch, Birth weight, mother BMI and father BMI were filled by each participant.

Physical activity was assessed using the short form international physical activity questionnaire (IPAQ) which assesses the individuals physical activity in the past 7 days as part of their everyday lives, which includes the following domains like walking, moderate activity which requires moderate physical effort like carrying light loads and double tennis and vigorous activity which requires hard physical effort like heavy lifting, digging and aerobics; and all these activities should have taken at least 10 minutes at a time. Scores were given for each domain which was converted into Metabolic Equivalent of Task (MET) - minutes/week.
The candidates were categorized into low, moderate and high physical activity groups based on their MET values (23). These following values continue to be used for the analysis of IPAQ data: Walking = 3.3 METs, Moderate PA = 4.0 METs and Vigorous PA = 8.0 METs(34).

The Sedentary life style included watching TV, sitting in front of computer, reading and others like talking over phone lying down but not asleep and listening to music(32).

Weight was measured using normal weighing scale with subject taking off shoes, standing straight in minimal clothing and recorded to the nearest 0.1 kilogram.

Height was measured using a measuring tape, with the individual standing straight next to the wall, with the heels, buttocks, shoulders and occipit touching the wall without shoes and recorded to the nearest 0.01 meters.

Body Mass Index was calculated from the anthropometric data collected using the following equation:

\[ \text{BMI} = \frac{\text{Weight (Kg)}}{\text{Height}^2 \text{(m2)}} \]

**Study variables:**

1. Sociodemographic data (name, age, sex, batch)

2. Anthropometric measurements
   - Weight
   - Height
   - BMI

3. Independent variables
   - Birth weight
   - Mother BMI
   - Father BMI
   - Physical activity level (PAL)
**Data management:**
Data was entered, managed and analyzed using the statistical package for the social sciences version 23. Descriptive analysis was done for age, gender, batches, weight, height, BMI, mother and father BMI, PAL and reported as means, SD and frequencies.
The correlation between students BMI and birth weight, mother and father BMI and PAL by person’s correlation
Multiple linear regression was used to predict students BMI from Birth weight, Mother and Father BMI and PAL
P value <0.05 was considered statistically significant

**Ethical consideration:**
Ethical clearance was approved from the ethical committee at the international university of Africa
A written consent was taken from all the participants in the study; a copy of which is attached in the annex.
CHAPTER FOUR
RESULTS

Socio-demographic Characteristics of study participants:

The age of the students who participated ranged between 17 to 29 years with a mean age of 21.76 years ±2.48. Fifty two percent (n=104) of the respondents were female while 48% (n=96) were males. According to batches the percentage of study participants were 17.5% from batch 20, 17.5% batch 19, 23.0% from batch 18, 25.5% were from batch 17 and 16.5 were from batch 16(Table 1).

Table 1: percentage of study participants according to batch (n = 200)

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<tr>
<th>batch</th>
<th>number</th>
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<td>19</td>
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<td>33</td>
<td>16.5</td>
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Anthropometric measurement:

The mean weight of the study population was 65.17 kg ±15.5, ranged between 36.0 Kg to 150.0 kg. Their height varied form 1.40 m to 1.97 m with a mean height of 1.69 m±0.09. The mean body mass index (BMI) was 22.48±4.42 with a range of 14.84 to 43.35 kg/m2 (table 2).
Table 2: Anthropometric measurements of students (n=200)

<table>
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<tr>
<th></th>
<th>weight (Kg)</th>
<th>Height (m)</th>
<th>BMI (Kg/m2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean± Std. Deviation</td>
<td>65.17±15.50</td>
<td>1.69±0.09</td>
<td>22.48±4.42</td>
</tr>
<tr>
<td>Minimum</td>
<td>36.0</td>
<td>1.40</td>
<td>14.84</td>
</tr>
<tr>
<td>Maximum</td>
<td>150.0</td>
<td>1.97</td>
<td>43.36</td>
</tr>
</tbody>
</table>

Prevalence of obesity among medical students at IUA

According to the WHO classification of obesity, more than half of our study population had normal weight 59.0%, the underweight were 19.5%, overweight were 15.0% and obese were 6.5% (table3)

Table 3: classification of participants according to body mass index (n=200)

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>39</td>
<td>19.5</td>
</tr>
<tr>
<td>Normal</td>
<td>118</td>
<td>59.0</td>
</tr>
<tr>
<td>Overweight</td>
<td>30</td>
<td>15.0</td>
</tr>
<tr>
<td>Obese</td>
<td>13</td>
<td>6.5</td>
</tr>
</tbody>
</table>

In our study the prevalence of obesity was higher in males than females (9.4% and 3.8% respectively), overweight 11.5% and 18.3% respectively,
normal weight 61.5% and 56.7% respectively and underweight 17.7% and 21.2% respectively (figure 1). However, chi-square revealed no significant difference between males and females in the prevalence of obesity (person chi-square = 4.38 and P = 0.22)

Figure 1:

Spearman’s correlation was done to detect the relationship between the prevalence of obesity and study level and the test revealed no statistically significant correlation (r = 0.04, P = 0.53).

**Prevalence of obesity among parents**
Figures 2 and 3 show the prevalence of overweight and obesity among parents of the participants and it reveals that the percentage of maternal overweight was 43.2% and obesity was 29.6% which is much higher than paternal overweight 39.2% and obesity 13.6%
Figure 2:

Prevalence of obesity among participants mothers (n=199)

- Underweight: 2.0%
- Normal: 25.1%
- Overweight: 43.2%
- Obese: 29.6%

Figure 3:

Prevalence of obesity among participants fathers (n=199)

- Underweight: 2.0%
- Normal: 45.2%
- Overweight: 39.2%
- Obese: 13.6%
As shown in table 4; the mean birth weight of the student who participated in the study was 3.14kg ± 0.57 ranging from 2.0 to 6.0kg.

**Table 4: Birth weight of participants**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.14</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>0.57</td>
</tr>
<tr>
<td>Minimum</td>
<td>2.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>6.0</td>
</tr>
</tbody>
</table>

**Physical activity level**

Table 5 shows the overall physical activity level with a mean of 2130.63 ±2059.59MET-minutes/week, the minimum being zero and a maximum of 11729.9959MET-minutes/week

**Table 5: Overall physical activity level in MET-minutes/week**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2130.63</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>2059.59</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>11729.99</td>
</tr>
</tbody>
</table>

The levels of physical activity among students showed that 24.5% were minimally active, 48.5% (600- 1500 MET-minutes/week) were moderately active and 27% (3000 MET-minutes/week) were highly active(Figure 4)
As revealed in table 6; there was a significant correlation between obesity and father and mother BMI with a P value of 0.00 for both, however there were no significant correlations between obesity with birth weight and the overall physical activity level P= 0.08 and P= 0.26 respectively.

Table 6: correlation between BMI with birth weight, mother BMI, father BMI and overall physical activity per week

<table>
<thead>
<tr>
<th>BMI</th>
<th>Pearson Correlation</th>
<th>P value</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BW</td>
<td>MBMI</td>
<td>FBMI</td>
</tr>
<tr>
<td></td>
<td>0.123</td>
<td>0.302**</td>
<td>0.346**</td>
</tr>
<tr>
<td></td>
<td>0.083</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

| BW= birth weight |
| MBMI= mother body mass index |
| FBMI= father body mass index |
| OVAWM= overall physical activity per week in minutes |

** = highly significant
Multiple linear regression was used to predict the BMI from four independent variables (birth weight, mother BMI, father BMI, and physical activity level). The model was fit and significant (F= 9.81, P= 0.001) mother and father BMI showed a positive correlation with student BMI were p= 0.006 and 0.001 respectively, while birth weight and physical activity level showed an insignificant relation with student BMI.

**Equation:** $\text{BMI} = 7.84 + 0.84 \text{BW} + 0.18 \text{MBMI} + 0.26 \text{FBMI} + 0.00 \text{Physical Activity}$
CHAPTER FIVE
DISCUSSION

The prevalence of obesity among medical students in this study is in consistence with different studies conducted nationally and worldwide. In our study 6.5% of the undergraduate medical students were obese, which is quiet low in comparison to the results of the study conducted in Ribat university which showed a prevalence of 9.2%(18). This difference in results might be attributed to the multinationality in IUA. The Ajman study almost had matching figures with a prevalence of 6.9%(33), and the Indian study in Azeezia medical college by Napolean Reny et al.(2014) showing a prevalence of 6.3%(19). Closely related results were reported by the Indian Kanchipuram (32) and west Bengal (17) studies performed on medical students of both districts with a prevalence of 8.6%and 9% respectively. Slightly lower figures of 4.3% were seen in the study of Crete Greece(27), the Malaysian study by Boo N Y et al. 2010 with a prevalence of 3.3%(30) and the AIMST University in Malaysia which showed a prevalence of 5.2%(29).

According to gender our study concluded that, there was no difference in the prevalence of obesity between males and their female counterparts, which might be attributed to the influence of the uniform environment that surrounds them, including same stressful and hectic schedules and unhealthy dietary choices. This result is in line with the Indian west Bengal study by Basu et al.2016, which found no association as well(17). This was not the case in the Ajman study with high prevalence in males 34.6% than females 21.5%(33), similar finding was in the Malaysian study in Ipoh by Sandheep Sugathan et al.2014(28) and Boo N Y et al.2010(30),as well as the Malaysian study by Gopalakrishnan, S et al.2012 in AIMST University which stated that male medical students were facing more risk of being
obese than their female colleagues (29). The opposite result was found in the Kanchipuram study with female prevalence of 52% which was more than males 32% (32).

Age is another non-modifiable factor which influences individual's susceptibility to weight gain and the development of obesity. In this study there was no relation between obesity and the age of students, which might be due to less number of participants in a certain age group leading to under representation. This was comparable to the Ipoh Malaysian study by Sandheep Sugathan et al. 2014 (28) and the Indian west Bengal study by Basu et al. 2016 (17). The Ajman study by M. Huque et al. 2015 was also in line with no significant results between age and BMI (33). In contrast, the National Ribat study in Sudan by S. Abdalla et al. 2008, showed a positive association with age and a prevalence of obesity being higher 28.5% in elder age group of above 20 compared to 25.5% among students 16-20 years of age (18).

In this study there was insignificant relationship between students of different levels and obesity. The almost equal study hours and tight schedule of both clinical and preclinical students might be the causative factor. This result was the case in the Sandheep Sugathan et al. 2014 study as well (28). On the other hand in the Ajman study there was a clear significant correlation between year of study and obesity, in which first year students showed increased prevalence of obesity than the second year students presumably owing to stress (33). This was also supported by the southern Thailand study by Wattanapisit A et al. 2016; in which clinical students were found less active (49.5%) than their preclinical colleagues (50.5%), owing to their tight and busy schedule with spare time favored for studies than sport (31).
A positive family history of obesity was found in this study with prevalence of maternal obesity (29.6%) more than paternal (13.6%), which was consistent with prior studies by Basu et al.2016(17), Napoleon Ray et al.2014(19). The Kanchipuram study results as well showed that 65% of overweight and obese individuals gave a family history of one or both parents being obese(32). Maternal dominance is in line with the retrospective cohort study by R.Whitaker et al.2004, which concluded that obesity during the preschool years was strongly associated with the prepregnancy BMI level of the mother(14). The longitudinal cohort study by V.Svensson et al.2011 as well confirmed that; the severity of obesity at age 7 was related significantly with the mother’s BMI, but not with paternal BMI, supporting the theory that genetic factors have a stronger influence(12).

There was an insignificant relation between birth weight and obesity among the participants in this study which was in favor with the Swedish study by V.Svensson et al.2011 showing no relevant association between birth weight and the severity and onset of obesity in childhood and adolescence(12). Contradicting this is the S.Danielzik et al.2004 and the R.Whitaker et al.2004 studies; which found that obese children frequently had high birth weight when compared to their normal counterparts(11)(14). Supporting the two above studies is the Canadian review by T.D.Brisbois et al.2012 who concluded that both high and low birth weights were associated with increased BMI in a number of studies, in others mixed results were shown with no clear conclusion(23).

The impact of exercise intensity on change in body composition is uncertain(26). Most of the students in this study are minimally active 48.5% and highly active 27% followed with least figures by inactive individuals with 24.5% this was in consistence with the Napolean Reny et al.2014 study.
with 40.2% of students doing exercise of which 15% did daily exercise and 25% did regular exercise while the rest do exercise occasionally; 59.8% of candidates were physically inactive(19). In the Wattanapisit A et al.2016 study as well less than half of participants (49.5%) were physically active(31), in line with this is is the Basu et al.2016 results, which concluded that only 34% of the study population had habit of regular exercise(17). This was not the case in the Sandheep Sugathan et al.2014 study; where overweight and obese students did engage in exercise for more than 60 minutes duration per week, but was not meeting the required physical activity level(28).

There was no significant association between the lack of physical exercise and obesity in this study which is supported by the Napolean Reny et al.2014(19), Boo N Y et al.2010(30) and the Wattanapisit A et al.2016(31) studies. The Kanchipuram study also revealed that physical activity and obesity were statistically insignificant although most participants follow a sedentary lifestyle(32). In the Swedish prospective case-control study by U Ekelund et al.2007, physical activity and physical activity energy expenditure are only weakly related to gain in Body Weight and Fat Mass, therefore among obese individuals change in activity level was not related to change in body weight and fat mass(26) which was also in line with our study. But in some of the studies conducted on medical students, physical inactivity was significantly associate with obesity, this is the case in Basu et al.2016(17) and Sandheep Sugathan et al.2014(28) results.

In conclusion, our study showed a significant correlation between family history of obesity and students BMI with one or both parents being obese. There was an insignificant relationship between birth weight and physical activity level to obesity. However, there were some limitations to this study:
1. Birth weight was filled by students and depended on their parent’s recall memory.
2. Their parent’s weight and height were also self-reported.
3. Filling of the IPAQ depended on the sincerity of the students as well.
CHAPTER SIX
CONCLUSION

1. Prevalence of obesity among medical students was high in the international university of Africa
2. About quarter of the students were physically inactive, while those engaging in exercise do not meet the WHO recommended physical activity level, and although most students followed a sedentary lifestyle. However, the association between physical activity level and obesity was insignificant
3. There was a significant correlation between obesity and family history of either one or both parents being obese with maternal dominance
4. There was no relationship between birth weight and obesity
RECOMMENDATION

1. Further studies should be carried out to determine the high prevalence of obesity among medical students.

2. Longitudinal study should be carried out to find a long term relationship between student’s behavior and their physical activity to reduce the prevalence of obesity.

3. As family history played a major role in development of obesity in those students with maternal dominance, this encourages women to maintain a healthy weight and to gain a recommended amount of weight during pregnancy to have a positive long-term health benefits for their offspring.

4. Promoting a healthier lifestyle by health education programs and proper food choices, in addition to engaging in a physically active daily routines and outdoor extracurricular activities, will minimize the danger and risk of developing chronic diseases later on in adulthood.

5. Health workers are the role model of the society and especially in everything related to being and staying healthy. Medical students our future doctors and leaders towards a healthy nation should convert the knowledge gained into healthy practices in order to reflect it back on the general population. And since obese individuals perform less academically and professionally at work with poor job prospects and low self-esteem, prevention of this out breaking phenomena should start from our future generation (adolescents and young adults) especially medical students.


22. Ahmed, Aisha M. B; Ahmed, Hoyam, A; Mohammed, Tagwa, E; Alawad, Samia S. Prevalence of obesity and overweight among the


34. Research IC. Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ) - Short Form, [Internet]. 2004. Available from: www.ipaq.ki.se
We appreciate your participation in this study which views the predictors of obesity and finding a relation between birth weight, parental BMI, and physical activity to obesity.
Clearly answer the questions bellow:

**Sociodemographic data:**
Name
Age
Sex
Year of MBBS
Weight
Height
BMI
Birth weight
Mother BMI  
( weight:  height:  )
Father BMI  
(weight:  height:  )
Short Last 7 Days IPAQ

READ: I am going to 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. Think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

READ: Now, think about all the vigorous activities which take hard physical effort that you did in the last 7 days. Vigorous activities make you breathe much harder than normal and may include heavy lifting, digging, aerobics, or fast bicycling. 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?
   _____ Days per week [VDAY; Range 0-7, 8-9]

8. Don't Know/Not Sure
9. Refused

[Interviewer clarification: Think only about those physical activities that you do for at least 10 minutes at a time.]

[Interviewer note: If respondent answers zero, refuses or does not know, skip to Question 3]

2. How much time did you usually spend doing vigorous physical activities on one of those days?
   ____ ____ Hours per day [VDHRS; Range: 0-16]
   ____ ____ ____ Minutes per day [VDMIN; Range: 0-960, 998, 999]
998. Don't Know/Not Sure
999. Refused

[Interviewer clarification: Think only about those physical activities you do for at least 10 minutes at a time.]

[Interviewer probe: An average time for one of the days on which you do vigorous activity is being sought. If the respondent can't answer because the pattern of time spent varies widely from day to day, ask: "How much time in total would you spend over the last 7 days doing vigorous physical activities?"
   ____ ____ Hours per week [VWHRS; Range: 0-112]
   ____ ____ ____ ____ Minutes per week [VWMIN; Range: 0-6720, 9998, 9999]
READ: Now think about activities which take moderate physical effort that you did in the last 7 days. Moderate physical activities make you breathe somewhat harder than normal and may include carrying light loads, bicycling at a regular pace, or doubles tennis. Do not include walking. Again, think about only those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities?
   _____ Days per week [MDAY; Range: 0-7, 8, 9]

8. Don't Know/Not Sure

9. Refused

[Interviewer clarification: Think only about those physical activities that you do for at least 10 minutes at a time]

[Interviewer Note: If respondent answers zero, refuses or does not know, skip to Question 5]

4. How much time did you usually spend doing moderate physical activities on one of those days?
   ___ ___ Hours per day [MDHRS; Range: 0-16]
   ___ ___ ___ Minutes per day [MDMIN; Range: 0-960, 998, 999]

998. Don't Know/Not Sure

999. Refused

[Interviewer clarification: Think only about those physical activities that you do for at least 10 minutes at a time.]

[Interviewer probe: An average time for one of the days on which you do moderate activity is being sought. If the respondent can't answer because the pattern of time spent varies widely from day to day, or includes time spent in multiple jobs, ask: “What is the total amount of time you spent over the last 7 days doing moderate physical activities?”]

___ ___ ___ Hours per week [MWHRS; Range: 0-112]

___ ___ ___ ___ Minutes per week [MWMIN; Range: 0-6720, 9998, 9999]

9998. Don't Know/Not Sure

9999. Refused.
READ: Now think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done 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 [WDAY; Range: 0-7, 8, 9]

8. Don't Know/Not Sure

9. Refused

[Interviewer clarification: Think only about the walking that you do for at least 10 minutes at a time.]

[Interviewer Note: If respondent answers zero, refuses or does not know, skip to Question 7]

6. How much time did you usually spend walking on one of those days?
   ___ ___ Hours per day [WDHRS; Range: 0-16]
   ___ ___ ___ Minutes per day [WDMIN; Range: 0-960, 998, 999]

998. Don't Know/Not Sure

999. Refused

[Interviewer probe: An average time for one of the days on which you walk is being sought. If the respondent can't answer because the pattern of time spent varies widely from day to day, ask: “What is the total amount of time you spent walking over the last 7 days?”]

   ___ ___ ___ Hours per week [WWHRS; Range: 0-112]
   ___ ___ ___ Minutes per week [WWMIN; Range: 0-6720, 9998, 9999]

9998. Don't Know/Not Sure

9999. Refused

READ: Now think about the time you spent sitting on week days during the last 7 days. Include time spent at work, at home, while doing course work, and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television.

7. During the last 7 days, how much time did you usually spend sitting on a week day?
   ___ ___ Hours per weekday [SDHRS; 0-16]
   ___ ___ ___ Minutes per weekday [SDMIN; Range: 0-960, 998, 999]
998. Don't Know/Not Sure
999. Refused

[Interviewer clarification: Include time spent lying down (awake) as well as sitting]

[Interviewer probe: An average time per day spent sitting is being sought. If the respondent can't answer because the pattern of time spent varies widely from day to day, ask: “What is the total amount of time you spent sitting last Wednesday?”]

___ ___ Hours on Wednesday [SWHRS; Range 0-16]
___ ___ ___ Minutes on Wednesday [SWMIN; Range: 0-960, 998, 999]
998. Don't Know/Not Sure
999. Refused

Once again thanks for participation and feedback will be given to you about results of the study. We wish you all the best in your studies.
CONSENT FORM

I ______________________________________________________________________ willingly participate as a candidate in the study Predictors of obesity among the medical students of the International University of Africa during the period March–May 2017.

You have the full right to withdraw from the study at any time and this will not affect your academic performance by any means.

اقرار

انا ______________________________________________________________________ اتطوع بالاشتراك في هذا البحث بعنوان مؤشرات السمنة بين طلبة الطب بجامعه إفريقيا العالميه في الفترة من مارس الى مايو 2017.

لك الأحقية بالإنسحاب من هذا البحث متى شئت وهذا لن يؤثر سلباً على تحصيلك الأكاديمي باي شكل من الاشكال.

Signature:                توقيع:

Date:          |   2017