



COLLEGE OF NATURAL SCIENCES

SCHOOL OF BIOSCIENCES

**PREVALENCE OF OVERWEIGHT AND OBESITY AMONG RURAL AND URBAN
PRIMARY SCHOOL GOING CHILDREN OF UGANDA (KISORO AND KAMPALA
RESPECTIVELY)**

BY

MANISHIMWE ENOCK

19/U/0224/

1900700224

**A RESEARCH DISSERTATION SUBMITTED TO THE DEPARTMENT OF
BIOCHEMISTRY AND SPORTS SCIENCE IN PARTIAL FULFILLMENT FOR THE
AWARD OF BACHELOR OF SCIENCE IN SPORTS SCIENCE OF MAKERERE
UNIVERSITY**

JANUARY 2023

DECLARATION

I ENOCK MANISHIMWE declare that this research report is my original work and that it has never been submitted for the award of degree in any other higher institution of learning

Signature... Manishimwe Date... 09/01/2023

Manishimwe Enock- 19/U/0224

APPROVAL

This research report titled “Prevalence of overweight and obesity among rural and urban primary school going children of Uganda (Kisoro and Kampala)” has been submitted to the department of Biochemistry and Sports Science, School of Biosciences, College of Natural Sciences, Makerere University for examination with my approval as a university supervisor.

Signature.......... Date..... 10th January 2023.....

Bernadette Nakabazzi (PhD)

Department of Biochemistry and Sports Science

Makerere University Kampala

DEDICATION

This work is dedicated to my cousin Hitimana Richard for his tremendous support to my education from joining secondary level up to now, if it wasn't him, I wouldn't have made it to this level, may the Almighty God continue to bless his work.

My appreciation also goes to my parents Jack Ndagiwenimana and Nyabutono Agness who put me on this earth and raised me up, thanks to them. I also dedicate this study to my brothers who gave me support sometimes which kept me going.

ACKNOWLEDGEMENT.

I would like to acknowledge my supervisor Dr. Nakabazzi Bernadette for her kindness, tolerance, availability and guidance towards this study, may God be with her always.

My thanks also go to the other lectures of sports science for their academic support and mentorship and my classmates especially Edgar Muhumuza and Niwamanya Denis for their availability to me when I needed them.

I would like to also acknowledge my roommate Nsengiyumva Wilberforce for the brotherhood that we shared during our time at the university, may God bless him abundantly.

I would also like to thank Kisoro Missioners Fellowship especially elders and the St Francis chapel that has led me through campus life without going astray and helped me grow spiritually, Glory Be to God.

Finally, I thank the administration and children of the schools that I collected data from namely Nyanamo Primary school, Kibugu primary school, Kaboko primary school from rural (Kisoro) and Makerere C.O.U Primary School, old Kampala Primary school, Kisuule Pre and Primary School and Sir Apollo Kaggwa Primary school

GOD IS FAITHFUL!!!!!!!!!!!!!!!!!!!!

TABLE OF CONTENTS.

DECLARATION	i
APPROVAL	ii
DEDICATION	iii
ACKNOWLEDGEMENT.....	iv
TABLE OF CONTENTS.....	v
LIST OF TABLES.....	viii
LIST OF FIGURES.....	ix
LIST OF ABBREVIATIONS AND ACRONYMS	x
OPERATIONAL DEFINITION OF TERMS.....	xi
ABSTRACT.....	xii
CHAPTER ONE. INTRODUCTION.....	1
1.0 Background of the study.....	1
1.1 Statement of the problem	2
1.2 The purpose of this study.	3
1.3 Objectives of the study.....	3
1.4 Research questions.....	3
1.5 Significance of the study.....	4
1.6 Scope of the study	5
CHAPTER TWO. LITERATURE REVIEW	6
2.0 Introduction.....	6
2.1 Concept of Overweight and Obesity.....	6
2.2 The anthropometrics.....	6
2.2.1. Weight and height in children.....	6
2.2.2 Waist circumference	7
2.3 Weight status	9
2.4 Difference in prevalence of obesity and overweight in primary schools	10
2.4.1 Prevalence of overweigh and obesity.....	10
2.4.2 Differences in prevalence of overweight and obesity among rural and urban primary school going children	11

2.5 Conclusion and Summary of gaps and issues that inform the proposed concept	13
CHAPTER THREE: - METHODOLOGY.....	14
3.0 Introduction	14
3.1 Research design.	14
3.2 Target population	14
3.3 Sample size, sampling technique and sampling procedure.....	14
3.4 Data collection methods/tools.	15
3.5 Data analysis methods.....	16
3.5.1 Analysis of measurements	16
3.6 Ethical consideration.....	17
CHAPTER FOUR. RESULTS.	18
4.0 Introduction.	18
4.1 Demographics	18
4.2 The anthropometric measurements.....	19
4.2.1 Weight of the participants	19
4.2.2 Height of the participants	20
4.2.3 Waist circumference	21
4.3 Weight status.....	22
4.4 Differences in prevalence of overweight and obesity between urban (Kampala) and rural (Kisoro) primary school going children.....	23
CHAPTER FIVE. DISCUSSION OF THE FINDINGS	25
5.0 Introduction.	25
5.1 Summary of findings.	25
5.2 The anthropometrics	25
5.2.1 The weight of the children.....	25
5.2.2 The height of the children.....	26
5.2.3 Waist Circumference (WC).....	26
5.3 The weight status.....	26
5.4 Differences in prevalence of Obesity and overweight between rural (Kisoro) and urban (Kampala) primary school going children.....	27
5.5 Summary of results	28

CHAPTER SIX; - CONCLUSION AND RECOMMENDATIONS.....	29
6.0 Introduction.	29
6.1 Conclusions	29
6.2 Recommendations.	29
REFERENCES.....	31
APPENDICES.	34
APPENDIX A: Questionnaire.....	34
Demographic information.....	34
Anthropometrics.....	34
APPENDIX B: Data collection log.....	35
APPENDIX C. Anthropometry-measurements protocols.	36
Protocol for measuring weight	36
Protocol for measuring waist circumference.....	36
Protocol for measuring height.	36

LIST OF TABLES

Table 3. 1 Description of the weight status in children between 5 and 19 years	Error! Bookmark not defined.
Table 4. 1 Number of children per age (N=810)	18
Table 4. 2, Total distribution of the pupils(N=810).....	18
Table 4. 3, The average weight (Kg) of the participants (N=810).....	19
Table 4. 4, Participants; -Average waist circumference (cm) according to age(N=810)	22
Table 4. 5 Weight status of the participants (N=810).....	23

LIST OF FIGURES

Figure 4. 1, A histogram showing the difference in average height of pupils in metres with corresponding age in years for the rural and urban areas.	20
Figure 4. 2, A histogram showing the average height inmetres with the corresponding age in years for the males and females.	21
Figure 4. 3, A graph showing the weight status of school going children.....	24

LIST OF ABBREVIATIONS AND ACRONYMS

BMI: _____Body Mass Index

WC: _____Waist Circumference

WHO: _____World Health Organization

CDC: _____Center of Disease Control & Prevention

Kg: _____Kilograms

M: _____Meters.

CM: _____Centimeters

CNAHL: _____Cumulative Index to Nursing and Allied Health Literature

US: _____United States

IOTF: _____International Obesity Task Force

P.1: _____Primary One

P.4: _____Primary four

OPERATIONAL DEFINITION OF TERMS.

Overweight: - It is the body weight falling above the normal percentile range associated with minimum mortality.

Obesity: - refers to body Mass Index (BMI) above the 95th percentile on the growth chart for children between 2 and 20 years

Body mass index (BMI): - refers to a measure of relative body weight that takes height into account and is correlated with direct measures of body fat (Sharkey, 1997).

Weight status: - is the description of the current weight condition of the specific population. Weight status may be; underweight, normal weight, overweight and obese.

Anthropometrics: - are measurements of the body which include the weight, height, skinfolds, waist circumference among others.

ABSTRACT

Overweight and obesity are increasing across the world. Previously it was more in developed countries but is now also prevalent in developing countries. We undertook this study to find out the prevalence of overweight and obesity in public day primary school going children of Kampala and Kisoro districts in Uganda.

This research used a cross-sectional descriptive research design. Participants were public day primary school going children (n=810) between 6 and 12 years. Waist circumference, height and weight of each child were measured to describe the weight status of the children.

Out of the 810 students used in the study, 56(6.91%) were underweight, 698(86.17%) were normal weight, 45(5.56%) were overweight and 11(1.36%) were obese. The prevalence of overweight and obesity in rural areas was 1.95% and 0% respectively while for urban (Kampala) was 9.25% and 2.75% respectively. The overall prevalence of overweight and obesity in rural (Kisoro) and urban (Kampala) was 2% and 12% respectively. The waist circumference of rural school going children was generally higher than that of urban school going children.

There is prevalence of overweight and obesity in Uganda and this is more in urban school going children than the rural school going children. Therefore, interventions to reduce on overweight and obesity need to be developed.

CHAPTER ONE. INTRODUCTION

1.0 Background of the study.

Overweight and obesity have been increasing over years. The increasing prevalence of childhood obesity has become a growing matter of public health concern worldwide.

Globally by 2017, 8% of death were because of obesity and this represents an increase from 4.5% in 1990 in middle income countries. (Ritchie and Roser (2017)

Obesity had increased from 4.5% in 1990 to 13% by 2016 in adults between 18 years and above (Ritchie & Roser 2017). The risk is more for children in industrialized countries. In 2010, 43 million children were estimated to be obese worldwide, out of whom, 35 million (81.4%) were from developing countries (The estimated prevalence of childhood obesity in Africa in 2010 was 8.5% and was expected to reach 12.7% in 2020. North Africa is the region with highest prevalence of childhood obesity in Africa. (Mercedes de Onis et al, 2010.).

The analysis done by world health assembly in March 2022 found out that by 2030, obesity among high burden countries in Africa will range from 5% to 16.5%

However few studies have been conducted on the prevalence of overweight and obesity among primary school children in Uganda. Prevalence of obesity among young adults aged 18–30 years in Kampala and Kamuli was 4.4% and 0% respectively, while for the overweight was 10.2% and 10.6% respectively (Baalwa et al, 2010)

Overweight and obesity are considered a multivariate syndrome which can negatively affect the whole-body functioning (WHO, 2005). They were previously common in highly developed countries, but in recent years a progressive increase is noticeable in developing countries. They were also considered health conditions for adults; currently they are highly prevalent among children and adolescents (Wang, 2004).

Obese children are likely to be obese adults and have an increased and long-term risk for breast, colon, and kidney cancers, stroke, cardiovascular disease, hypertension, diabetes, gall bladder disease and musculoskeletal disorders (Daniels et al, 2009). The increasing tendency of childhood overweight and obesity calls for accelerating programs that target primary prevention in developing countries, a practice that requires local data on the magnitude of the problem and the associated risk factors.

Therefore, this study set to find out the prevalence of overweight and obesity among the rural and urban primary going children in Uganda.

1.1 Statement of the problem

Overweight and obesity entail health risks with potential effects in social and economic wellbeing of an individual and community at large. Poor health condition resulting from overweight, and obesity may act as a barrier to the development of good mind and thus pave the way for poor learning behavior and outcomes for the primary school going children.

Even though overweight and obesity are identified as a serious health and social problem with economic and academic impacts all over the world, studies on their prevalence amongst primary school going children in rural and urban settings are quite limited in Uganda yet according to

Shriver (2016) national institute of health- recommends the age from 5years as the best age for start of controlling obesity.

Therefore, this study will assess the prevalence of overweight and obesity among urban and rural primary school going children of Uganda.

1.2 The purpose of this study.

To assess the prevalence of overweight and obesity in Urban and Rural primary school going children in Uganda

1.3 Objectives of the study.

The study was based on the following objectives

1. To assess anthropometrics (height, Waist circumference and weight) of urban (Kampala) and rural (Kisoro) primary school-going children in Uganda
2. To assess the weight status of urban (Kampala) and rural (Kisoro) school-going children in Uganda
3. To establish the differences in prevalence of obesity and overweight between primary school going children in urban (Kampala) and rural (Kisoro) in Uganda.

1.4 Research questions.

The research answered the following questions.

1. What is the anthropometrics (height, waist circumference and weight) of urban (Kampala) and rural (Kisoro) primary school going children in Uganda?
2. What is the weight status of urban (Kampala) and rural (Kisoro) school going children in Uganda?
3. What are the differences in prevalence of obesity and overweight among primary school going children in Urban (Kampala) and Rural (Kisoro) in Uganda?

1.5 Significance of the study

This study sought to establish the status of overweight and obesity among urban as well as rural primary school going children in Kampala and Kisoro districts. Findings from this study will be helpful in raising awareness among teachers, parents and other stakeholders in education, health and sports context about the prevalence of overweight in the society.

The study findings will enhance teachers and parents' plan on effective use of leisure time at schools and homes by putting great emphasis on sports as well as physical activities. In due regards, children would be able to expend extra energy that could otherwise be stored in their bodies and cause overweight as well as obesity.

The study was also aimed at providing information that can be useful in developing ways to avoid heart diseases, diabetes, blood pressure and respiratory disorders that are derivatives of overweight and obesity.

In another vein, understanding the weight status of the primary school going children will enable the authorities to come up with the control measures for respective conditions.

1.6 Scope of the study

This study was delimited to investigation of prevalence of overweight and obesity among public day primary school going children, aged 6 to 12 years, from Kisoro and Kampala districts in Uganda. Only public day schools in Kampala that are purely in urban setting and schools in Kisoro that are purely rural were considered.

CHAPTER TWO. LITERATURE REVIEW

2.0 Introduction.

This chapter gives a brief account of theoretical and empirical reviews about overweight and obesity globally, regionally and nationally. It presents the theoretical concept of overweight and obesity as well as prevalence of overweight and obesity.

2.1 Concept of Overweight and Obesity

The human body is divided into fat free mass and body fat (Insel & Roth, 2002). The fat free mass composed of all body's non-fat tissues such as bones, water, muscles, teeth and connective tissues (Insel & Roth, 2002). Body fat composes of essential and non-essential fats. Essential fats are crucial for normal body functioning such as provision of warmth and carrying out metabolic activities. They make up 3% and 12% of the total body weight in men and women respectively (Insel & Roth, 2002). Non-essential fat exists within adipose tissues located below the skin and around major organs. Adiposity of non-essential fats results from a long-term energy surplus in the body where energy intake exceeds energy expenditure. Excess non-essential fat in the body is what causes overweight and obesity (Sharkey, 1997).

2.2 The anthropometrics.

2.2.1. Weight and height in children.

Weight and height are important measurements in the determination of BMI in all categories of people and therefore it should be given much attention. Weight is a very important anthropometric measurement that should be given attention in children. An article written by (Kilen, - 2014) about if weight measurement should be a business in schools explains about a girl who refused to be measured when other students are looking at her. The girl only preferred her measurements to be

known to only her mum and a doctor which she did and her measurements were taken by a doctor but she became outspoken and teared at the results before her mum saw them because they were not favorable to her. Therefore, this shows that, the weight of a students has a social effect to learners because it brings insecurity to those with undesirable weight and these measurements of the primary school children would therefore enable the parents and schools to adjust accordingly. Weight is also what is based on, to measure obesity which comes with many risks.

Weight is also important in the assessing body composition and monitoring changes following diet and exercise (Wood, 2008). These changes include fat mass and fat free mass.

Urban–rural differentials in children’s anthropometric status have been reported in some countries at one point in time (Stevens et al, 2013). These authors aimed at analyzing trends in children’s height and weight, which are anthropometric measures of their nutritional status and determinants of their survival, cognitive development, and lifelong health, by rural and urban place of residence, for 141 low-income and middle-income countries. They also investigated the urban–rural differentials in height and weight, and how they have changed between 1985 and 2011. Finally, they estimated the contribution of changes in children’s heights and weights in rural and urban settings versus the contribution of urbanization to the regional trends in these measures. The findings of this study revealed that children who lived in cities were taller and heavier than their rural counterparts in almost all low income and middle-income countries.

2. 2.2 Waist circumference

WC is more strongly associated with better prediction of cardiovascular disease, type 2 diabetes, metabolic disease, and all-cause mortality than BMI, WC is a better predictor of medical costs than

BMI, WC is easier to measure; and WC is more easily understood by the public (Fredriksen et al, 2018), therefore it is highly recommendable for predicting the health risks.

The present study outlines the simplicity of using WC as a measure of fat distribution, and, hence, as a predictor of children's health. (-Mehta et al, -2015) discovered a significant rise in cardiovascular risk factors as the values of WC increased for both male and female subjects. This reinforces the utility of WC as an essential anthropometric measure for predicting health risks. Other studies confirm the association between WC, as a determinant of physical fitness and health, and metabolic function among children younger than 12 years, as well as its role in predicting myocardial infarction later in life. Public health authorities could therefore use this insight to suggest efficient intervention strategies for reducing WC to reduce obesity-related diseases and resultant mortality and morbidity. Referring mainly to adults, Ford et al. offer four suggestions why WC is preferable to BMI: WC is more strongly associated with better prediction of cardiovascular disease, type 2 diabetes, metabolic disease, and all-cause mortality than BMI, WC is a better predictor of medical costs than BMI; WC is easier to measure; and WC is more easily understood by the public. Despite these apparent advantages, there is some disagreement regarding the usefulness of WC over BMI. Therefore, the measurements of the WC are a very important in the anthropometrics as can also be used to access the obesity levels in the body.

In a study done by (-Miranda JWB et al, - 2019) on anthropometric indicators associated with high blood pressure in children living in urban and rural areas. The prevalence of high blood pressure was significantly higher among rural children. In the urban area, the chance of high blood pressure was higher in children who had a high body mass index and in the rural area, in those who had

increased waist circumference and the age range of 9-10 years. Therefore, waist circumference is very key in assessment of high blood pressure.

2.3 Weight status

Perception of children's weight status may be important in prevention and treatment, obesity science and practice (Wiley Blackwell 2020), a review of articles in the quantitative studies revealed that 55% of caregivers underestimated the children's level of overweight and obesity using verbal scale and 47% using visual scale. Of the children studied, 34% underestimated their own overweight and obesity using both scales. Underestimation was associated with the children's age, gender, BMI and parental weight status, ethnicity and education. In the quantitative studies, parents/main caregivers for children with overweight and obesity described their child's weight in terms other than overweight for example "big boned", thick and solid. In 2013, meta-analysis showed that 50.7% of parents living with overweight and obesity children underestimated their children's weight status.

This article confirms the prevalence of underestimation of children's overweight status across the international studies in the reviewed articles from years 2000_2020.

Therefore, this becomes a problem in controlling and treatment of obesity since parents and children don't acknowledge that they are overweight and obese.

Kafyulilo (2008) studied overweight and obesity among primary school children in Tanzania and found that BMI results for rural primary school children were 49% underweight, 47% normal weight, and 4% overweight. No cases of obesity were found among rural school children. Where

as in urban areas; 33% underweight, 44% normal weight, 14% overweight, 8% obesity level 1 and 1% obesity level 2

2.4 Difference in prevalence of obesity and overweight in primary schools

2.4.1 Prevalence of overweight and obesity

According to the World Health Organization (WHO) in 2010, 43 million children of which 35 million were in developing countries were estimated to be overweight and obese. Also, 92 million children were found to be at risk of overweight and the prevalence of childhood overweight and obesity had increased from 4.2% in 1990 to 6.7% in 2010, world widely. This trend was expected to reach 9.1% (60 million) in 2020. In 2010, the prevalence of childhood overweight and obesity in Africa was estimated to be 8.5% and is expected to reach 12.7% in 2020. Furthermore, it was determined that the prevalence of overweight and obesity was lower in Asia than in Africa at 4.9% in 2010. The number of affected children estimated at 18 million was higher in Asia than in Africa. There is an increase in the prevalence of obesity, particularly in developed countries. This is partially explained by the societal changes that promote both consumption of energy-dense foods and unhealthy eating patterns (CDC, 2011). According to CDC in Ireland, 2011, an estimate of almost 20% of all children aged 6 to 11 are obese. Overall, 10% of the school-aged children in the world were overweight (IOTF, 2004). According to the Global School-Based Student Health Survey 2003: Uganda Country Report, 5.3% of Ugandan school children aged 13-15 years (2% were male and 12% were female) were identified as at risk of overweight (BMI > 25 or more than 85 percent of weight for age and sex).

Overweight increases with age if not controlled (Nora EL- Said Badawi et al, 2013). In this study he used children between 6 and 12 years and it was found out that the children between 7-8 years had more obesity cases than the 9-11 age children.

2.4.2 Differences in prevalence of overweight and obesity among rural and urban primary school going children

Childhood overweight is influenced by many different aspects that range from genetics to the social cultural environment (Wood et al., 2015; Papoutsis et al., 2012). However, considering the enormous growth of overweight and obesity in the last decades, the environment might play a role in this effect. A factor that is linked to overweight and obesity are urban-rural differences (Wood et al., 2015). There is an ongoing debate about whether inhabitants of urban areas are more likely to be overweight or obese or inhabitants of rural areas (Wood et al., 2015). According to different literature; urbanization is associated with higher obesity and overweight levels (Rosin, 2008; WHO, 2018). In the study of (Zhang et al, 2014), there was found a link between overweight and obesity in children and adolescents in China. The level of children and adolescents with overweight or obesity increased for different levels of urbanization (Zhang et al., 2014). Besides, (Zhang et al, 2014) found that this effect was stronger for boys than for girls. Further, (Hyska et al, 2014) found the effect of urbanization on overweight and obesity levels for children in Albania. Zou et al. (2016) also report this link between urban areas and the prevalence of overweight and obesity in children and adolescents in their study in China. Yet, they also acknowledge the double burden of malnutrition. (Neuman et al, 2013) found that BMI in less-developed countries was usually higher in urban areas.

On the other hand, there are also studies indicating that children and adolescents in rural areas are more likely to be overweight. (McMurray et al, 1999) found that rural children had a 54.7% greater

risk of becoming obese compared to their urban counterparts. Also, (Joens-Matre et al, 2008) concluded that rural children have a higher chance of becoming overweight, during their study in the US. Further, childhood overweight and obesity are more prevalent in small towns and rural areas in Sweden (Sjöberg et al, 2011). The negative effect of urbanity on childhood overweight is also found in Japan (Itoi et al, 2012). Urban-rural differences are thus found in several studies. However, with contradicting results. This might be due to the development level of a country (Itoi et al., 2012). More developed countries, where the development is very high based on the HDI, like the US, Sweden and Japan show a negative effect between urbanity and childhood overweight while the less developed countries, with only a high development, show a positive relationship between urban living and overweight (United Nations, 2019.)

Urban- rural differences in childhood and adolescents' obesity in the United States (Marry Ann Liebert, 2015). A systematic literature review and subsequent meta-analysis were performed to investigate differences in childhood obesity between urban and rural areas in the United States. A search of published studies comparing childhood obesity in urban and rural settings was undertaken by probing PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL) for articles that met predetermined inclusion criteria. A subsequent meta-analysis was conducted to determine the combined effect size and significance of differences in childhood obesity between urban and rural areas. Ten studies were identified for systematic review, five of which contributed to the meta-analysis. All but one study suggested that residence in rural areas was associated with higher prevalence or increased odds of childhood obesity, compared to children living in urban areas. A meta-analysis of 74,168 pooled participants ages 2–19 found that rural children have 26% greater odds of obesity, compared to urban children.

In a study conducted in Kampala and Kamuli by (Baalwa et al, 2010) showed that the prevalence of obesity among young adults aged 18–30 years was 4.4% and 0% respectively. While for the overweight, it was 10.2% and 10.6% respectively. This indicates the high health risk in urban areas than the rural areas

2.5 Conclusion and Summary of gaps and issues that inform the proposed concept

- a. The worldwide distribution and increased trends in the prevalence of childhood overweight and obesity suggest a real public health threat to this and future generations that creates tremendous health and social adversity. There is need for more research regarding this issue for better prevention and treatment strategies. Therefore, the current study is relevant to this cause.
- b. The review has demonstrated the fact that children grow and develop in different contexts and thus childhood obesity is a dynamic process as it is influenced by different factors like urbanization among others.
- c. Some parents and guardians taking care of children under estimate their weight status which makes them not to take their children for the assessment. Therefore, this study will increase on the awareness of parents and guardians or other parental careers to know the prevalence of obesity and overweight which may attract them to take children for assessment. Added to this some children are not willing to be assessed, therefore need to develop policies in schools. This study will reduce on this gap
- d. There are limited studies carried on the prevalence of overweight and obesity in school aged children in Uganda and therefore this study will bridge on this gap.

CHAPTER THREE: - METHODOLOGY

3.0 Introduction

It comprises of research design, study area and target population. Also, there are sampling techniques, data collection methods and data analysis procedures.

3.1 Research design.

This study used cross-sectional descriptive research design to describe the current status of overweight and obesity in the selected areas. This design was used because it gives the current status of obesity and overweight.

3.2 Target population

The target population for this study included the primary school children between 6 and 12 years from both rural and urban settings in Kisoro and Kampala districts respectively. The schools were government sponsored (public) schools and were purely day schools.

3.3 Sample size, sampling technique and sampling procedure.

The sample for this study was public day primary school going children. Four schools from each district were selected. From each school, mainly four classes, P.1 to P.4 were considered, 25 pupils from each class were considered, meaning a minimum of 100 pupils from each school were considered and a total of 810 pupils was used in the study.

The pupils from each class were selected by simple random sampling such that every pupil in class had equal chance of being selected. Strips of papers written on **YES** and the rest written on **NO** were used. Every pupil was given a chance to pick a paper and a paper picked was not replaced

(Kothari, 2004). To ensure equal presentation of males and females, the strips of papers were displayed separately.

Those that picked no did not participate in the study while the ones that selected yes participated in the study

3.4 Data collection methods/tools.

This refers to the many methods that help in the acquisition of data (Best & Kahn 2006). In order to determine the prevalence of overweight and obesity, the heights and weights of selected pupils were measured to determine body mass index (BMI), waist circumference was measured to determine the size of the obesity and overweight risks.

Weight of the pupils was measured by standing on a digital weighing scale (Seca 786) in kilograms with only one decimal place where necessary. Pupils had to remove shoes and other heavy clothes like sweaters and belts “for boys”, then stand upright on the weighing scale with the legs fully on the scale

Height was measured using a stadiometer (213) labelled in centimeters (cm) where it was later converted to meters by dividing by 100. Pupils had to remove shoes and other bulky clothing, measurements were taken on a non-carpeted surface, standing with feet flat and together, legs straight, arms straight at sides and shoulders at the same level, pupils would lean on stadiometer such that the head, hips and heels of legs are on it, a straight head piece making an angle of 90 to the stadiometer was used to locate the measurement. Measurement was taken when the pupil is facing forward and the sight is parallel to the stadiometer and were recorded to nearest centimeter.

Waist circumference was also measured using a tape measure (Seca 201) and was recorded in centimeters. The bottom of the ribs and the top of the pupils' ribs were located, then a tape measure was placed around the middle, halfway between them, then the tape measure was placed tight but not digging into the skin, the pupils were then requested to breathe normally, and the measurement was taken.

Differences in prevalence of overweight and obesity among primary school children were studied by analysis of these measurements

The current study employed measurement of BMI and waist circumference only.

3.5 Data analysis methods.

The data collected was entered in Microsoft excel and the mean values were calculated and the results were presented in tables and graphs.

3.5.1 Analysis of measurements

Weight and height measurements were subjected to calculations of BMI to determine their implication to children's weight status. The following formula was used in BMI calculation: $BMI = \text{weight in kg} / \text{height in m}^2$. Results were used to classify weight status as "underweight, normal weight, overweight, obesity by referencing the calculated BMI to the percentiles in the growth chart (WHO, 2007) of children aged 5 to 20 years" as shown in Table below.

Table 3. 1 Description of the weight status in children between 5 and 19 years

Percentile rankings	IMPLICATION TO WEIGHT STATUS
<5th percentile	Underweight
>5th percentile<85th percentile	Normal weight
≥85th percentile<95	Overweight
≥95th percentile	Obese

This table was generated from WHO (2007) growth references for children between 5 and 19 years

3.6 Ethical consideration.

The participants participated voluntarily, explanations were given to the participants and they participated with confidence. During the time of participation, the participants were placed in safe environment free from obstacles and harmful objects to maintain their safety, the results of each participant were confidential in that they were known to only individual participant and the researcher. The mode of communication was efficient in that participants who required explanation were handled individually.

CHAPTER FOUR. RESULTS.

4.0 Introduction.

This chapter presents findings obtained from the field. It consists of several sections that present different anthropometric measurements taken from the pupils from the rural and urban children in Uganda.

4.1 Demographics

This study included primary school pupils between 6 and 12 years, **400 (49.4%)** pupils from urban schools and **410 (50.6%)** from rural schools. 406(50.1%) of these were girls and **404 (49.9%)** were boys.

Table 4. 1 Number of children per age (N=810)

Age	Number of Participants			
	Rural		Urban	
	Males	Females	Males	Females
6	08	10	15	35
7	24	24	31	35
8	32	27	42	34
9	27	27	35	20
10	37	41	23	50
11	38	39	22	16
12	43	34	28	14

Table 4. 2, Total distribution of the pupils(N=810)

Characteristic	Number	Percentage (%)
Overall	810	100
Area:		
rural	410	50.6
urban	400	49.4
Sex.		
Males	404	49.9
females	406	50.1

4.2 The anthropometric measurements

4.2.1 Weight of the participants

This study indicated that there is increase in weight with increase in the age of the pupils and the urban school going children were generally heavier than the rural school going children as presented in table 4.2.

Table 4. 3, The average weight (Kg) of the participants (N=810)

Age (years)	Overall	Rural		Urban	
		males	females	males	females
6	68	20.90	20.20	22.60	20.94
7	113	22.50	21.76	22.65	22.87
8	135	24.35	23.41	24.82	23.81
9	109	26.14	26.13	32.03	28.22
10	151	27.83	27.31	33.06	32.53
11	116	29.44	31.55	38.92	38.42
12	119	31.98	34.20	43.6	41.48

4.2.2 Height of the participants

The findings of this study presented in figure 4.1 and 4.2 also indicate that the height of children increases with age for both the rural and the urban going children and the urban primary school going children are generally taller than the rural school going children according to figure 4.1.

From figure 4.2, boys are taller than girls.

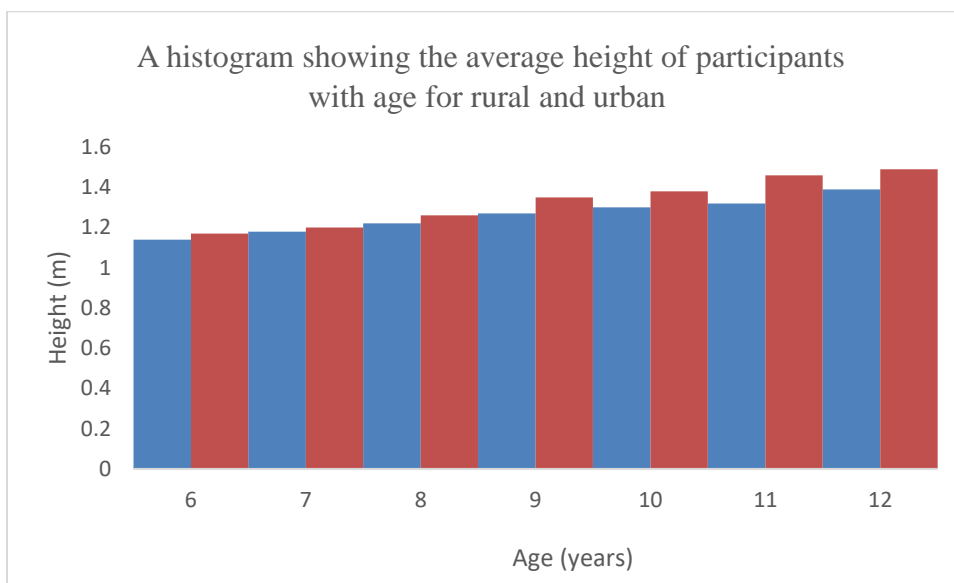


Figure 4. 1, A histogram showing the difference in average height of pupils in metres with corresponding age in years for the rural and urban areas.

The blue color represents the rural school going children while the red colour represents the urban school going children.

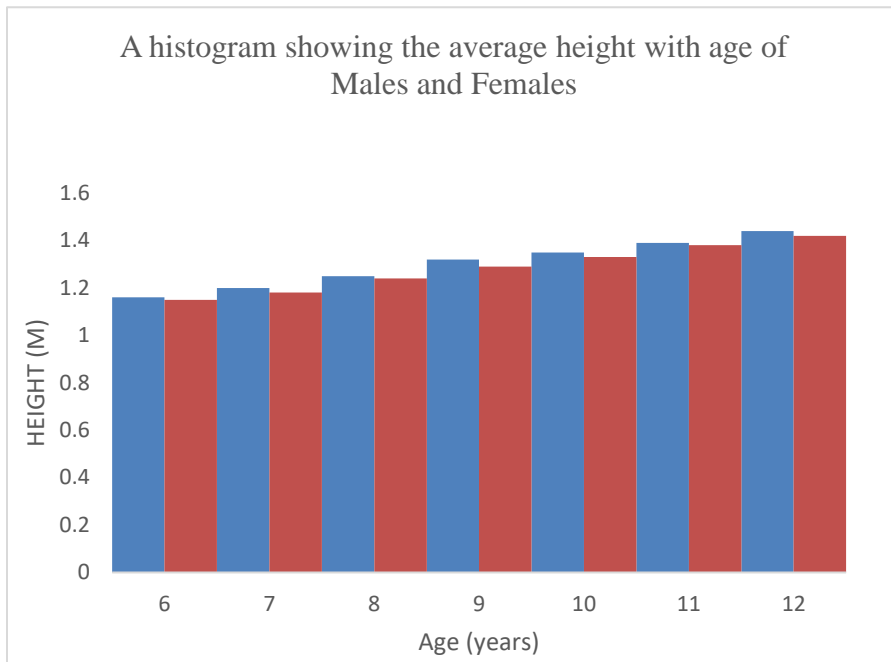


Figure 4. 2, A histogram showing the average height in metres with the corresponding age in years for the males and females.

The blue colour represents the males and red colour represents females

4.23 Waist circumference

The waist circumference of the pupils increases with increase in age for both rural and urban primary school going children. The urban primary school going children generally have higher waist circumference than the rural school going children. Males have higher circumference than females.

Table 4. 4, Participants; -Average waist circumference (cm) according to age(N=810)

Age(years)	Overall	Urban Males	females	Rural Males	females
6	68	54.21	53.28	49.90	48.70
7	113	55.98	54.91	51.85	52.79
8	135	57.13	55.26	51.90	52.80
9	109	57.81	57.38	57.21	54.54
10	151	58.86	58.92	58.82	57.02
11	116	60.27	59.86	59.15	60.25
12	119	62.05	61.93	61.64	60.94

4.3 Weight status.

Results from table 4.5 Show that the weight status of the rural school going children is as follows, underweight 31(7.56%), normal weight (90.5%), overweight 8(1.95%) and there were no cases of obesity. The weight status of the urban school going children was as follows, underweight 25(6.25%), normal weight 327(81.75%), overweight 37(9.25%) and obesity was 11(2.75%)

Table 4. 5 Weight status of the participants (N=810)

Weight status	Overall	Rural		Urban	
		males	females	males	females
Underweight	56	18	13	13	12
Normal weight	698	187	184	155	172
Overweight	45	3	5	18	19
Obese	11	0	0	8	3

4.4 Differences in prevalence of overweight and obesity between urban (Kampala) and rural (Kisoro) primary school going children.

The prevalence of overweight and obesity is higher in urban primary school going children (Kampala) compared to the rural primary school going children (Kisoro) as illustrated in figure 4.3.

There are few cases of overweight and no cases of obesity in rural school going children whereas cases of overweight and obesity were found in urban school going children.

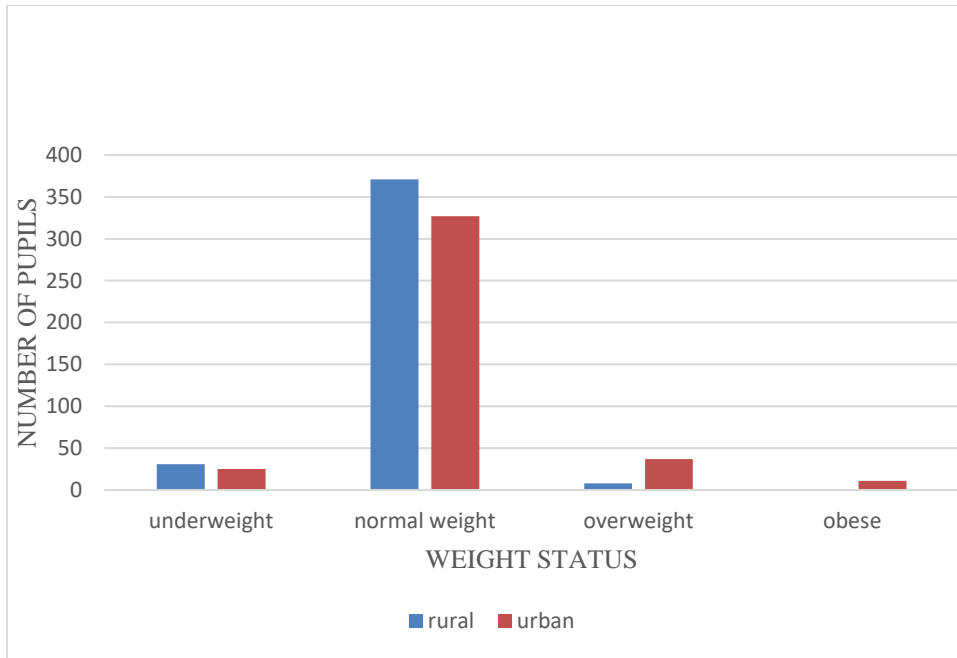


Figure 4. 3, A graph showing the weight status of school going children.

CHAPTER FIVE. DISCUSSION OF THE FINDINGS

5.0 Introduction.

This chapter presents the interpretation and the discussion of the main findings of the study. These discussions will be based on the measurements done while collecting data and other findings by other scholars on the same topic.

5.1 Summary of findings.

This study investigated the prevalence of overweight and obesity among the school going children in rural and urban areas. This study indicated that there is difference between the prevalence of overweight and obesity among urban (12%) and rural (2%) going children. The waist circumference of the children in the rural areas was generally higher than the one of the children in urban areas. The urban primary school going children were taller and heavier than the rural primary school going children.

5.2 The anthropometrics

5.2.1 The weight of the children.

The results of this study indicate that the weight of urban school going children is higher than that of rural going children. The findings are similar to the study done by (Christopher, 2013), Lancet Global Health who found out that children in urban areas were at more risk of overweight and obesity than rural children. The current study results are also similar to Oninla et al, 2006) who found out that the children in the urban areas are heavier than those in rural areas. On contrary (Yingying & Qian 2022) ho found out that there are no significant differences between the weight of children of urban and rural areas between 2 and 4 years in China. This is similar to the findings of (Gretchen A Stevens et al, 2013) who found out that the children who live in the

cities are heavier than those that live in the rural areas in both middle income and low-income countries.

5.2.2 The height of the children

Urban school going children are taller than the children in the rural school going children and the boys are taller than girls in all areas. This is similar to findings of (S.O Oninla et al, 2006) who found out that the children in urban areas are taller than the rural children. This is also similar to findings of (Yingying & Qian, 2022) who found out that the urban children between 2 and 4 years are taller than their counterparts in rural areas in China. This is similar to the findings of (Gretchen A Stevens et al, 2013) who found out that the children who live in the cities are taller than those that live in the rural areas in both middle income and low-income countries.

5.2.3 Waist Circumference (WC)

Waist circumference of the urban school going children is generally higher than that of the urban school going children between 6 and 12 years. This finding agrees with the findings by (Arnab Ghosh, 2011) who found out that the mean waist circumference of urban children is higher than that of the rural area.

Results from the rural school going children indicate that the waist circumference of the boys is higher than that of the girls between 6 and 12 years while also the urban boys had higher waist circumference than the girls of the same age. This is similar to the findings by (J Stevens et al, 2009) who found out that males had higher values of waist circumference than females.

5.3 The weight status.

From the findings in this study which was based primary school going children in the public day schools in rural areas and urban areas of Uganda, underweight 6.91%, normal weight 86.17%, overweight 5.56% and 1.36% were obese

The prevalence of obesity and overweight was 6.92% with obesity at 1.36% and overweight at 5.56%. These findings are quite similar to those early found by Petronella (2011) that indicated that the prevalence of overweight and obesity in a sample of primary school children was 13% of which 9% were overweight and 4% obese. They are also similar to those done by (Mosha et al, 2010) where 3.9% of the children aged between 10–12 years in Dodoma were obese compared to 5.8% of their counterparts in Kinondoni municipality. They are also similar to those found by (Kevin Teckla Nawangi, 2012) on the prevalence of obesity and overweight on primary school children of Mukono and Kampala districts where the overall was obesity 3.8% and overweight as 4.1%

5.4 Differences in prevalence of Obesity and overweight between rural (Kisoro) and urban (Kampala) primary school going children.

There is more prevalence of overweight and obesity in urban primary school going children (12%) than the rural primary school going children (2%). This result is agreeing to the findings by (Nurwanti E et al, 2019), who found out that the urban children were at higher risk of being overweight and obese. This is also in line with the study by (Baalwa et al, 2010) in Kampala (urban) and Kamuli (rural), who found out that the overall prevalence of overweight and obesity among young adults aged 18–30 years was 10.4% and 2.3% respectively. The findings of (Arnab Ghosh, 2011) on rural urban comparison of overweight and obesity in children and obesity aged between 8 and 18 years found out that the children in urban areas were associated with more overweight and obesity than the rural ones which is similar to findings of this research.

This disagrees with the research done by (McMurray et al, 1999) who found out that rural children had a 54.7% greater risk of becoming obese compared to their urban counterparts.

5.5 Summary of results

From this study we found out that the overall prevalence of overweight and obesity in rural (Kisoro) and Urban (Kampala) was 12% and 2% respectively. Obesity in Kisoro was 0% and overweight was 2%, obesity in Kampala was at 2.75% and overweight at 9.25%. It was more common in girls (1.22%) than boys (0.73%) for rural and was more prevalent in boys (6.5%) than girls (5.5%) in Urban. Also, the children in the rural (Kisoro) generally had bigger waist circumference compared to the children in Urban setting.

Generally, the high prevalence of overweight and obesity implies a heavy burden of diseases like coronary heart disease, cancers, high blood pressure and stroke amongst others exists. Therefore, as a policy, schools need to establish a safe and supportive environment characterized with practices that support healthy behaviors amongst pupils.

CHAPTER SIX; - CONCLUSION AND RECOMMENDATIONS

6.0 Introduction.

This chapter makes the conclusions and recommendations for possible improvements based on the objectives alongside suggesting the areas for further inquiry.

6.1 Conclusions

The prevalence of overweight and obesity among primary pupils attending schools is in such a way that though most of the pupils attending schools are normal weight, the prevalence of overweight and obesity stands at 12% and 2% in Kampala and Kisoro districts respectively, cases of also underweight should also be taken care of. Overweight and obesity is significantly attributed to the gender of the pupil in that more males were more obese compared to their female counterparts. The 12% and 2% are from public day primary school going children which implies a significant prevalence because these children are characterized by being more active.

Primary school going children in Kampala are taller and heavier than the children in Kisoro and boys are generally taller than the girls.

The waist circumference of urban children is generally higher than that of rural school going children.

Pupils' involvement in physical activity after school and mode of feeding might be the leading factors of obesity in the primary school going children. The sedentary behaviors such as the average number of hours spent watching might be leading to overweight and obesity.

6.2 Recommendations.

The government and non-governmental organizations ought to leverage items of knowledge through sensitization to both the parents and pupils the implications of being overweight or obese in terms of risk to other conditions diabetes mellitus and hypertension among others. This sensitization may attract parents and pupils to always take their measurements to access overweight and obesity.

I also recommend the primary schools to have the anthropometric measurements tools to enable them always access the status of their learners in order to help those who are at risk due to overweight and obesity.

The urban primary schools should advise the parents and learners to always check the lifestyle of their children as they are the most affected by this condition.

The ministry of education and sports through its examining body the Uganda National Examinations Board (UNEB) should do regular assessment of the status in these schools such that correct feeding and participation in physical activities is given priority. This will help schools, parents and pupils into pushing for physical education activities which will in term reduce incidences of overweight and obesity amongst the pupils.

This study was also based on only two districts and a small sample therefore more studies on the prevalence of overweight and obesity should be carried out.

The administrators of the public primary schools in Kampala should avail the playing materials and facilities to improve on the physical nature of learners to reduce on overweight and obesity.

REFERENCES

1. Mosha, T.C.and Fungo, S, (2010). Prevalence of overweight and obesity among children aged 6-12 years in Dodoma and Kinondoni Municipalities, Tanzania. *Tanzania Journal of Health Research*, 12(1). Available at: <https://doi.org/10.4314/thrb.v12i1.56202>.
2. Kafyulilo, A.C. and Mafumiko, F.M. (2011), implications of childhood overweight and obesity on learning behavior and classroom performance, *SSRN Electronic journal* available at: <https://doi.org/10.2139/ssrn.1909205>
3. De Onis, M., Blössner, M. and Borghi, E. (2010) “Global prevalence and trends of overweight and obesity among preschool children,” *The American Journal of Clinical Nutrition*, 92(5), pp. 1257–1264. Available at: <https://doi.org/10.3945/ajcn.2010.29786>.
4. Karki, A., Shrestha, A. & Subedi, N (2019). Prevalence and associated factors of childhood overweight/obesity among primary school children in urban Nepal. *BMC Public Health* **19**, 1055. available at <https://doi.org/10.1186/s12889019-7406-9>.
5. Pirgon, Ö. and Aslan, N. (2015) “The role of urbanization in childhood obesity,” *Journal of Clinical Research in Pediatric Endocrinology*, 7(3), pp. 163–167. Available at: <https://doi.org/10.4274/jcrpe.1984>.
6. Baalwa J, Byarugaba BB, Kabagambe EK, Kabagambe KE, Otim AM (2010). Prevalence of overweight and obesity in young adults in Uganda. *Afr Health Sci*. 2010 Dec;10(4): pp 367-73.
7. Obesity Science & Practice - Wiley Online Library (2003). Available at: <https://onlinelibrary.wiley.com/journal/20552238> (Accessed: November 22, 2022).

8. Johnson, J.A. and Johnson, A.M. (2015) “Urban-rural differences in childhood and adolescent obesity in the United States: A systematic review and meta-analysis,” *Childhood Obesity*, 11(3), pp. 233–241. Available at: <https://doi.org/10.1089/chi.2014.0085>.
9. Abu Baker, N.N. and Daradkeh, S.M. (2010) “Prevalence of overweight and obesity among adolescents in Irbid governorate, Jordan,” *Eastern Mediterranean Health Journal*, 16(06), pp. 657–662. Available at: <https://doi.org/10.26719/2010.16.6.657>.
10. Do, L.M, Toan Tran, BO Eriksson, Max Petzold, Henry Ascher (2017) “Prevalence and incidence of overweight and obesity among Vietnamese preschool children: A longitudinal cohort study,” *BMC Pediatrics*, 17(1). Available at: <https://doi.org/10.1186/s12887-017-0904-y>.
11. de Onis, M. (2007) “Development of a who growth reference for school-aged children and adolescents,” *Bulletin of the World Health Organization*, 85(09), pp. 660–667. Available at: <https://doi.org/10.2471/blt.07.043497>.
12. Ghosh, A. (2011) “Rural–urban comparison in prevalence of overweight and obesity among children and adolescents of Asian Indian origin,” *Asia Pacific Journal of Public Health*, 23(6), pp. 928–935. Available at: <https://doi.org/10.1177/1010539511428697>.
13. Who child growth standards: Length/height-for-age, weight-for-age, weight-for-length, weight -for-height and body mass index-for-age: Methods and development (1970) *World Health Organization*. Available at: <https://apps.who.int/iris/handle/10665/43413> (Accessed: November 22, 2022).
14. Badawi, N.E.-S, Abeer A.B, Sehem A.E, Muhammed Fawzy H (2013) “Prevalence of overweight and obesity in primary school children in Port Said City,” *Egyptian Pediatric*

- Association Gazette*, 61(1), pp. 31–36. Available at: <https://doi.org/10.1016/j.epag.2013.04.007>.
15. Fredriksen, P.M., Skår, A. and Mamen, A. (2018) “Waist circumference in 6–12-year-old children: The Health Oriented Pedagogical Project (HOPP),” *Scandinavian Journal of Public Health*, 46(21_suppl), pp. 12–20. Available at: <https://doi.org/10.1177/1403494818767790>.
16. Andrade GN, Matoso LF, Miranda JWB, Lima TF, Gazzinelli A, Vieira EW (2019). Anthropometric indicators associated with high blood pressure in children living in urban and rural areas. *Rev Lat Am Enfermagem*;27: available at e3150. doi: 10.1590/1518-8345.2760-3150.
17. Robert Wood (2008), "Body Weight Measurement." *Topend Sports Website*, available at <https://www.topendsports.com/testing/tests/mass.htm>, Accessed 9 December 2022
18. Sivam, S. and Harith, S. (2022) “The prevalence of overweight and obesity among young adults in Terengganu: A cross-sectional study,” *Asian Journal of Medicine and Biomedicine*, 6(S1), pp. 136–137. Available at: <https://doi.org/10.37231/ajmb.2022.6.s1.562>.
19. Freedman, D.S., Kit, B.K. and Ford, E.S. (2015) “Are the recent secular increases in waist circumference among children and adolescents independent of changes in BMI?,” *PLOS ONE*, 10(10). Available at: <https://doi.org/10.1371/journal.pone.0141056>.
20. Paciorek, C.J, Gretchen A. S, Mariel M Finucane, Majid, Ezzati (2013) “Children's height and weight in rural and urban populations in low-income and middle-income countries: A systematic analysis of population-representative data,” *The Lancet Global Health*, 1(5). Available at: [https://doi.org/10.1016/s2214-109x\(13\)70109-8](https://doi.org/10.1016/s2214-109x(13)70109-8).

APPENDICES.

APPENDIX A: Questionnaire

Am by names of Manishimwe Enock, a student of Bachelor of science in sports science, Makerere University doing research to investigate the prevalence of overweight and obesity in primary school going children of Kisoro and Kampala districts. Data collected will be used as reference only and will remain confidential. Feel free to allow me take the measurements to gathers the information concerning overweight and obesity at your home and school.

Personal information

Demographic information

Name of the school.....

Age.....

District.....

Gender.....[male/female].

Village/street.....

Anthropometrics

Weight.....

Height.....

Waist circumference.....

APPENDIX B: Data collection log

Age(years)	Gender (m or f)	W.C (cm)	Weight (kg)	Height (cm)	BMI(Kg/M2)

APPENDIX C. Anthropometry-measurements protocols.

Protocol for measuring weight

Measured using a digital scale

Remove shoes and other heavy clothing like sweaters.

Stand on the center of the weighing with both feet while upright

Take the measurement to the nearest fraction for example 35.6 kg

Weight =Kg

Protocol for measuring waist circumference.

Measured using a tape measure and was recorded in centimeters.

Let the child remove sweaters and stand upright and breathe normally

Locate the bottom of the ribs and the top of the pupils' ribs, then place a tape measure around the middle, halfway between them, while tight but not digging into the skin, the pupils.

Allow the child to breathe normally, and take the measurement

Waist circumference =cm

Protocol for measuring height.

Measured using a stadiometer.

Place the stadiometer on a non-carpeted surface.

Let the child remove shoes and other bulky clothing.

Let the child stand with feet flat and together, legs straight, arms straight at sides and shoulders at the same level.

Let the pupil lean on stadiometer such that the head, hips and heels of legs are on it, a straight head piece making an angle of 90 to the stadiometer locates the measurement.

Let the pupil face forward such that the sight is parallel to the wall of stadiometer by using the pointer on the head piece

Height =cm