

**OVERWEIGHT AND OBESITY AMONG ADOLESCENTS:
BURDEN AND ASSOCIATED FACTORS - A CASE STUDY OF
BABATI, MANYARA, TANZANIA.**

Furahini D. Chinenere

**Master of Public Health Dissertation
Muhimbili University of Health and Allied Sciences,
October, 2014.**

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AND ASSOCIATED FACTORS; A CASE STUDY OF BABATI,
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By

Furahini D. Chinere

**A dissertation Submitted in (partial) Fulfilment of the Requirement for
the Degree of Master of Public Health of
Muhimbili University of Health and Allied Sciences**

**Muhimbili University of Health and Allied Sciences
October, 2014.**

CERTIFICATION

The undersigned certify that she has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled; **“Overweight and obesity among adolescents: burden and associated factors - a case study of Babati, Manyara, Tanzania”**, in (partial) fulfilment of the requirements for the degree of Master of Public Health of the Muhimbili University of Health and Allied Sciences.

Dr. Germana H. Leyna (MD, PhD)

(Supervisor)

Date

DECLARATION AND COPYRIGHT

I, **Furahini Daniel Chinere**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

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- All the students who participated in the study and their parents/guardians who allowed them to.
- Last but by all means not least, I am grateful to the School of Public Health academic and non-academic staff for their unsurpassed commitment.

DEDICATION

This work is dedicated to my late father Daniel Tluway for his foresight and my brave son Quenth who inspires me daily.

ABSTRACT

Introduction: Childhood and adolescent overweight and obesity have increased dramatically globally in the recent years. Though initially thought to be a problem of developed countries, studies have shown that this is not the case as developing countries have also been affected. Childhood overweight and obesity tend to persist through adulthood and may lead to early onset of non-communicable diseases (NCDs), and a number of psychological consequences. It must be noted that there is paucity of data on the magnitude of overweight and obesity among adolescents in Tanzania. This study intended to establish the burden and factors associated with overweight and obesity among secondary school students in Babati, Manyara.

Objective: The main objective of this study was to estimate the prevalence of overweight and obesity as well as associated factors among secondary school students in Babati, Manyara.

Methods: A descriptive cross-sectional survey was carried out involving adolescents attending secondary schools in Babati, Manyara. The minimum required sample size was 602 study units. A multi-stage cluster sampling procedure was used. Anthropometric measurements were taken using standard procedures. Information about physical activity, dietary pattern and socio-demographic factors was obtained using a self-administered questionnaire. Ethical clearance was sought from the Muhimbili University of Health and Allied Sciences (MUHAS) Directorate of Research and Publication. In order to participate in this study, students' assent and parents/guardians consent were obtained. Descriptive statistics was used to summarize data; chi-square test was used to ascertain association between categorical variables. Regression models were run and presented as adjusted odds ratio with their 95% confidence intervals. A p-value of < 5% was used as a cut off point for statistical significance.

Results: A total of 619 students aged between 12-19 years (mean age 16.7 ± 1.6 years), sampled from Babati secondary schools were included in this study. These were either from public (62.2%) or private (37.8%) schools. The overall prevalence of overweight and obesity was 13%. Female students had a five-fold increased risk of overweight or obesity than their male counterparts ($p < 0.001$, Adjusted OR=5.5, 95% CI=2.8- 10.5). The level of

physical activity was found to be associated with overweight/obesity, ($p=0.01$, AOR=0.6, 95% CI= 0.4- 0.9). Those who consumed unhealthy diet doubled their risk of being overweight/obese, ($p=0.04$, AOR= 2.3, 95% CI= 1.0- 5.4)

Conclusion: The prevalence of overweight and obesity was found to be high with a higher frequency in female students than their male counterparts. Mild physical activity and unhealthy diet were found to be associated with overweight/obesity. Comprehensive evidence based interventions need to be employed to reduce the magnitude of this problem among adolescents.

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
CDC	Centre for Disease Control and Prevention
CSHP	Coordinated School Health Program
DED	District Executive Director
DEO	District Education Officer
DEXA	Dual-energy radiograph absorptiometry
FAO	Food and Agriculture Organization of the United Nations
IOTF	International Obesity Task Force
IPAQ	International Physical Activity Questionnaire
MRI	Magnetic Resonance Imaging
MUHAS	Muhimbili University of Health and Allied Sciences
NCDs	Non-communicable diseases
WHO	World Health Organization

DEFINITION OF KEY TERMS

Adolescence is the period in human growth and development that occurs after childhood and before adulthood, from ages 10 to 19 as defined by the World Health Organization (WHO) (20).

Body Mass Index (BMI) is defined as the individual's body mass (kg), divided by the square height (m²) – with the value universally being given in units of kg/m².

Overweight/obesity in children and adolescents classified based on International Obesity Task force (IOTF) BMI cut off-points(44) , categorise as overweight/obese and others.

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure.

Dietary patterns are individual eating habits that encompass the type and amount of food/drink consumed as well as eating frequency.

CHAPTER ONE

1.0. INTRODUCTION

1.1. Background

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health (1). Emerging evidence strongly suggests that overweight and obesity have reached epidemic proportions globally. The magnitude of overweight and obesity is increasing at an alarming rate worldwide with both developed and developing countries seriously affected. Moreover, the problem appears to be increasing rapidly in children. The magnitude of the range of health consequences associated with overweight/obesity in childhood may only become fully apparent later (2). Member states of WHO introduced a voluntary target to halt the rise in obesity by 2025 and widespread calls have been made for regular monitoring of changes in the prevalence of overweight and obesity in all populations (3).

There are many factors that contribute to child and adolescent obesity, some are modifiable and others are not. Modifiable factors include dietary intake, physical activity, sedentary behaviour characterized by high frequency of television viewing, computer usage, and similar leisure activities that take up time for physical activity. Others are over-consumption of high-calorie foods and drinks (4). In Tanzania like many developing countries, nutritional transition can be explained in the context of significant social and economic changes that have occurred in the recent past. The most significant changes directly related to nutrition are changes in food production, alcohol consumption, urbanization, reduced energy expenditure and adoption of the Free Trade Market Policy (5). Other contributing factors include over-exposure to advertising of foods that promote high-calorie foods, lack of recreational facilities, and use of personal car or public transportation instead of walking (4,5). Non-modifiable causes include genetics where greater risk of obesity has been found in children of obese and overweight parents (4).

In most developing countries including Tanzania infectious disease and under-nutrition are still a cause for concern. Simultaneously, the country is experiencing a rapid increase in non-communicable disease and their risk factors such as overweight and obesity

particularly, in urban settings. It is not uncommon to find under-nutrition and obesity existing side-by-side within the same country, the same community and the same household. These dietary patterns in conjunction with lower levels of physical activity, result in sharp increases in childhood obesity while under nutrition still remains unsolved (1). This is compounded by the fact that obesity is looked upon with admiration as a symbol for health and wealth (5).

Overweight and obesity during childhood and adolescence not only influence well-being during this period, but can also persist into adulthood. Excess body fat in children and adolescents increases the risk for the development of several medical conditions during adulthood, including insulin resistance, adult-onset type 2 diabetes mellitus and cardiovascular problems such as hypertension, ischaemic heart disease and stroke. Overweight and obesity are also said to increase the risk for different cancers, skeletal problems, non-alcoholic fatty liver disease, polycystic ovarian syndrome, and a variety of inflammatory conditions (6).

From a psychological point of view, low self-esteem seems to be the overriding concern of overweight and obesity during childhood and adolescence. Overweight and obesity during childhood and adolescence can give rise to a lack of confidence, negative self-perception and depression. Stereotyping, discrimination and social rejection may occur. These, in turn, may lead to withdrawal from physical activities, which further aggravate weight problems. As with the physical effects of overweight and obesity, the psychological impact may extend into adulthood (6). Social isolation and stress could also interfere with learning and academic performance (7). Overweight and obesity in all age groups is preventable as most of the risk factors are modifiable (1). Health services, especially in developing countries including Tanzania, may not easily bear these costs of non-communicable diseases, and the result could be a significant fall in life expectancy (8).

Up-to-date information about levels and trends in overweight and obesity is essential both to quantify the health effects and to prompt decision makers to prioritise action and assess where progress is, or is not, being made (3). Effective strategies to reduce body-mass index (BMI) in populations are scarce. Understanding this situation, so that acceptable remedial

action can be properly discussed and implemented, should be an essential part of public health policy in the next few decades (9). The emphasis should be based on controlling the environmental causes of obesity which will require broad-based, public health programs (8). It is unlikely, however, that any single strategy will be sufficient to reverse current trends in childhood and adolescent obesity. Success is more likely to be achieved by the implementation of sustainable, economically viable, culturally acceptable active-living policies that can be integrated into multiple sectors of society (10). Eventually, national strategies can then be assessed in their global context according to local BMI distribution changes with time and policy (9).

1.2. Literature review

1.2.1. Prevalence of overweight and obesity

Worldwide obesity has nearly doubled since 1980. In 2008, more than 1.4 billion adults, 20 and older, were overweight. Of these over 200 million men and nearly 300 million women were obese. In 2008, 35% of adults aged 20 and over were overweight, and 11% were obese. About 65% of the world's population live in countries where overweight and obesity kills more people than underweight. Further, more than 40 million children under the age of five were overweight in 2011 and 78% of these are in the developing countries(1). In a systematic analysis for the Global Burden of overweight and obesity in children and adults during 1980–2013, worldwide prevalence of overweight and obesity combined rose by 27.5% for adults and 47.1% for children between 1980 and 2013 (3).

Published data regarding prevalence of overweight and obesity among adolescents, especially those in secondary schools in Tanzania is scarce. However, there are studies in other African countries that show an increase in overweight and obesity in this age group. Where trends have been noted, the prevalence of overweight has increased dramatically in the recent past. For example, adolescent overweight in South Africa has doubled from 6.3% to 11.0% among boys and from 24.3% to 29.0% among girls between 2002 and 2008 (6).

The gap between rural and urban overweight among adolescents is closing. Uganda has shown almost equal prevalence of overweight among adolescents in urban (10.2%) and rural (10.8 %) areas (7). However, the general trend, is that there is higher prevalence in urban as opposed to rural settings, as shown in studies done in Dar es Salaam, Tanzania (11,12). Also, the prevalence of overweight and obesity is significantly higher among private schools students compared to their counter parts in public schools (13). Without exception, there are more overweight and obese adolescent girls than boys (4,8,13). In a systematic review of studies done among children and adolescents in South Africa, a higher prevalence of overweight or obesity was found in girls linked to the time of menarche. Factors suggested to play a role in this gender disparity include possible

differences in the energy needs between boys and girls, in the levels of physical activity, in behavioural or cultural phenomena and in the timing of sexual maturation. The association between puberty and overweight in girls may be a double-edged sword: one hand, overweight or obesity is said to contribute to the early onset of puberty, while on the other hand, early onset of puberty is reported to predispose to an increase in development of overweight or obesity in later life (6).

1.2.2. Factors associated with overweight and obesity

Factors associated with overweight and obesity in most literature reviewed have been categorised as non-modifiable and modifiable. Although, non-modifiable factors are above the scope of this study, a brief description will be provided.

1.2.2.1. Non modifiable factors

Non-modifiable factors are those that are inherent to the individual and cannot be changed or altered. Studies have shown that genetics including some genetic syndromes, such as Prader-Willi, Turner, and Lawrence-Moon-Biedl syndromes can lead to obesity (14). The prenatal period is now understood as a critical growth period. Anomalies during early life can lead to higher risk of obesity later in life. For example: studies have shown that prenatal deprivation, gestational diabetes, and high birth weights correlate positively with rates of obesity later in life (14).

Observations in twin, sibling, and family studies suggest that children are more likely to be overweight if relatives are similarly affected and that heritability may play a role in as many as 25% to 85% of cases. However, to suggest that only genetic factors have caused the recent global epidemic of childhood obesity would not be realistic. It is more likely that most of the world's population carries a combination of genes that may have evolved to cope with food scarcity. In environments in which calorie-dense foods are readily available and low energy expenditure, this genetic predisposition would adapt and could lead to an obese population (8). Puberty, a particularly dynamic time of growth and body-composition changes, and early menarche has also been shown to increase the risk of later developing obesity and metabolic syndrome (15,16).

1.2.2.2. Modifiable factors

There are many modifiable risk factors associated with overweight and obesity in the adolescents, all of which are lifestyle related.

The two overriding causes of the increased prevalence of overweight and obesity in developing countries are said to be a decline in physical activity and diets rich in refined fats, oils and carbohydrates (17). Overweight, in certain African cultures, is seen as an indication of wealth and happiness and, in more recent times, as an indication that the individual does not have HIV or AIDS (18,19). This study will focus on physical (in) activity, and dietary practices as risk factors for obesity in students in Manyara district.

Physical (in) activity:

Overweight and obesity have been associated with an increase in use of motorized transport, e.g. to and from school, replacing walking and cycling. There is a noteworthy fall in opportunities for recreational physical activity and increased sedentary recreation such as watching television and playing video games (20,21). Increased television viewing time, playing video games, and using the internet have been often cited as contributing factors to the increased prevalence of sedentary behaviour during leisure time and a decline in physical activity levels (21).

There is a significant shift in the activity patterns from outdoor play to indoor entertainment. An important factor in many developing countries including Tanzania is the lack of open spaces and playgrounds in schools and communities. Neighbourhoods are often considered unsafe for walking and other outdoor activities in these countries (7). This has also been shown in other areas like North America where particular individuals have increased risk of having low levels of physical activity. These include children who are from ethnic minorities (especially girls) in the pre-adolescent/adolescent age groups, children living in poverty, children with disabilities, children residing in apartments or public housing, and children living in neighbourhoods where outdoor physical activity is restricted by climate, safety concerns, or lack of facilities (10).

Dietary practices

Nutrition transitions have significantly contributed to overweight and obesity among children and adolescents. There is a growing tendency to consuming greater quantities and variety of energy dense foods, high in fat, sugar and salt, as well as rising levels of promotion and marketing of energy -dense foods, and increased frequency of eating occasions and use of soft drinks to replace water especially in schools (14). Children and adolescents are increasingly consuming foods high in saturated fat and refined carbohydrates, sweetened carbonated beverages, and diets low in polyunsaturated fatty acids and fibre (8). Nutrition transition is no longer a phenomenon in urban areas alone, even in rural Tanzania; an early stage of the nutrition transition is underway (22). There is lack of knowledge about adverse effects of unhealthy nutrition in schoolchildren (8)

Children who receive higher amounts of money to take to school were shown to have increased likelihood of being obese than those who do not. This is because these children are more likely to buy fast foods like chips, biscuits, cakes and sugary drinks whilst at school (11). There is good evidence that there is an inverse association between fruit/vegetable consumption and weight gain (16). Skipping breakfast or intake of a poor nutritional value breakfast is common among both children and adults. Recent systematic review of 16 studies from Europe has showed that eating breakfast is associated with a reduced risk of becoming overweight or obese and a reduction in the BMI in children and adolescent (21). Alcohol consumption and cigarette smoking have also been shown to contribute to overweight and obesity (23,24).

1.2.3. Effects of overweight and obesity

Although the effects of overweight and obesity are not in the scope of this study, it is important to establish why our society should be worried about increasing overweight and obesity prevalence. Whereas under -nutrition and communicable diseases were once the overriding health threats in developing countries, it is now estimated that non-communicable diseases, such as obesity-associated disorders, could be the cause of 7 out of every 10 deaths by 2020 (17) . Childhood obesity is associated with a higher chance of

obesity, premature death and disability in adulthood (1). Adolescent overweight and obesity is often associated with significantly lower health-related quality of life compared with their normal weight peers (14). These effects of overweight and obesity may be physical and/or psychological as explained below.

1.2.3.1. Physical effects

Excess body fat in children and adolescents increases the risk for the development of several non-communicable diseases including insulin resistance, type -2 diabetes mellitus and cardiovascular problems such as hypertension, ischaemic heart disease and stroke. Overweight and obesity are also said to increase the risk for different cancers, skeletal problems, non-alcoholic fatty liver disease, polycystic ovarian syndrome, and a variety of inflammatory conditions. Other conditions found in association with overweight and obesity in childhood and adolescence include the risk of developing asthma or an increase in the severity of existing asthma, obstructive sleep apnoea and early onset of puberty (6,25). Abnormalities in menstruation and early menarche represent part of the endocrine response to excess body weight in girls. Previous studies have established a relationship between obesity and lowered fertility but the impact of excess weight on menstrual problems in adolescence is less well established (8).

Gastro-esophageal reflux disease, presenting as chronic epigastric pain after meals, is found frequently in obese populations and improves after weight loss. It should be considered and treated whenever an overweight adolescent complains (26). Overweight children are at increased risk for a number of weight-related orthopaedic complications. Chronic excess weight can lead to a bowing of the tibia and femur, causing an overgrowth on the medial aspect of the proximal tibia metaphysis called Blount disease. Slipped capital femoral epiphysis can also result from excess weight and is considered an orthopaedic emergency. Finally, many overweight patients have degenerative disease of the spine, leading to discomfort and decreased mobility as a result of excess pressure on the lower spine from their body mass (27).

1.2.3.2. *Psychological effects*

Physical consequences notwithstanding, obesity can also lead to social and psychological problems. As early as five years of age, overweight or obese children display lower self-esteem (28). Obese adolescent females demonstrated significantly lower levels of self-esteem, which lead to sadness, loneliness, and high-risk behaviours, such as smoking or alcohol consumption (29). Stereotyping, discrimination and social rejection may also occur (30). These, in turn, may lead to withdrawal from physical activities with further aggravation of the weight problem. In a local study on urban school children living in Potchefstroom (South Africa), it was shown that overweight and obesity can significantly influence scholastic and athletic competency, physical self-concept and social acceptance (31). In addition to poor self-esteem and depression, childhood obesity is also linked with eating disorders like anorexia nervosa and bulimia (32).

The effects of childhood and adolescent obesity do not stop at physical and psychological outcomes; recent research indicates that childhood obesity may also affect cognition and therefore academic performance. (33). It has been shown that, there is a significant negative correlation between BMI and academic performance of both girls and boys. Normal weight adolescents showed better academic performance than their obese counterparts. The gap between obese and normal-weight girls' academic performance was much wider than what was found between obese and normal-weight boys, thus girls' weight status had a stronger association with academic performance as compared to boys (35,36)

1.2.3.3. *Economic implications*

Childhood and adolescent overweight has substantial economic consequences. Among youths aged 6-17 in United States of America, estimated hospital expenditures where obesity was a principal or secondary diagnosis equalled \$127 million in 2001. This represents a near threefold increase from \$35 million in 1979- 1981. Direct national medical expenditures for conditions attributable to obesity reached \$70 billion in 1995 and indirect costs totalled \$48 billion (36). Health services and individuals, especially in

developing countries including Tanzania, may not easily bear costs of non-communicable diseases, and the result could be a significant fall life expectancy (8). It was estimated that in 2005 chronic NCD cost the Tanzanian economy US\$ 100 million. This is expected to increase to US\$ 500 million a year by 2025 and will lead to an accumulated loss of income in Tanzania over this period of US\$ 2.5 billion (37). There is general lack of awareness among parents and adolescents on factors associated with overweight and obesity (38). Overweight and obesity, as well as their related non-communicable diseases and other outcomes, are largely preventable. Supportive interventions in making the healthier choice of foods and regular physical activity are needed (1). In Schools, addressing physical activity and nutrition through a Coordinated School Health Program (CSHP) approach is essential (39).

The food industry can play a significant role in promoting healthy diets by reducing the fat, sugar and salt content of processed foods; ensuring that healthy and nutritious choices are available and affordable to all consumers; most importantly, practicing responsible marketing especially those aimed at children and adolescents (1).

1.2.4. Different measurement of overweight/obesity

Various measures are used to assess overweight/obesity in children, ranging from clinical assessment, to skinfold thickness, weight-for-age, body mass index (BMI; kg/m²), waist-to-hip ratio and others. Although not a perfect indicator of body composition, BMI is the most generally used index, or indicator, of fat mass. Whereas adult BMI assessment is fairly straightforward, the BMI of children differs at different ages and gender. Overweight and obesity in children and adolescents are therefore usually expressed as BMI-for-age and sex. A number of internationally comparable reference sets for children and adolescents exist, such as those of the International Obesity Taskforce (IOTF), the Centre for Disease Control and Prevention (CDC) and the World Health Organization (WHO) (20). However, these charts have thus far been compiled without adequate normative values for the African and Asian continent (6). Other measures of adiposity have been studied, including skinfold-thickness measurements by callipers, electrical impedance techniques, waist circumference, dual-energy radiograph absorptiometry (DEXA), densitometry, and Magnetic Resonance Imaging (MRI). Although these have some utility in describing

visceral fat and body composition beyond a measure of BMI, few of them have paediatric norms, and some are expensive and not accessible on a routine basis; for these reasons, they are not used routinely (14).

1.3. Conceptual framework of the study

Adolescent overweight and obesity is a result of lifestyle factors such as poor dietary habits, tobacco and alcohol use, sedentary life style and lack of physical activity. There are other associated factors such as family size, number of siblings, parental socio-economic status and level of education, living in urban areas and female sex. The **Conceptual Framework** below illustrates the relationship between variables of particular interest for this study.

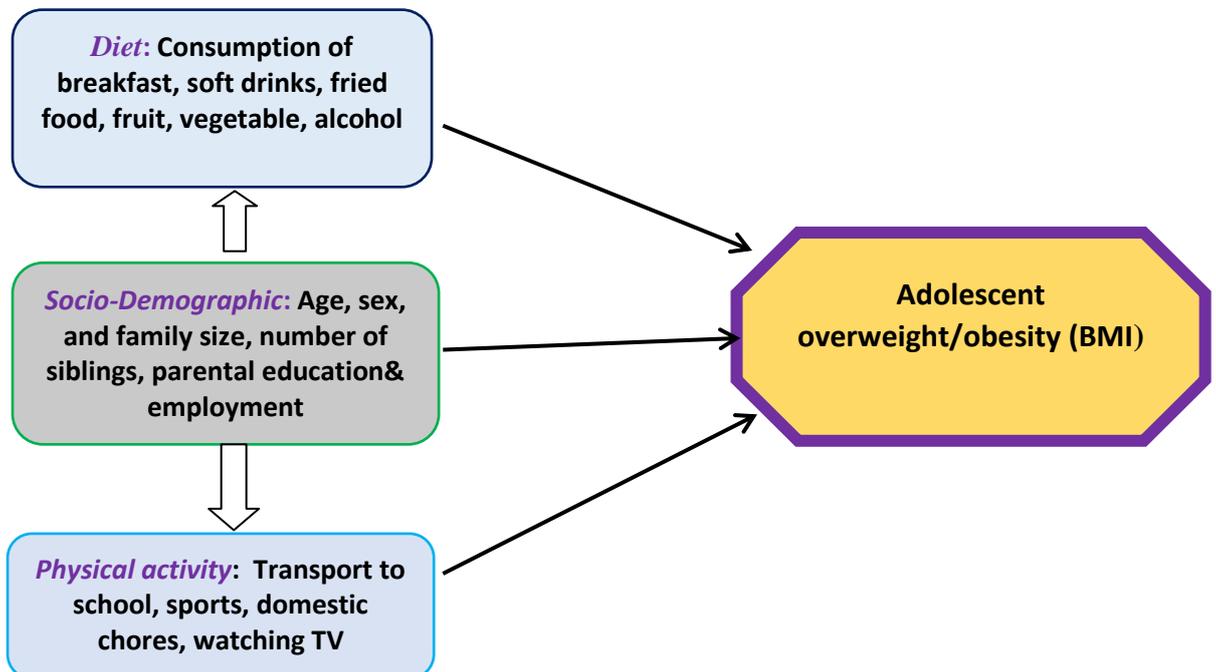


Figure 1. Conceptual framework of factors associated with adolescent overweight and obesity.

1.4. Statement of the problem

Overweight and obesity among children and adolescents in Tanzania is a public health problem with magnitude of overweight/obesity varying between 8.7% - 10.2%. Studies have shown that girls, private schools and urban areas are more affected. The variation observed in these few studies, and the concentration of the studies in urban areas, has led to a paucity of data on the overall distribution of obesity across other regions of Tanzania in particular rural districts.

Modifiable risk factors for obesity and overweight have been well documented in studies on childhood obesity in urban areas. These include lack of adequate physical activity, poor dietary habits, and alcohol and tobacco consumption. However, there is limited data on whether these factors affect children from rural Tanzania in the same way. This study therefore aims at establishing the magnitude of overweight/obesity in a rural setting of Tanzania, as well as to explore the relationship with known risk factors.

1.5. Rationale

Due to scarcity of data on magnitude and trends of overweight and obesity in children and adolescents in the country, public health specialists and policymakers in Tanzania are generally unaware of the magnitude of the problem (prevalence and associated factors of overweight and obesity) in Tanzanian children and adolescents.

This study will generate new knowledge on the burden of overweight and obesity in rural districts of Tanzania – Manyara being a case study. This information can be used by school administrations, local and national policy makers to develop strategies that can address it.

Our findings will also act as a point of departure for more research into NCDs and their risk factors in children and adolescents from a developing countries perspective.

1.6. Research Question

What is the burden of and factors associated with overweight and obesity among secondary school students in Babati district, Tanzania?

1.7. Research objectives

The **main objective** of this study was to estimate the burden of and factors associated with overweight and obesity in secondary school pupils in Babati district, Tanzania

Specific objectives

1. To estimate the prevalence of overweight and obesity among secondary school students in Babati district, Tanzania
2. To identify lifestyle factors associated with overweight and obesity among secondary school students in Babati district, Tanzania

CHAPTER TWO

2.0. MATERIALS AND METHODS

2.1. Study design

A descriptive cross-sectional study was employed. This study design was selected to enable calculation of prevalence. Cross-sectional studies can also be used to describe associations between an outcome and explanatory factors collected at the same time. However, this study design has an inherent weakness in its inability to determine temporal relationship (40).

2.2. Study area

Babati was purposively selected to represent semi-rural settings in Tanzania. The administrative capital of Babati district is also the administrative capital of Manyara Region. Manyara Region was formed from the former Arusha region in 2002. Babati town has developed from a mere village since Babati District was established in 1985. The new status boosted the town into rapid growth, mostly due to relatively new road network connecting Babati with Arusha, Dodoma and Singida Regions. Babati Town council covers an area of 460.86 km² (18) and has a total population of 93,108 out of which 47,313 are male 45,795 are female. On average the household size is 4.4. The town council comprises of 2 division, 8 wards and 13 villages (43).

Climatic conditions

The Town receives an average rainfall between 450mm and 1,200mm per year, with two rain seasons. The short season begins in October and ends in December while the long rain season starts in February and ends in May. It has an average temperature of 13° C during the cool and dry season (June to September), and an average of 33 ° C during rainy season (October to April) (42).

Economic activities

The main economic activities in Babati are agricultural production, livestock keeping and fishing. Peasant (small scale) farming is the main method for agriculture production. The major food crops and cash crops that are cultivated by small farmers (peasants) include

maize, beans, pigeon peas, sunflower, onions, garlic and finger millet. Other activities include small to medium scale businesses and formal employment (42).

2.3. Study population

The study population included all adolescents attending private or public, day or boarding schools in selected secondary schools in Babati Town Council, in Manyara region. This study population was selected because majority of the pupils who are in secondary schools in Tanzania fall within the World Health Organization (WHO) age range for adolescents (10-19 years).

2.3. Sample size and sampling procedure

2.3.1. Sample size

Sample size (n) of 602 was calculated using a formula for estimation of a proportion in a finite population (41) assuming a 10% non-response rate.

$n = \frac{g * N Z^2 P (1-P)}{\epsilon^2 (N-1) + Z^2 P (1-P)}$	$N_2 = n * 1/RR$
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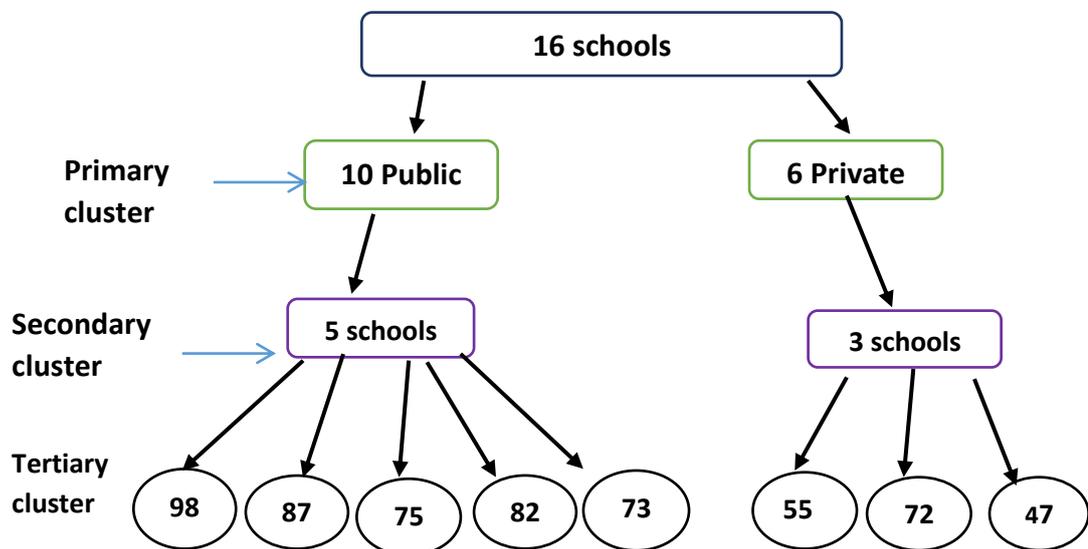
Where; Design effect (g) = 1.5,
 Study population (N) =6000,
 Expected prevalence (P) =10% (9).
 Margin of error (ε) =3%,
 Z=1.96 (for 95% confidence level) and
 Response Rate = 90%

Open Epi, open source calculator (Version 3.01; Updated in April, 2013) was used for calculations. A design effect (g) was included as the study employed a cluster sampling strategy.

2.3.2. Sampling procedure

A **multi-stage cluster sampling procedure** was used to obtain study units. The sampling frame consisted of all secondary schools in Babati. There are a total of 16 schools in Babati town council, of these 10 are public and 6 are private. A flow chart illustrating the sampling strategy is shown below. A private or public school was considered as the primary cluster, all private schools are boarding and all public schools are day. Fifty percent (50%) of the schools in each cluster were randomly selected. Probability proportion to size was used to estimate the number of students to be recruited from each school.

From each participating school, depending on class size, two streams or a whole form that approximated the required sample for that school was randomly selected. In each school. All students in these streams or form participated in the study. Probability proportional to size sampling was used to estimate the sample size in each school.



2.4. Eligibility criteria

Inclusion criteria

- Students who have been residents of Babati for at least 6 months,
- Students who assent to participate in the study,
- Students whose parents/guardians consent to participation for day schools and teachers/administration for boarding schools.

Exclusion criteria

- Students with physical deformities prohibiting accurate height measurements
- Students absent from class on the day of data collection

2.5. Data collection procedure and study variables

2.5.1. Data collection Procedure

Selected students who assented to participate in the study were given consent forms to take to their parents / guardians. Only students, with parents' consent, were finally included in the study. For boarding school students, consent was sought from their respective Headmasters. Questionnaires were self-administered, mimicking an exam setting, with all participants in the same room. The research assistant read and explained how to answer the questions in front of the class and the students answered one question after another. Each school also provided at least one teacher to assist in supervision. The investigator was responsible for taking anthropometric measurements of all study units. Students were called to the front of the room for measurements one at a time.

2.5.2. Data collection technique

Data was collected using a questionnaire containing closed and open -ended questions. The questionnaire was developed in English, translated in Kiswahili and back translated into English to ensure the meaning was not lost. The questionnaire was piloted on 20 secondary school children from a school that was not included in the study before the commencement of actual data collection. Modifications were made accordingly. The adjustments had no

effect on the psychometric properties of the tool. Socio-demographic, anthropometric and lifestyle risk factors information was enquired from participating students. Age was recorded in years and months and rounded to the nearest half year. This information was verified using school records, where applicable.

2.5.3. Anthropometric measurements

Bathroom digital weighing scales (Omron, Japan) were used to measure **weight**. Students were weighed minimally dressed by requesting them to remove excess clothing (e.g. sweaters), as well as their shoes. Weight measurements were recorded in kilograms and rounded to the nearest decimal place. **Height** (m) was measured using a Shorr height board; students were measured with their shoes off. Study participants stood in front of the height board placed on a flat floor with heels, buttocks, shoulders and back of the head touching the wall. Two measurements were taken and the average was recorded to the nearest 0.1cm.

2.5.4. Categorization of overweight/ obesity using BMI

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his/her height in meters (kg/m^2) (1). However, it is difficult to develop one simple index for the measurement of overweight and obesity in children and adolescents because their bodies undergo a number of physiological changes as they grow. Depending on the age, different methods to measure a body's healthy weight are available (45). In this study, the International Obesity Task Force (IOTF) criteria were used. The IOTF proposed a set of BMI cut off points for children based on pooled data collected by surveys of children in Brazil, Britain, Hong Kong, Singapore, Netherlands and the United States of America (44). Subsequently the IOTF published BMI cut-points for defining overweight and obesity in children between 2 and 18 years in 2000. The cut off points can be extrapolated to the widely accepted definitions for adult overweight and obesity; a BMI ≥ 25 and a BMI ≥ 30 , respectively and enables global comparison (44).

Overweight and obesity in children and adolescents are therefore usually expressed as BMI-for-age and -sex. A number of internationally comparable reference sets for children and adolescents exist, besides those of the International Obesity Task Force (IOTF). These

include the Centres for Disease Control and Prevention (CDC) and the World Health Organization (WHO). However, these charts have thus far been compiled without adequate normative values for the African and Asian continents (6).

2.5.5. Assessment of dietary pattern

Guidelines for Measuring Household and Individual Dietary Diversity by the United Nations Food and Agriculture Organization (FAO) of 2011 were used to assess dietary patterns. This guideline has been modified to suit the needs of this study. Only a few selected food groups were included in the study.

2.5.6. Assessment of physical activity

A modified WHO STEPwise approach to chronic disease risk factor surveillance (STEPS) Instrument version 2 was used. This is an easy tool developed and recommended by the WHO. Some questions were also adapted from the International Physical activity Questionnaire (IPAQ), although there were no specific questions for this population (adolescents).

2.6. Key Variables

The **dependent** variable in this study is overweight and/or obesity obtained from BMI categorization. This is a dichotomous variable where if overweight/obese = 1 and else (underweight/normal weight) = 0.

The **explanatory** variables assessed were:

- ***Socio-demographic factors*** –sex (male, female), household size and number of siblings (numerical-discrete); parent/guardian level of education and employment (categorical)
- ***Dietary practices***- breakfast consumption, type of food purchased at school, consumption of soft drinks, alcohol, snacks, fried foods, fruits, and vegetables. All these are categorical variables measured on a nominal scale. Dietary practice was summarized into a composite variable where consumption of vegetables, fruits and breakfast at least three times per week and consumption of fried foods and soft drinks less than three times per week was considered as a healthy diet. Any other dietary pattern was considered unhealthy.

- **Physical activity**- participation in sports, involvement in doing different activities at schools/home e.g. gardening, transport to and from school were assessed on a nominal scale. A composite score of all listed activities was created. Physical activity was then categorized into mild, moderate and vigorous physical activity.
 - Mild physical activity – Does not walk to or from school, did not participate in sport and at least one day of chores per week.
 - Moderate- Walks to or from school for less than an hour, participates in sports at least once a week, and does chores at least three days per week.
 - Vigorous- Walk to or from school for more than an hour, participates in sport more than three times a week, and does chores at least three days a week.
- **Sedentary time** is categorised as:
 - Sedentary- 15 or more hours of watching television or playing video games per week.
 - Non-sedentary- less than 15 hours of television watching or video game playing per week

2.7. Data Management

2.7.1. Data quality

Data was checked daily for missing -ness and inappropriate entries. Questionnaires with problems were returned to the field to be corrected before leaving the school.

2.7.2. Data entry and processing

A codebook was prepared where codes were assigned to all categorical variables. The codebook was used to identify the names of variables and to which question they belong to. Database structure was developed so as to store data for subsequent analysis. Data processing was done using Statistical Package for Social Sciences (SPSS) software version 20.0. Descriptive statistics were run to ensure data cleanliness.

2.7.3. Data analysis

Data was summarized using descriptive statistics. Contingency tables were drawn and Chi-square test used to conduct statistical test for categorical data. Multivariable logistic regression models were used to control for potential confounders and correlation of data. Odds ratio and their 95% confidence interval are presented. P-value of <0.05 was used to assess statistical significance.

2.8. Study limitations and mitigations

- In this study, multistage cluster sampling procedure was used. From all the different type of probability sampling, this technique is the least representative of the population. There is a tendency of individuals within a cluster to have similar characteristics and therefore a possibility of high sampling error. The limited clusters included in the sample leave off a significant proportion of the population un-sampled. Higher sampling error has been addressed by adjusting for design effect. And regression techniques that account for correlation of data hence adjusting the standard errors were used in the data analysis.
- Recall bias may have affected the participant's ability to remember types of snacks consumed or time spent on physical activity or sedentary time. Participants were asked to recall only events that took place in the past week to minimize recall bias.
- Measurement error may also have affected the study results. However, Use of standard procedures to assess anthropometric indices may have minimized measurement errors. In addition, calibration of the weighing scale was done daily.

2.9. Ethical Considerations

2.9.1. Ethical clearance

Ethical clearance to conduct the study was sought and obtained from the Muhimbili University of Health and Allied Sciences (MUHAS), Research and Publication Ethical Committee.

2.9.2. Consent

Written consent to take measurements and interview students below the age of 18 years was sought from school authority and parents/guardians. Students above 18 years of age signed consent forms on their own. Student's assent was sought for all participants below 18 years of age.

2.9.3. Confidentiality

Unique identification numbers was used to identify students involved in the study to ensure anonymity. Students were not required to give or write their names during data collection. This anonymity was explained to teachers, parents/guardians and students in the informed consent forms provided to them.

CHAPTER THREE

3.0. RESULTS

3.1. General characteristics of the study population

A total of 619 students from 8 (5 public and 3 private) randomly selected secondary schools in Babati were included in the study. Table 1 summarises the general characteristics of the study participants. The mean age and BMI of the participants was 16.7 ± 1.68 years (age range 12-19 years) and 19.9 ± 3.16 kg/m², respectively. A majority of the participants 528 (85.4%), were between the age of 15 and 19 years and 91 (14.6%) were between 10 and 14 years. Three hundred fifty-four (354; 57.2%) of the participants were female. The mean household size was 6.08 ± 1.37 with five hundred and thirty four (86.3%) of the students coming from households with more than 4 family members. The mean number of sibling was 3.11 ± 1.41 with about 524 (84.7%) reporting having less than or equal to 4 siblings (including themselves) and 95 (15.3%) had more than four siblings. Just over a half of students 339 (54.8%) reported the level of education of their fathers to be secondary education and above compared to 235 (38%) of their mothers. The majority of fathers were either in farming (31.9%) or business (37.6%) while 27.2% of mothers were farmers and 29.3% housewives. Only 4 students (0.6%), all male reported using tobacco products and alcohol.

Table 1: General characteristics of the study population (n=619)

Variable	Description	Frequency (%)
Age (years)	Mean (SD)	16.7 (1.68)
	10-14	91 (14.6)
	15-19	528 (85.4)
Sex	Female	354 (57.2)
	Male	265 (42.8)
BMI (kg/m²)	Mean (SD)	19.9 (3.16)
School type	Government	385 (62.2)
	Private	234 (37.8)
Number of siblings		3.11±1.41
	≤ 4	524 (84.7)
	> 4	95 (15.3)
Number of people living in a household		6.08±1.37
	≤ 4	85 (13.7)
	>4	534 (86.3)
Father's level of education	Secondary and above	339 (54.8)
	Primary and below	280 (45.2)
Mother's level of education	Secondary and above	235 (38.0)
	Primary and below	384 (62.0)
Fathers occupation	Government	115 (18.5)
	Private sector	65 (10.5)
	Farmer	197 (31.9)
	Business	232 (37.6)
Mothers occupation	Government	76 (12.3)
	Private sector	37 (6.0)
	Farmer	168 (27.2)
	Business	155 (25.1)
	Housewife	181 (29.3)
Alcohol use	Yes	4(0.6%)
	No	534(99.4%)
Tobacco use	Yes	4(0.6%)
	No	534(99.4%)

3.2. Prevalence of overweight and obesity

Although overweight and obesity for adolescents have different IOTF cut off points, the analysis combined these because risk factors are the same; obesity is a progression of overweight. Table 2 summarise the prevalence of overweight and obesity according to different population characteristics. Out of 619 students who participated in the study, 80 (13.0%) were either overweight or obese. The prevalence of overweight/obesity was higher in female students (19.2%) compared to male students (4.5%). This difference was statistically significant ($P < 0.001$). The proportion of students who were overweight/obese in the 10-14 age groups was slightly higher than of the 15-19 age groups (14.4% vs. 12.7%; $P=0.652$). More private school students were categorized as overweight (15.4%) compared to 11.4% in public school students, with no statistical significance ($P=0.156$). The prevalence of overweight/obesity in relation to maternal level of education was significantly associated with overweight/obesity of the student. Students who reported their Mother's level of education was secondary school or above were more likely to be categorized as overweight/obese than those who reported primary school (17.4% vs. 7.6%; $P=0.009$). Paternal level of education had a borderline association with overweight/obesity ($P=0.085$). The proportion of overweight/obese students was higher in students whose fathers were farmers (17.8%) and mothers in private sector (21.6 %) ($p= 0.037$).

Table 2: Prevalence of overweight and obesity

Variable/category		n	Overweight/obese (%)	Others (%)	P value
Sex	Female	354	68 (19.2)	286 (80.8)	< 0.001
	Male	265	12 (4.5)	253 (95.5)	
Age group	10-14	91	13 (14.4)	77 (85.6)	0.652
	15-19	528	67 (12.7)	462 (87.3)	
School type	Public	385	44 (11.4)	341 (88.6)	0.156
	Private	234	36 (15.4)	198 (84.6)	
Siblings	≤ 4	524	72 (13.7)	452 (86.3)	0.160
	> 4	95	8 (8.4)	87 (91.6)	
Family size	≤ 4	85	10 (11.8)	75 (88.2)	0.732
	>4	534	70 (13.1)	464 (86.9)	
Father's education	Secondary/above	339	51 (15.1)	288 (84.9)	0.085
	Primary/below	280	29 (10.0)	251 (90.0)	
Mother's education	Secondary/above	235	41 (17.4)	194 (82.6)	0.009
	Primary/below	384	29 (7.6)	251 (92.4)	
Father's occupation	Government	115	17 (14.8)	97 (85.2)	0.033
	Private sector	65	10 (15.4)	55 (84.6)	
	Farmer	197	35 (17.8)	163 (82.2)	
	Business	232	18 (7.8)	214 (92.2)	
Mother's occupation	Government	76	14 (18.4)	194 (87.6)	0.037
	Private sector	37	8 (21.6)	29 (78.4)	
	Farmer	168	22 (13.1)	146 (86.9)	
	Business	155	16 (10.3)	139 (89.7)	
	Housewife	181	20 (11.1)	161 (88.9)	

3.3. Lifestyle factors associated with overweight and obesity.

Associations between dietary habits, being given pocket money, amount of pocket money, physical activity and sedentary time, and overweight/obesity are summarised in Table 3. Dietary habits and being given pocket money was significantly associated with a student being categorized as overweight/obese. A higher proportion of students who had consumed an unhealthy diet (18.6%) were categorized as overweight/obese as students who consumed a healthy diet (10.8%; $p=0.012$). Students who were given pocket money were more likely to be overweight/obese than those who were not given any pocket money. (17.2% vs. 8.2%; $P=0.001$). The amount given for pocket money, physical activity levels and sedentary time showed no significant associations with overweight/obesity in the study.

Table 3: Association overweight/obesity and diet and physical (in) activity

Variable	N	Overweight/ obesity (%)	Others (%)	P value
Diet				
Unhealthy	167	31 (18.6)	136 (81.4)	0.012
Healthy	452	49 (10.8)	408 (89.2)	
Pocket Money				
No	294	24 (8.2)	269 (82.8)	0.001
Yes	325	56 (17.2)	270 (91.8)	
Amount of pocket money (Tsh.)				
<50,000	276	47 (17.0)	41 (82.8)	0.867
≥50000	50	9 (18.0)	229 (83.0)	
Physical activity				
Mild	203	24 (11.8)	179 (88.2)	0.186
Moderate	331	40 (12.1)	291 (87.9)	
Vigorous	85	16 (18.8)	69 (81.2)	
Sedentary time				
Non-sedentary	270	42 (15.6)	72 (99.8)	0.435
Sedentary	89	17 (19.1)	228 (84.4)	

Further analysis with Logistic regression to adjust for cofounders was done. Table 4 shows factors which were significant after adjusting for age group (10-14, 15-19), sex, parental level of education and occupation. Other factors adjusted for were family size, number of siblings and type of school (public or private). In this analysis, sex was found to have a significant association, with female students 6 times more likely to be overweight/obese compared to male students. Mother's level of education, and parental occupation were also found to have association with overweight/obesity. A healthy diet was found to be statistically protective against overweight/obesity. Pocket money was also an independent predictor of overweight/obesity.

Table 4: Factors that were found to have significant association with overweight /obesity after Logistic regression analysis

Variable	Unadjusted OR [95% CI]	Adjusted OR [95% CI]	P value
Sex			
Male			
Female	5.01 [2.67-9.47]	6.14 [2.65-14.33]	<0.001
Mother's education			
Secondary/above			
Primary/below	1.87 [1.17-2.99]	1.52 [0.73-3.15]	0.009
Mother's occupation			
Government			
Private sector			
Farmer			
Business			
Housewife	1.20[1.01-1.43]	1.02[0.79-1.26]	0.037
Father's occupation			
Government			
Private sector			
Farmer			
Business	1.25[1.02-1.52]	1.19[0.89-1.61]	0.033
Given Pocket money			
No			
Yes	2.34[1.41-3.89]	1.86[1.02-3.36]	0.001
Diet			
Unhealthy			
Healthy	1.86[1.15-3.06]	2.02[1.08-3.76]	0.012

CHAPTER FOUR

4.0. DISCUSSION

4.1. Summary of key findings

The main objective of this study was to determine the prevalence of overweight and obesity, and associated factors among secondary school students in Babati, Tanzania. The overall prevalence of overweight/obesity was 13%. Sex, dietary habits, maternal level of education, parental occupation and whether a student was given pocket money or not, were significantly associated with overweight and obesity.

4.2. Main discussion

Concern about the health risks associated with rising obesity has become nearly universal; member states of WHO introduced a voluntary target to halt the rise in obesity by 2025 and widespread calls have been made for regular monitoring of changes in the prevalence of overweight and obesity in all populations (3). The rising prevalence of childhood overweight and obesity is a serious public health problem given its established link to chronic health problems during childhood and adulthood (1,2,6). This study revealed that 13% of students are either overweight or obese. This is of concern as overweight/obesity in adolescence is likely to continue into adulthood, therefore increasing the risk of NCDs. These results are comparable to the prevalence of overweight and obesity among primary school children in Kinondoni Dar es Salaam (12,13). Similar findings have also been reported in other countries in the African Continent (6,48). Our findings are slightly higher than what has been observed in other East African countries like Uganda (23).

As in other studies, there was a differential sex distribution in the prevalence of overweight/obesity, where girls had a higher prevalence than boys (3). This is however, not the case in countries like United States of America where the prevalence of overweight/obesity in boys is 28.8% and 29.7% for girls (3). The observed difference could be attributed to lifestyle differences for children in North America and developing countries like Tanzania, Uganda and Kenya. Female gender has been established to be a risk factor of overweight/obesity in Tanzania and other parts of Africa (6,8,13). Overweight and obesity in adolescent girls has been linked to the time of menarche.

Factors suggested to play a role in this gender disparity include possible differences in the energy needs between boys and girls, in the levels of physical activity, in behavioural or cultural phenomena and in the timing of sexual maturation (6).

This study has shown no association between overweight/obesity and school type (private, public) unlike other studies done in Kinondoni (12,13), and Dodoma (13), which showed increased risk in private students than their peers in public schools. This may be due to lack of large difference in socio-economic status between families with students in public and those in private schools, unlike what was observed in Dar es Salaam. Parental characteristics, occupation and mother's level of education were found to be statistically associated with overweight/obesity status of a student. This is similar to what has been shown in other studies (13), which have looked at the association between socio-economic characteristics and overweight and obesity. Some studies have established increased risk of being overweight or obese and number of sibling (12,42), however this was not the case in this study. This may be explained by large household sizes in this population regardless of number of siblings. In the sampled population 82% of students reported to come from households with more than 4 members.

We observed no association between increased level of physical activity and overweight/obesity. Sedentary lifestyle measured by time spent watching television in a week, was not associated with overweight or obesity. Most of the students studied, watched television for an average of 2 hours a day, coupled by at least mild physical activity every day.. Studies done in other areas have established increased risk, (12,20,21).

Unhealthy dietary habits are a major a risk factor for overweight and obesity (8,14,24). In this study students who consumed an un-healthy diet had twice as much risk of being overweight/obese (OR=). This has also been shown in other studies (11-13). Alcohol consumption and tobacco use have also been shown to contribute to overweight and obesity (23,24). However, in this study the prevalence of alcohol and cigarette/tobacco consumption was low. This may be a result of under reporting as both alcohol and cigarette consumptions in school can lead to expulsion. This may have been exacerbated by the presence of teachers during data collection.

Interpretation of our findings must be done with caution, due to some study limitations. The use of a cross-sectional study design precludes statements of cause and effect. This becomes especially limiting when interpreting associations that could have two legitimate pathways such as the reverse association between obesity and participation in sports. Overweight or obese students may find it difficult to perform in sport due to their limiting weights or associated stigma. Another limitation is that puberty and genetic factors that could have an effect on obesity were not assessed. However, age was adjusted for in our regression models, and may have minimized the confounding effect of fat deposition during puberty.

The reported dietary and physical activity tools were not validated for use in our setting. A pre-test was done to assess the face-validity of the tool with good response, hence an indication that the tool may have been valid in its assessment of self-reported dietary and level of physical activity. In addition, though questions were designed to be age appropriate and have a short recall period, we cannot rule out the possibility of recall bias. The research assistant read to the students all questions and all students simultaneously answered one question after another with clarifications were necessary.

There was a differential under-reporting of alcohol and/or tobacco consumption by the respondents. This social desirability bias was introduced by the presence of an assigned teacher in the classroom during data collection.

CHAPTER FIVE

5.0. CONCLUSION AND RECOMMENDATIONS

5.1. CONCLUSION

In conclusion, the prevalence of overweight and obesity in Babati is modest amongst secondary school students. The prevalence was significantly higher in female students than their male counterparts. Un-healthy diet, maternal level of education, and parental occupation were significantly associated with overweight and obesity.

5.2. RECOMMENDATIONS

1. The prevalence of overweight/obesity was modest but may increase in the future. There is a need to develop evidence-based interventions in this age group in both rural and urban settings.
2. More research to confirm and establish other determinants of overweight and obesity, not covered in this study among adolescents need to be explored.
3. Further studies with more representative sample of adolescents in the country are needed to establish if overweight/obesity is generalized.

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APPENDICES

Appendix 1: Questionnaire – English Version**SURVEY ON PREVALENCE AND FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY AMONG SECONDARY SCHOOL PUPILS IN BABATI, MANYARA**

Questionnaire number:

Name of school:

Type of School: A. 1.Day.....2.Boarding.....

B. 1. Public 2. Private

Date of interview:

Please answer all the questions.

A: SOCIAL AND DEMOGRAPHIC CHARACTERISTICS

1. Age
 - a. How old are you? complete years
 - b. What is your birth date?/...../.....
2. Sex (*Please check only one*)
 - 2.1 Female
 - 2.2 Male
3. What is the highest level of education that your father has completed? (*Please tick only one*)
 - 3.1 Post-secondary education / college
 - 3.2 Secondary education
 - 3.3 Primary education.....
 - 3.4 No formal education
 - 3.5 I don't know

4. What is the highest level of education that your mother has completed? (*Please tick only one*)

4.1 Post-secondary education / college

4.2 Secondary education

4.3 Primary education

4.4 No formal education

4.5 I don't know

5. What is your father's occupation? (*Please tick*)

5.1 Government employee

5.2 Private sector employee

5.3 Farmer

5.4 Business

5.5 Others.....

6. What is your mother's occupation? (*Please tick*)

6.1 Government employee

6.2 Private sector employee

6.3 Farmer

6.4 Housewife

6.5 Business

6.6 Others

7. What is the total number of individuals living in your household including parents?

(Please choose one only)

7.1 Less than 5

7.2 Between 5 and 7

7.3 More than 7

8. How many siblings do you have? *(Please choose one only)*

8.1 2 or less

8.2 Between 3 and 5

8.3 More than 5

B: PHYSICAL ACTIVITY INFORMATION

9. How do you usually commute to and from school? *(Please choose one only)*

9.1 I usually walk

9.2 I usually cycle

9.3 I use public transport

9.4 I use private transport/ school bus

10. If you walk, how much time do you usually spend every day? Minutes

11. If you cycle to school, how much time do you usually spend every day? Minutes

12. Are there any sport activities at your school?

12.1 Yes

12.2 No

13. If yes, do you participate in any of these? *(Please tick where applicable)*

Sport	Participated days in the past week		
	4 or more	1-3	never
13.1 Football			
13.2 Netball			
13.3 Basketball			
13.4 Swimming			
13.5 Running			

13.6 Others (Specify).....

14. Do you have a television set at home? *(Please choose one)*

14.1 Yes

14.2 No

15. If yes, on average how many times per week do you watch television?

15.1 Monday to Friday.....Hours/day

15.2 Saturday and Sunday.....Hours/day

16. What other activities, do you usually perform while at home or school?

Activity	How many times in the past week
16. 1 Cleaning	
16.2 Laundry	
16.3 Gardening	
16.4 Farm work	
16.5 I don't do anything	
16.6 Others (specify)	

C. DIETARY INFORMATION

17. Are you usually given money to take to school?

17.1 Yes

17.2 No

18. If yes, how much money were you given last term per term? Tsh.

19. How do you use the money you have been given?

19.1 To buy food/drinks

19.2 To buy books/stationary.....

19.3 Others (specify).....

20. If you usually buy food/drinks what type do you buy? (*Please tick where applicable*)

Food/drink	How many times in the past week			
	7 or more	4-6	3 or less	Never
20.1 Biscuits				
20.2 Cakes/vitumbua/ maandazi				
20.3 French fries				
20.4 Fried/roasted meat				
20.5 Soda				
20.6 Fruit juice drink				
20.7 Sweets/chocolate				
20.8 Others (specify)				

21. Are you given lunch at school?

21.1 Yes

21.2 No.....

22. If yes, what type of lunch are you usually given at school?

23. Do you usually take breakfast?

23.1 Yes

23.2 No

24. If yes, in the past week how many days did you take breakfast?

24.1 Every day

24.2 1 to 3 days

24.3 4 to 6 days

25. What do you usually eat for breakfast?

26. In the past week did you eat the following food items? (*Please tick where applicable*)

Food item	How many times in the past week			
	7 or more	4-6	1-3	Never
26.1 Fruit				
26.2 Vegetables				
26.3 Fried meat				
26.4 French fries				
26.5 Soda				

27. Do you smoke cigarettes or use tobacco

27.1 Yes

27.2 No

28. If yes, how sticks many did you smoke in the past week?

29. Do you take alcohol?

29.1 Yes

29.2No.....

30. If yes, how may time in the past week did you drink alcohol.....

E: ANTHROPOMETRIC MEASUREMENTS

33. Waist circumference in cm:

34. Height in m:

34.1.1 First reading

34.2 Second reading.....

34.3 Average

35. Weight in Kg:

Interviewer observation.....

Appendix II: Questionnaire – Kiswahili Version

DODOSO LA KUTATHMINI UKUBWA WA TATIZO LA UZITO WA KUPINDUKIA NA SABABU ZINAZOSABABISHA TATIZO HILO KWA WATOTO WA WANAOSOMA SHULE ZA SEKONDARI, BABATI MKOANI MANYARA

Namba ya dodoso:

Jina la shule:

Umiliki wa shule: A. 1.Serekali 2 Binafsi.....

B. 1.Kutwa 2. Bweni

Tarehe ya usaili:

A: TAARIFA BINAFSI

1. Umri

1.1 Je, unamiaka mingapi?(kamili)

1.2 Je ulizaliwa lini?/...../.....

2. Jinsia

2.1 Mwanamume

2.2 Mwanamke

3. Baba yako ana kiwango gani cha juu cha elimu? (chagua moja)

3.1 Elimu baada ya masomo ya sekondari

3.2 Elimu ya sekondari

3.3 Elimu ya msingi

3.4 Hajasoma

3.5 Sijui

4. Mama yako ana kiwango gani cha juu cha elimu? (chagua moja)
 - 4.1 Elimu baada ya masomo ya sekondari
 - 4.2 Elimu ya sekondari
 - 4.3 Elimu ya msingi
 - 4.4 Hajasoma
 - 4.5 Sijui

5. Baba yako anafanya kazi gani?
 - 5.1 Amejiriwa serikaliki
 - 5.2 Amejiriwa katika makampuni binafsi
 - 5.3 Anafanya biashara ndogo ndogo
 - 5.4 Mkulima
 - 5.5 Nyinginezo (taja).....
 - 5.6 Sijui

6. Mama yako anafanya kazi gani?
 - 6.1 Amejiriwa serikaliki
 - 6.2 Amejiriwa katika makampuni binafsi.....
 - 6.3 Anafanya biashara ndogo ngodo
 - 6.4 Mkulima.....
 - 6.5 Mama wa nyumbani.....
 - 6.6 Nyinginezo (taja).....
 - 6.7 Sijui

7. Nyumbani kwenu kunaishi watu wangapi, (pamoja na wazazi)?
 - 7.1 Chini ya watano.....
 - 7.2 Kati ya watano na saba.....
 - 7.3 Zaidi ya saba.....

8. Je, una kaka na dada wangapi?

8.1 1-2.....

8.2 3-4.....

8.3 Watano au Zaidi.....

B: UTATHIMINI WA MAZOEZI YA MWILI

9 Je huwa unakwendaje na kurudi kutoka shuleni

9.1 Natembea kwa miguu.....

9.2 Naenda kwa baisikeli

9.3 Natumia usafiri wa jumla kama daladala, bajaji.....

9.4 Natumia usafiri binafsi/basi la shule.....

10 Kama unatembea, je unatumia dakika ngapi kwa siku? Dakika.....

11 Kama unaendesha baiskeli, je unatumia dakika ngapi kwa siku? Dakika

12 Je shule yako inautaratibu wa kuwa na michezo?

12.1 Ndiyo.....

12.2 Hapana.....

13 Kama ndiyo, wewe unashiriki mchezo wowote kati ya hii?

Mchezo	Mara ngapi katika wiki?		
	4 au Zaidi	1-3	never
13.1 Mpira wa miguu			
13.2 Netiboli			
13.3 Mpira wa kikapu			
13.4 Kuongelea			
13.5 Riadha			

13.6 Mgingineyo (taja).....

14. Je, nyumbani kwenu mna luninga?

14.1 Ndiyo

14.2 Hapana.....

15. Kwa wastani unanaangalia luninga masaa mangapi?

15.1 Jumatatu hadi Ijumaa, masaa..... kwa siku

15.2 Jumamosi na Jumapili, masaakwa siku

16 Je, huwa unafanya shughuli gani nyingine ukiwa shuleni au nyumbani?

Shughuli	Marangapi kwa wiki
16.1 Usafi	
16.2 Kufua	
16.3 Kazi za bustani	
16.4 Kazi za shamba	
16.5 Sifanyi kazi yoyote	
16.6 Nyingine (zitaje)	

C. UTATHMINI WA MAZOEA YA CHAKULA

17. Je, huwa unapewa hela unapoenda shuleni?

17.1 Ndiyo

17.2 Hapana.....

18. Kama ndiyo, huwa unapewa shilingi ngapi kwa muhula? Shilingi

19. Unatumiaje hela unazopewa?

19.1 Kununua vyakula/vinywaji.....

19.2 Kununua vitabu,kalamu.....

19.3 Vingenevyo (taja)

20 Kama huwa unananunua vyakula/vinywaji, unanunua vipi?

Vyakula/vinywaji	Mara ngapi kwa wiki			
	7 au zaidi	4-6	Chini ya 3	sinunui
20.1 Biskuti				
20.2 keki/vitumbua/ maandazi				
20.3 Chipsi				
20.4 Nyama za kuchoma/kukaanga				
20.5 Soda				
20.6 Juisi ya matunda				
20.7 Pipi/ chokoleti				
20.8 Vinginevyo (taja)				

21. Huwa mnapewa chakula cha mchana shuleni? Are you given lunch at school?

21.1 Ndiyo.....

21.2 Hapana.....

22 Kama ndiyo, mnakula vyakula gani?

23 Huwa unakula kifunguakinya?

23.1 Ndiyo

23.2 Hapana.....

24 Kama ndiyo ni mara ngapi kwa wiki?

24.1 Kila siku.....

24.2 Siku4-6.....

24.3 Siku 1-3.....

25 Huwa unakula vyakula kani kufungua kinywa?

26. Katika juma lililopita, je umekula vyakula hivi?

Vyakula/ vinywaji	Mara ngapi kwa			
	7 au zaidi	4-6	1-3	Hapana
26.1 Matunda				
26.2 Mboga za majani				
26.3 Nyama za kukaanga				
26.4 Chipsi				
26.5 Soda				

27. Unavuta sigara au kutumia umbaku?

27.1 Ndiyo

27.2 Hapana.....

28. Kama ndiyo, unavuta sigara ngapi kwa wiki?

29. Je unakunywa pombe?

29.1 Ndiyo.....

29.2 Hapana.....

30. Kama ndiyo, unakunywa mara ngapi kwa juma?

D: VIPIMO VYA KUTATHMINI UKUAJI

33. Kiuno cm

34. Urefu katika m:

34.1 Kipimo cha kwanzam

34.2 Kipimo cha pilim

35. Uzito katika Kg:

Maoni ya msaili.....

Appendix III: IOTF – recommended cut off points for overweight and obesity by gender and by age from 2 to 18 years

Age in years	Overweight cut off points		Obesity cut off points	
	Males	Females	Males	Females
2	18.4	18.0	20.1	20.1
2.5	18.1	17.8	19.8	19.5
3	17.9	17.6	19.6	19.4
3.5	17.7	17.4	19.4	19.2
4	17.6	17.3	19.3	19.1
4.5	17.5	17.2	19.3	19.1
5	17.4	17.1	19.3	19.2
5.5	17.5	17.2	19.5	19.3
6	17.6	17.3	19.8	19.7
6.5	17.7	17.5	20.2	20.1
7	17.9	17.8	20.6	20.5
7.5	18.2	18.0	21.1	21.0
8	18.4	18.3	21.6	21.6
8.5	18.8	18.7	22.2	22.2
9	19.1	19.1	22.8	22.8
9.5	19.5	19.5	23.4	23.5
10	19.8	19.9	24.0	24.1
10.5	20.2	20.3	24.6	24.8
11	20.6	20.7	25.1	25.4
11.5	20.9	21.2	25.6	26.1
12	21.2	21.7	26.0	26.7
12.5	21.6	22.1	26.4	27.2
13	21.9	22.6	26.8	27.8
13.5	22.3	23.0	27.2	28.2
14	22.6	23.3	27.6	28.6
14.5	23.0	23.7	28.0	28.9
15	23.3	23.9	28.3	29.1
15.5	23.6	24.2	28.6	29.3
16	23.9	24.4	28.9	29.4
16.5	24.2	24.5	29.1	29.6
17	24.5	24.7	29.4	29.7
17.5	24.7	24.8	29.7	29.8
18	25.0	25	30	30

Source: Cole et al, 2007 (44)

Appendix IV: Consent Form – Head Master / Mistress - English Version

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES



DIRECTORATE OF RESEARCH AND PUBLICATION

NAME OF SCHOOL

INVITATION:

Dear Head master/Mistress,

My name is Dr Furahini Chinenere. I am currently pursuing studies in Master of Public Health (MPH) at Muhimbili University of Health and Allied Sciences.

I am kindly inviting your school to participate in a survey assessing student's health and their associated factors. The leaflet you are reading will provide information about the purpose of the study. Together with this leaflet is the Informed Consent Form. Please read carefully the information in the leaflet, and in case you agree for your school to participate please sign at the designated area in the Informed consent form.

STUDY PROCEDURE

Students will be interviewed on questions related to their health, also height and weight measurements will be taken in the course of the interview.

VOLUNTARY PARTICIPATION

Please note that your school's participation in this study is voluntary and you have a right to refuse to consent. If you consent for your school to participate you have the right to withdraw your school from the study at any time if you wish to do so.

BENEFITS

Participation in this study will provide useful information to us and others stakeholders. The results of the study will be made available to you through a planned means of research results dissemination.

RISKS AND DISCOMFORT

There are no risks or discomforts involved in this study. Participants will be asked questions and their height; weight measurements will be taken using non-invasive techniques.

CONFIDENTIALITY

Names of interviewed student will not appear on the questionnaire and no record of their participation as individuals will be kept.

REVIEW AND APPROVAL

The review and approval of the study has been done by the Ethical committee of Muhimbili University of Health and Allied Sciences (MUHAS).

CONTACTS FOR FURTHER INFORMATION

In case you have any questions concerning the nature of this study, please contact:

The Principal investigator, Dr Furahini Chinenere,

Muhimbili University of Health and Allied Sciences (MUHAS),

P. O BOX 65001, Dar es Salaam

Mobile no. 0784 400 506

Dr G. H. Leyna,

Muhimbili University of Health and Allied Sciences (MUHAS),

P.O BOX 65001, Dar es Salaam

Director of Research and Publication

Professor M. Moshi

Muhimbili University of Health and Allied Sciences (MUHAS),

P.O. BOX 65001, Dar es Salaam

Office Tel: 022 2150302-6

Consent form – head master/mistress

I confirm that I have read carefully and I have understood the information provided in the leaflet. **I agree/ disagree** for my school to participate in the study. I am aware that I can freely withdraw my school from this study any time I wish to do so.

Signature: _____

Date: _____

Signature: Research assistant _____

Date _____

Appendix V: Consents Form Parents / Guardians – English Version

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES



DIRECTORATE OF RESEARCH AND PUBLICATION

ID NUMBER.....

INVITATION:

Dear parent/guardian,

My name is Dr Furahini Chinenerere. I am currently pursuing studies in Master of Public Health (MPH) at Muhimbili University of Health and Allied Sciences.

I am kindly inviting your child to participate in a survey assessing student's health and their associated factors. Together with this leaflet is the Informed Consent Form. Please read carefully the information in the leaflet, and in case you agree for your child to participate please sign at the designated area in the Informed consent form.

STUDY PROCEDURE

Children will be interviewed on questions related to their health, also height and weight measurements will be taken in the course of the interview.

VOLUNTARY PARTICIPATION

Please note that your child's participation in this study is voluntary and you have a right to refuse to consent. If you consent for your child to participate, you have the right to withdraw them from the study at any time if you wish to do so.

BENEFITS

Your child's participation in this study will provide useful information to us and others stakeholders.

RISKS AND DISCOMFORT

There are no risks or discomforts involved in this study. Participants will be asked questions and their height; weight measurements will be taken using non-invasive techniques.

CONFIDENTIALITY

Names of interviewed student will not appear on the questionnaire and no record of their participation as individuals will be kept.

REVIEW AND APPROVAL

The review and approval of the study has been done by the Ethical committee of Muhimbili University of Health and Allied Sciences (MUHAS).

CONTACTS FOR FURTHER INFORMATION

In case you have any questions concerning the nature of this study, please contact:

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Director of Research and Publication

Professor M. Moshi

Muhimbili University of Health and Allied Sciences (MUHAS),

P O BOX 65001, Dar es Salaam

Office Tel: 022 2150302-6

Consent form- parents / guardians.

I confirm that I have read carefully and I have understood the information provided in the leaflet. I agree/ disagree that my child participates in the study. I am aware that I can freely withdraw my child from this study any time I wish to do so.

Signature: Parent/guardian _____

Date: _____

Signature: Research assistant _____

Date: _____

Assent form for participating students below 18 years

I agree/ disagree to participate in the study. I am aware that I can freely withdraw from the study at any time.

Signature: Student

Date:

Signature: Research assistant

Date:

Appendix VI: Consent Form – Parents / Guardians – Swahili Version

CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI



KURUGENZI YA UTAFITI NA MACHAPISHO

Namba ya utambulisho

Ndugu mzazi/mlezi,

Jina langu ni Dr Furahini Chinenere. Mimi ni mwanachuo wa Chuo cha Sayansi za Afya Muhimbili.

Ninachukua fursa hii kukuomba ridhaa ilimtoto wako aweze kushiriki kwenye utafiti nitakaofanya kuhusu afya za wanafunzi. Mwishoni wa haya maelezo, kutakuwa na fomu ya ridhaa. Tafadhali soma maelezo yafuatayo kwa makini. Ukiridhia mtoto wako ashiriki, tafadhali tia sahihi kwenye sehemu husuika.

UTARATIBU WA UTAFITI

Utafiti huu una lengo la kukusanya taarifa kuhusu afya za wanafunzi. Wanafunzi wataulizwa maswali kuhusu afya zao, pia tutapima uzito na urefu woa.

HAKI YA KUSHIRIKI

Kushiriki katika utafiti huu ni uamzi wako. Mtoto wako ana haki ya kutoshiriki au kukatisha ushiriki wakati wowote hata kama ulikwisha toa ridhaa kushiriki.

FAIDA

Kama utakubali mtoto wako ashiriki kwenye utafiti huu, tunategemea kwamba taarifa tutakazo zipata zitakuwa na manufaa kwetu na kwa wadau wengine katika huduma za afya

MADHARA

Hatutegemei kuwa mtoto wako atapata madhara yoyote katika utafiti huu.

USIRI

Habari zote tutakazo zipata kutoka kwako zitakuwa ni siri, wala hatutatumia jina bali namba yako ya utambulisho

WATU WA KUWASILIANA NAO

Kama utakuwa na swali lolote kuhusu kushiriki utafiti huu, unaweza wasiliana na:

Mtafiti Dr Furahini Chinenere

Chuo Kikuu cha Sayansi za Afya Muhimbili

S.L.P 65001, Dar es Salaam

Namba ya simu: 0784 400 506

Dr G. H. Leyna

Chuo Kikuu cha Sayansi za Afya Muhimbili

S.L.P 65001, Dar es Salaam.

Mwenyekiti wa kamati ya Chuo ya Utafiti na Machapisho,

Profesa M. Moshi

Chuo Kikuu cha Sayansi za Afya Muhimbili

S.L.P 65001, Dar es Salaam

Namba ya simu: 022 2150302-6

Fomu ya ridhaa- Mzazi/Mlezi

Nimeisoma na nimeelewa maelezo yaliyotolewa hapo juu. **Nakubali/ sikubali** mtoto wangu kushiriki katika utafiti huu. Naelewa kuwa mtoto wangu ana haki ya kutoshiriki au kukatisha ushiriki wakati wowote hata kama nimeshatoa ridhaa kushiriki.

Sahihi ya Mzazi/mlezi

Tarehe

Sahihi ya Mtafiti

Tarehe

Fomu ya ridhaa- wanafunzi chini ya maika 18

Nakubali/ sikubali kushiriki katika utafiti huu. Naelewa kuwa nina haki ya kutoshiriki au kukatisha ushiriki wakati wowote hata kama nimeshatoa ridhaa kushiriki.

Sahihi ya mwanafunzi:

Tarehe:

Sahihi ya Mtafiti:

Tarehe: