A COMPARATIVE ASSESSMENT OF DAY AND BOARDING ADOLESCENT GIRLS ON THEIR DIETARY INTAKE AND NUTRITIONAL STATUS AT MUKAMAMBO II SECONDARY SCHOOL IN CHONGWE DISTRICT, LUSAKA PROVINCE, ZAMBIA.

By

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A dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the degree of Master of Science in Human Nutrition

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DECLARATION

I hereby declare that this dissertation is a product of my own work and that all the sources quoted have been indicated in the references. I further declare that this work has not been previously presented elsewhere whether wholly or in part for any other study programme at any university. It has been produced in accordance with the guidelines for Master of Science in Human Nutrition for the University of Zambia.

Signed ……. Date ……..

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APPROVAL

This dissertation of Wila Zambezi has been approved as partial fulfilment of the requirements for the award of the Degree of Master of Science in Human Nutrition by the University of Zambia.

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ABSTRACT

The adolescent period is second only to infancy for rapid growth. Adolescents between 10-18 years, experience a growth spurt that increases their nutritional needs. Therefore, consumption of an inadequate diet results in delayed growth which leads to long-term consequences such as undernutrition. In low-middle-income countries like Zambia, there is limited information pertaining to adolescent girls and yet research has shown that around 16 million adolescent girls give birth every year in developing countries. Adolescents in rural areas have poor nutritional status due to inadequate dietary diversity which has become a contributor to poor optimal growth.

The purpose of this study was to assess dietary intake and nutritional status of adolescent girls in a rural boarding and day secondary school at Mukamambo II Girls Secondary School in Chongwe District of Lusaka Province in Zambia.

A total of 208 girls were randomly selected and surveyed for nutritional status, socio-demographics and dietary intake. Anthropometric data was collected by measuring weight to the nearest 0.1kg and height to the nearest 0.1 cm, Socio-demographic data was collected using a questionnaire and dietary intake data were collected using a food frequency questionnaire.

Of the 208 girls, underweight was not detected among the day and boarding school participants based on BAZ- score. A total of 90.4% (n=188) were in the normal range of the BAZ for age. Five percent (n=4) and 12% (n=15) were overweight representing day and boarding school respectively. About 1% (n=1) in day and none of the students in the boarding school section were obese. There was evidence of a negative correlation between BAZ index and age at menarche ($r = -0.141$, $p = 0.042$). The results revealed that the girls usually consumed starchy staples such as bread (28% in the day section and 18% in the boarding section), breakfast cereals at 30% in the day section and 62% in the boarding section. Adolescents in the day section consumed more meats while adolescents in the boarding school section consumed more pulses. The study established that the majority of adolescent girls had a normal weight status, none were underweight and stunting was not prevalent. The study recommends measures to improve livelihood by incorporating nutrition education in schools in order to increase knowledge on healthy eating habits amongst adolescent girls.

Key words: Adolescents; Nutrition; Dietary Intake; Nutritional Status; Menarche

DEDICATION

I thank God through his son Jesus Christ for the enablement granted throughout my studies, for without him, I am nothing. I thank my dear husband Kayombo Chinyeka for the support and encouragement throughout this journey. I also thank my children Salifya, Kayombo III and Paul for the patience and endurance of my absence during my studies. Lastly, I thank my parents for the excellent academic example they have set and for being my biggest cheerleaders, to God alone be all the glory.

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TABLE OF CONTENTS

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

AGEP:	Adolescent Girls Empowerment Program
ANOVA:	Analysis of Variance
BAZ:	Body Mass Index-for-age Z-score
BMI:	Body Mass Index
CDC:	Centers for Disease Control
CSO:	Central Statistical Office
DD:	Dietary Diversity
DRIs:	Dietary Reference Intake
FAO:	Food and Agriculture Organization of the United Nations
FFQ:	Food Frequency Questionnaire
HAZ:	Length/Height-for-age Z-score
LMIC's:	Low-and Middle-Income Countries
MoH:	Ministry of Health
NCD's:	Non-Communicable Diseases
RDA:	Recommended Dietary Allowance
RDI:	Recommended Dietary Intake
SDG's:	Sustainable Development Goals
S-DQ:	Socio-Demographic Questionnaire
SES:	Socio-Economic Status
SPSS:	Statistical Package for Social Sciences
SSA:	Sub-Saharan Africa
UN:	United Nations
UNICEF:	United Nations Children's Fund
WHO:	World Health Organization
ZDHS:	Zambia Demographic and Health Survey

OPERATIONAL DEFINITION OF TERMS

Adolescent: A young person between the ages of 10-19 years.

Body Mass Index: A measure of body fat based on height and weight that applies to adult men and women. BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m2, resulting from mass in kilograms and height in metres.

Dietary Diversity: A qualitative measure of food consumption that reflects household access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals.

Growth Spurt: Growth characterized by rapid gains in height and weight.

Lifestyle: The interests, opinions, behaviors, and behavioral orientations which individuals develop.

Malnutrition: This refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients.

Menarche: The first occurrence of menstruation.

Micronutrients: A chemical element or substance required in trace amounts for the normal growth and development of living organisms.

Nutrition transition: The shift in dietary consumption and energy expenditure that coincides with economic, demographic, and epidemiological changes.

Obesity: Obesity is defined as a BMI at or above the 95th percentile for children and teens of the same age and sex.

Overweight: Overweight is defined as a BMI at or above the 85^{th} percentile and below the 95^{th} percentile for children and teens of the same age and sex.

Undernutrition: The outcome of insufficient food intake and repeated infectious diseases which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals

CHAPTER ONE: INTRODUCTION

1.1 Background

Adolescence is described as a period of rapid growth in human development. According to the World Health Organization (WHO, 2005) adolescence is defined as individuals that fall within the ages of 10 to 19 years. This is also a period of transformation from childhood to adulthood (Jaworska and Macqueen, 2015). Adolescent girls who enter pregnancy with poor nutrient stores are more likely to give birth to low birth weight babies. Therefore, the period of adolescence is a great opportunity to break the vicious intergeneration cycle of malnutrition (Bwalya, 2015; Gebregyorgis et al., 2016).

In Zambia, adolescent nutrition lacks the special attention that it deserves yet, poor nutrition has a significant impact on the development and health of adolescents (Bwalya, 2015). Low levels of nutritional status amongst adolescents have been reported. Statistics show that 30.6% adolescent girls in Zambia lack adequate meals and rural adolescents are more likely to be underweight (Bwalya, 2015).

During adolescence, a growth spurt occurs in terms of physical development. This unique phase in development is marked by accelerated physical growth and psychological maturity which sparks a demand for nutrients. The absence of growth can pose a risk for nutritional deficiencies which later translates into an increase in morbidity and mortality most notably in developing countries (Bolajoko, Ogundahunsi and Folahan, 2014).

Adolescence period is a stage when up to 45% of skeletal growth occurs and 15-25% of adult height is achieved (Gebregyorgis, Tadesse and Atenafu, 2016). Nutrition is of great importance in this stage of development. Good nutritional practices and habits should be adopted as a child transitions into adolescence and adulthood, to ensure optimum growth status and reproductive development (Bwalya, 2015).

Malnutrition is a term that is used to describe both under and over-nutrition. Developing countries are undergoing a nutrition transition. This has caused a shift from consuming traditional foods to foods that are energy dense and nutrient poor. This shift in food consumption is of major concern because it leads to an increased possibility of acquiring non-communicable diseases (NCD's) such as diabetes, hypertension, cardiovascular diseases and some cancers later in life (Onabanjo et al., 2014). Dietary intake is an important aspect to assess in order to determine its association with

nutritional status. This, according to (Ruel, 2002) can reflect nutrient adequacy, as diets ought to meet energy and all essential nutrient needs.

1.2 Problem Statement

Nutrition is critical in the developmental phase of adolescence for this reason, eating behaviors can affect the future health of adolescents. Statistics have shown that 13.7% adolescent girls in Zambia are underweight while 9.4% are either overweight or obese with high obesity rates in urban areas (Zambia Demographic and Health Survey, 2007). The problem of under nutrition amongst adolescent girls in Zambia has not been addressed fully, it therefore poses an intergenerational problem for adolescent malnutrition. This simply means that the upcoming girl child will grow into a malnourished mother who later gives birth to a malnourished baby.

An element of devotion and resources needs to be invested in adolescent girls in Zambia according to Naudeau, Hasan and Bakilana (2015) as they endure the consequences of undernutrition, which places them at risk of pregnancy and childbirth complications. Some studies conducted in Zambia have focused on food consumption and micronutrients (Alaofe *et al.*, 2014), patterns of urban food consumption and expenditure in Zambia (Hichaambwa and Beaver, 2009) and complementary feeding in under five children (Katepa-bwalya *et al.*, 2015). However, there is limited information on dietary intake and nutritional status of adolescent girls. Despite the long-term effects of malnutrition, there is little literature on dietary contributors to nutritional status among adolescent girls in Zambia.

Early menarche, undernutrition and the rise in obesity causes adverse health and reproductive consequences to adolescent girls. Menarche is the first menstrual cycle in the life of an adolescent, it is a significant marker for sexual maturity and nutritional status in adolescent girls (Barros *et al.*, 2018).

Zambian boarding schools have been known to provide a diet that does not meet the nutritional needs of learners (Siwawa, 2015). Some boarding school students prefer to live outside boarding schools due to poor diets, the students argue that the diet is monotonous consisting of nshima, beans and cabbage daily (Siwawa, 2015).

1.3 Rationale of the Study

Diet inadequacy leads to undernutrition with disastrous long-term effects. However, there is little literature on dietary contributors to nutritional status among adolescents in Zambia. This study

therefore intends to investigate and establish dietary pattern and its effect on the presence of underweight, stunting, overweight and obesity among adolescent girls in a Zambian boarding and day school in a bid to bridge the knowledge gap.

In Zambia, there is limited information on the health and nutritional status of adolescent girls. In addition, studies have revealed that diets in rural Zambia are monotonous, this causes an inability to contribute to dietary diversity which is a requirement for optimal nutrition (Siwawa, 2015).

Mukamambo II Secondary School was selected as the study site because it is the only girls' secondary school in Lusaka Province which provides boarding and day school services in the same school. This study assessed the dietary intake of adolescent girls in boarding and day school in order to determine its effect on nutritional status of adolescent girls. The findings of this study will provide information that could be utilized to design interventions that promote healthy lifestyle amongst adolescents in Zambia.

1.4 Research Objectives

The overall objective of this study was to assess dietary intake and nutritional status of adolescent girls at Mukamambo II Girls secondary school in Chongwe District of Lusaka Province Zambia.

Specific objectives include:

1. To determine and compare the dietary intake of adolescent girls in the boarding and day sections of Mukamambo II secondary school.
2. To assess nutritional status of adolescent girls in the boarding and day section of Mukamambo II secondary school.
3. To determine the relationship between dietary intake and nutritional status of adolescent girls.

1.5 Research Questions

This study aimed at answering the following questions;

1. What is the dietary intake of adolescent girls in the boarding and day sections of Mukamambo II secondary school?
2. To what extent do factors such as socioeconomic status influence dietary intake and nutritional status of adolescent girls?
3. What is the relationship between dietary intake and nutritional status?
4. What is the relationship between age at menarche and nutritional status of adolescent girls?

CHAPTER TWO: LITERATURE REVIEW

2.1 Diet and Nutritional Status of Female Adolescents in Developing Countries

In 2009, the world was habitant to 1.2 billion adolescents. Half of these were girls with a greater number in developing countries (UNICEF, 2011). Adolescent girls nutritional requirements are often overlooked, leading to their becoming victims of household hunger and infectious diseases (Korkalo *et al.*, 2014). Lately, much attention has been given to this age group owing to the increasing knowledge and understanding of difficulties being experienced amongst this population.

Physical growth, reproductive and cognitive development are some of the developmental stages experienced in adolescence, this very important stage in life comes with an increased need for energy, protein, vitamins and minerals. Deficiency in protein for example reduces growth during adolescence.

Iron is essential for skeletal growth and can be a growth limiting factor if intake is insufficient (Krishna, Mishra and Singh, 2012).

Generally, dietary needs increase during adolescence due to puberty and eventually menarche in girls. Nutritional requirements are higher at the peak of growth spurt and subsequent undernutrition can often be inevitable at this stage (Alam *et al.*, 2010; Olumakaiye, 2013). In developing countries, malnutrition has been noted among adolescent girls which stems from gender inequality in some cultures and poverty as contributing factors (WHO, 2005). There are some direct causes of malnutrition such as dietary deficiency, which translates into longstanding complications such as delayed sexual maturation, underweight and short stature in adulthood (Dewan, 2008).

In developing countries, the nutritional status of adolescent girls usually depends on whether the adolescent resides in a rural or urban area. Over the years, the government of Zambia has partnered with cooperating agencies to spearhead programs that would improve the nutritional status of adolescent girls in Zambia. Adolescents are at risk for micro and macro-nutrient deficiencies which still exist amongst adolescent girls in Zambia (Hewett *et al.*, 2017). Interventions such as the Adolescent Girls Empowerment Program (AGEP) were started with an aim to improve general, nutritional, maternal and child health. This program sought to highlight the nutritional needs for adolescent girls (Hewett *et al.*, 2017).

2.2 Diet Quality and Consumption Patterns of Adolescents Girls

A lot of changes occur during the adolescent growth spurt including cognitive, psychosocial and physiological changes. These changes can affect the nutritional status of adolescents and also increase their nutrient needs (Story and Stang, 2005; Amos, Intiful and Boateng (2012). Dietary habits in adolescents possess present and futuristic consequences on the health of adolescents in that diet quality plays a role in determining the prevention of various diseases and conditions such as diabetes and stunting (Assumpcao *et al.,* 2012).

Literature shows that there is a general tendency amongst adolescent girls to consume an inferior diet quality when compared to other age groups. For example, Rezali *et al.*, (2015) reveal that in the United States, 33.5% female adolescents consume a poor diet quality due to decreased consumption of healthy foods such as milk, fruits and vegetables and an increased consumption of fast foods and sugary-sweetened beverages. By contrast, a cross-sectional study that was conducted in India to determine the nutrient intake of adolescent girls reported that 36.3% of learners in the age group 15-18 years from government schools were severely undernourished as a result of consuming a nutritionally inadequate diet, which is one of the major causes of malnutrition among adolescents (Jaiswal, 2015).

In Bangladesh, periodic food shortages due to low family income has been associated with insufficient dietary intake which has led to high levels of undernutrition amongst adolescent girls (Alam *et al.*, 2010). In developing countries like Zambia, dietary patterns of adolescents are usually inspired by food availability and cost. Therefore, to improve the diet quality of adolescents, food production and food availability ought to be a priority at policy level to promote healthy eating habits in adolescents which translates into better nutritional status (Stang and Story, 2005).

2.3 Factors Affecting Dietary Patterns of Adolescents

There are various factors that affect the dietary patterns of adolescents. According to Wassie *et al.*, (2015), other factors that affect the dietary patterns of adolescents in developing countries include; inadequate access to nutrition information which changes the mind set about dietary habits to improve nutritional status, dietary diversity, community based nutrition programs and food insecurity. These factors are discussed in details in the following subsections.

2.3.1 Food Security and Socio-Economic Status

According to the Food and Agriculture Organization (FAO), "food security exists when all people at all times have physical and economic access to adequate amounts of nutritious, safe, and culturally appropriate food to maintain a healthy and active life" (FAO, 2015).

Countries in Sub-Saharan Africa have not made enough progress to reduce hunger thereby making food security one of the most challenges to economic growth (Cordeiro *et al.*, 2012). Adolescents living in food insecure homes are at risk of poor health and nutritional outcomes.

In a study to examine the nutritional implications of household food insecurity for Canadian adults and children which comprised of a sample size of 35,107 respondents of all ages, results showed that food insecure homes were negatively associated with consumption of protein, fat and fiber as well as intakes of all vitamins and minerals (Kirkpatrick & Tarasuk, 2008). The same authors further report that food insecure households obtained their energy intake from carbohydrates and consumed a lesser amount of fruits and vegetables. This study concluded that food insecurity can influence weight status in children, which eventually affects them in adolescence. It was also observed that food insecurity is an indicator of dietary conciliations among adolescents which increase the risk of nutrient shortfalls.

In Tanzania, a study showed that about 30% of the study population was incapable of meeting their essential food needs as a result of extreme poverty. The consequence to this is that chronically undernourished adolescents are at risk poor dietary habits and consequently delayed puberty. Food insecurity in adolescents leads to adjusting dietary behavior and increases the risk of stunting (Cordeiro *et al.*, 2012).

In a longitudinal study to determine the effect of food insecurity on the linear growth (height) of adolescents in Southwest Ethiopia, Belachew et al., (2013) reported that food insecure adolescent girls were of shorter stature as compared to their food secure peers. This assertion is further emphasized by the fact that food insecurity causes an effect on adequate nutrient intake which can potentially delay catch up growth to correct the height shortfall acquired from childhood.

Socioeconomic status (SES) is an important determinant of dietary trends particularly in low-and middle-income countries (LMICs). Marques-vidal *et al.*, (2014) show that SES is the most important health determinant in LMICs and a distinction can be made by this factor in that, individuals

of high-SES have a tendency to consume healthier diets that consist of whole grains, lean meats, fish, fruits and vegetables.

Studies have shown that food intake is influenced by SES. This is so because in as much as high quality diets are associated with wealth, nutrient-poor diets are normally utilized by populations of low SES (Darmon and Drewnowski, 2008; Konttinen and Sarlio-la, 2016). It still remains unclear the causes of different consumption patterns between low and high socio classes. In a study to examine if food choice is determined by income inequalities, Konttinen & Sarlio-la (2016) concluded that participants with low education and low income were concerned with price of food as this influenced the type and quality of food items to be purchased.

Another study to determine the influence of parental SES on diet quality of European adolescents was designed to determine dietary habits and patterns of European adolescents aged 12.5 to 17.5 years. This study enrolled 3865 students from different schools in Europe, it assessed the diet quality, parental education and occupational levels. The results of this study revealed that parental occupational levels, in this case wealth, was positively associated with adolescents' diet quality; drawing a conclusion that parents' economic status could have an impact on the diet quality of adolescents (Beghin *et al.*, 2014). The conclusions of this study match the observations made by Skardal et al., (2014) which reveal that the majority of adolescents do not have an individualistic SES and so depend on their parents for livelihood. The authors concluded that adolescents with low SES consume a lesser amount of healthy foods as compared to those of higher SES.

It has been observed that populations of high SES are both slender and healthier because they partly consume high quality diets as compared to the underprivileged (Darmon & Drewnowski, 2008). The same authors further state that diet quality is affected by conventional indexes of socioeconomic status/social class such as occupation, education and income levels; these are factors affecting developing countries and Zambia is no exception.

A study undertaken by Audain, Veldman and Kassier (2015) showed that parental education and employment status was higher among urban school adolescents and stunting was noticeably lower compared to the peri-urban school adolescents. Household food security and high socioeconomic status are key determinants of nutritional status which in turn protects adolescents from the negative outcomes of undernutrition on cognitive, physical growth and development.

2.3.2 Malnutrition among Adolescents

Undernutrition is defined as "failure to consume adequate energy, protein and micronutrients to meet basic requirements for body maintenance, growth and development" (Dewan, 2008). Research has shown that although the fight against hunger continues, 795 million people in the world were said to be under-nourished between 2014 and 2016 (FAO, 2018). The same report also reveals that in Sub-Saharan Africa (SSA), 23.2% of the general population is undernourished.

Studies continue to show that adolescent girls of low economic standing are victims of malnutrition thereby making rural adolescent girls likely to suffer from chronic energy deficiency (Assefa, Belachew and Negash, 2013). Chronic undernutrition leads to stunting which is "short height for age" in adolescents (Assefa, Belachew and Negash, 2013). There are many possible causes of mal-nutrition some of which include eating too little or too much and consuming certain foods that lack essential nutrients (Dewan, 2008).

Presently, many developing countries are experiencing nutritional transitions which has led to an increase in obesity (Pradeilles *et al.*, 2016). Obesity in adolescents leads to possible long-term consequences such as continued overweight in adulthood. In the United States for example, obesity is the second leading cause of preventable death. It is also a risk factor for other diseases such as hypertension, type 2 diabetes and cardiovascular diseases (Alton, 2005).

There is a growing trend of overweight and obesity amongst adolescents. Lifestyle changes appear to be the major contributor. Globalization has also contributed to the rise in obesity among adolescents in that populations have shifted from consuming traditional foods and have instead adopted the famous 'westernized' diet. Studies have shown that obesity in adolescence is becoming progressively prevalent in developing countries (Bargiota *et al.*, 2013).

Under-nutrition and over-nutrition are important public health concerns for both developed and developing countries, they both pose long term effects especially on adolescents such as delayed sexual maturation, stunting, poor academic performance as well as a rise in NCDs (Audain et al., 2015).

Adolescence is an opportunity to improve maternal health. Literature review shows that there is limited information pertaining to adolescent nutrition in Zambia and yet it is an important stage in development. The burden of undernutrition in children under 5 years has been well documented at national level however, it has not been fully addressed for adolescent girls in Zambia. This study will therefore aim to bridge the knowledge gap.

CHAPTER THREE: RESEARCH METHODS

3.1 Study Design

The study involved a descriptive cross-sectional study, which describes the dietary patterns and nutritional status of the learners. A cross-sectional design is useful in research that requires observations to be made at a single point in time; therefore it is the easiest type of research design to implement (Kothari, 2004). A descriptive design permits for the detailed profiling of a population, as well as an accurate description of a relationship occurring within the population (Kothari, 2004).

3.2 Study Population

Mukamambo II Girls Secondary school has a total population of 570 pupils in grades 8-11. The population of interest encompassed all adolescent girls.

3.3 Inclusion Criteria

The inclusion criteria for this study was as follows; adolescent girls enrolled in boarding and day school in Grades 8-11 aged 14-19 years.

3.4 Exclusion Criteria

This study excluded students under the age of 14 years and students over the age of 19. This criteria was necessary because the proposed age range (14-19 years) is a critical stage in the development cycle.

3.5 Study Site

Mukamambo II Girls Secondary School is a rural government owned school which is situated in the district of Chongwe in the Chalimbana area approximately 50km from the capital, Lusaka. The school is an all-girls secondary school which started operations in the year 2000 as a community school and has since grown. Mukamambo II Girls is the only Girls secondary school in Lusaka Province that has both boarding and day scholars; for this reason, it was purposively selected as the study site.

3.6 Sampling Criteria and Study Sample

The study was conducted among 208 female adolescents aged 14-19 years. A simple random sampling technique was used to sample the participants and the sampling frame was drawn from

the class registers. This information was registered by the researcher and field helpers. The list of selected adolescent girls was used to approach them.

The sample size for this study was calculated using an online version of Epi-Info Stat Calculator. At 95% confidence interval, the sample size was 229 learners. However, only 208 learners were enrolled in the study with an attrition rate of 7% due to refusal to participate by some learners.
The sample size was therefore calculated using the formula below:
Sample Size = z^2x p(1-p)/ e^2/ 1+(z^2 * p(1-p)/ e^2N
Where: N = Population Size (570)

Z = Z- score (1.96)

e = Margin of error (0.05)

P = Standard Deviation (0.5)

3.7 Data Collection Methods

A self-administered questionnaire with both open and closed ended questions was used. The questionnaire had three sections. Section A constituted socio-demographic data; section B comprised anthropometric data which included height and weight and BMI was calculated in WHO Anthroplus; section C constituted a food frequency questionnaire (FFQ) to ascertain how often and how much a particular food group was consumed by the adolescent girls. A Socio-demographic questionnaire provides information on dynamics relevant to the household with regards to the surroundings in which the study populations lived. Gathered information include age, age at menarche, marital status, eating behaviors, parental education and employment status.

3.7.1 Dietary Intake

To determine frequency of food intake, data was grouped into frequency of whether participants had consumed food; never <1 month, monthly, weekly and daily. It also prioritized the major foods groups that are consumed in Zambia, for example starches, vegetable, fruits, milk and milk products, meats, fats and fast foods. A food frequency questionnaire is used to assess how often a particular food is consumed. It approximates food intake as reported by participants making it an easy and economical mode of food data collection within a short period of time.

3.7.2 Anthropometry

A central location within the school was used for anthropometric assessments and administration of the questionnaire. As the primary sampling unit, adolescents provided needed information on age, socio-demographic data and dietary intake.

The WHO classification of BAZ is as follows: above plus three standard deviations (+3 SD) from the median of the WHO reference population is considered obese, above plus two standard deviations (+2 SD) from the median of WHO reference population is considered Overweight, above plus one to minus one (+1 SD through -1 SD) standard deviations from the median of WHO reference population is considered Normal weight, less minus two standard deviations (-2 SD) is considered thinness and less than minus three (-3 SD) standard deviations is considered severe thinness for age.

The height of the individual participants was measured using a stadiometer. The participant stood on the equipment without shoes. The head was looking straight ahead, the arms were on the side, knees straight, the back and shoulders touched the surface of the stadiometer, the feet were flat and the heels were placed together. After the participant was positioned, the measurement was read and recorded to the nearest 0.1cm. The weight of the participant was measured using a seca scale. The participant stood on the center of the scale without shoes, the measurement was read and recorded to the nearest 0.1kg.

The two anthropometric data, height and weight were used to calculate the BAZ in order to describe current nutritional status of the adolescent girls.

3.8 Data Analysis

The collected data was coded and entered in the Statistical Package for Social Sciences (SPSS Version 23) and analyze quantitative data. The WHO Anthroplus software was used to generate anthropometric indices. The HAZ and body mass index-for-age Z-score (BAZ) were calculated in Anthroplus before being fed into SPSS for analysis.

Both descriptive and inferential statistics were done. BAZ were presented using means and percentages. Spearman rank order correlation was conducted to determine the relationship between age at menarche and BMI. Spearman correlation was also used to establish the relationship between the socioeconomic variables and food intake.

The Independent samples t-test was used to establish the mean difference in BAZ of the adolescent girls in the day and boarding school sections of the school. Mann-Whitney test was conducted to compare food frequency intake between day and boarding groups.

In order to compare the nutritional status of the two groups (day and boarding school sections), the independent sample t-test was conducted using the BAZ continuous variable. The P-values for the test was at $p < 0.05$ confidence intervals.

To determine the influence of demographic factors, socio-economic factors and food groups on nutritional status, logistic (bivariate) regression analysis was conducted. The dependent variable was BAZ which was categorized into two groups; normal weight and overweight/obesity. Independent variables were age at menarche, guardian's highest educational level and guardian's employment status, food groups and other factors relating to food. In order to come up with food group variables, food types were combined (summed) to come up with starches, vegetables and fruits, milk products, meats, eggs, fats, fast foods, other foods and beverage drinks.

The model explained 10.20% (Cox and Snell R square) and 21.7% (Nagelkerke R square) of the variance in nutritional status. These values are low indicating a poor fit in the model. The Wald statistic was used to assess the importance of individual independent variables in predicting the probability of occurrence of normal weight or overweight/obese in the adolescent girls. A coefficient with a Wald statistic p-value less than 0.05 implies that the variable is important in the model and those variables with p-values greater than 0.05 were considered to be unimportant. The p-value < 0.05 was used to determine the statistical significance of the test at 95% confidence interval.

3.9 Ethical Considerations

Ethical clearance and approval to conduct the study was obtained from the Provincial Education Office in Chongwe and the University of Zambia Research Ethics Committee (UNZAREC). All participants were treated with respect in that written consent from parents for minors and written assent was obtained from the adolescents before commencement of the study. The process of consent involved explaining the purpose of the study and confidentiality procedures. Consent was thereafter indicated by a signature or thumbprint. Learners who consented to participate in the study were enrolled, interviewed and assessed.

3.10 Confidentiality, Data management and Security

The researcher planned for data storage before actual data collection. The researcher ensured that a filling cabinet for paper questionnaires was put in place where only those involved in the research were authorized to access the data.

The questionnaires where then entered into the computer using SPSS version 23. The computer used was also secured and no one was allowed to access the computer apart from the researcher. The computer system was password enabled to maintain optimum security.

3.11 Study Limitations

This study used the English language as a mode of communication therefore, adolescents who were not able to read were uncomfortable in giving their answers. The expectations of the Zambian society is that learners have the ability to read and write in English. This fact could have influenced adolescents' ability to answer the questions. This situation had the likelihood to bias their responses.

CHAPTER FOUR: RESULTS

4.1 Socio Demographic Characteristics of Adolescent Girls.

Table 4.1 shows that the day school participants were older than the boarding school participants, with the mean age at 16.69 years and 14.87 years respectively. The mean age of the total participants was 15.60 years. Majority of the girls were aged 14-15 years (55.3%, N=115). Thirty-eight percent (38%, n=47) day school section and (23%, n=19) boarding school section participants reported age at menarche at age 12 years and below. Most of the participants were residing in urban areas compared to those who resided in rural areas [(55%, n=114) and (45%, n=94) respectively]. Seventy-seven percent (77%, n=64) of girls in day school section were rural residents compared with (24%, n=30) girls in boarding school section. Seventy-six percent (76%, n=90) of girls in boarding school section were urban residents and (23%, n=19) were day school section. Grade ten (10) had the highest number of participants, (53%, n=44) in day school section and (53%, n=49) in boarding school section. Boarding school section participants had (81%, n=102) guardian's highest level of education at tertiary compared with (49%, n=41) for day school section.

Table 4.1 Socio demographic characteristics of adolescent girls 14-19 years

Characteristic	Day n (%)	Boarding n (%)	Total N (%)
Mean Age	16.69	14.87	15.60
Age Group			
14-15 years	23 (27.7)	92 (73.6)	115 (55.3)
16-17 years	30 (36.1)	32 (25.6)	62 (29.8)
18-19 years	30 (36.1)	1 (0.8)	31 (14.9)
Age at Menarche			
≤12	19 (22.9)	47 (37.6)	66 (31.7)
13	21 (25.3)	56 (44.8)	77 (37.0)
14	21 (25.3)	19 (15.2)	40 (19.2)
15	18 (21.7)	3 (2.4)	21 (10.1)
16≥	4 (4.8)		4 (1.9)
Residence			
Rural	64 (77.1)	30 (24.0)	94 (45.2)
Urban	19 (22.9)	95 (76.0)	114 (54.8)
School Grade of Participant			
Grade 8	1 (1.2)	12 (9.6)	13 (6.2)
Grade 9		32 (25.6)	32 (15.4)
Grade 10	44 (53.0)	49 (39.2)	93 (44.7)

Grade 11	38 (45.8)	32 (25.6)	70 (33.7)
Guardian's highest educational level			
Primary	14 (16.9%)	1 (0.8)	15 (7.2)
Secondary	28 (33.7%)	22 (17.6)	50 (24.0)
Tertiary	41 (49.4%)	102 (81.6)	143 (68.8)
Guardian's employment status			
Full-time	47 (56.6%)	109 (87.2)	156 (75.0)
Part-time	13 (15.7%)	10 (8.0)	23 (11.1)
Non	23 (27.7%)	6 (4.8)	29 (13.9)
Guardian of Participant			
Father and mother	45 (54.2)	91 (72.8)	136 (65.4)
Single Parent	24 (28.9)	20 (16.0)	44 (21.2)
Other	14 (16.9)	14 (11.2)	28 (13.5)
Common practice here to have breakfast			
No	13 (15.7)	2 (1.6)	15 (7.2)
Yes	70 (84.3)	123 (98.4)	193 (92.8)
Participant prepares/buys simple meals			
No	32 (38.6)	17 (5.6)	39 (18.8)
Yes	51 (61.4)	118 (94.4)	169 (81.2)
Total	83 (100)	125 (100)	208 (100)

4.2 Dietary Intake of Adolescent Girls Aged 14-19 years.

Table 4.2 shows the summary of the food categories as obtained from the questionnaire. The participants in day school and boarding school sections consumed foods from different food groups which included; starches, pulses (legumes), fruits, milk and milk products, meat, eggs and fats.

The foods regularly consumed from the carbohydrate group were: bread/bun/roll (28% day school section and 18% boarding school section); breakfast cereals (30%-day school section and 62% boarding school section); nshima (58%-day school section and 68% boarding school section). Participants in the day school section reported consuming pulses (legumes); beans and soya a few times/monthly (12%); weekly (42%); and almost daily (27%) compared with 13%, 34%, and 50% of the boarding school section respectively. In addition, boarding school section participants ate more legumes (pulses) than day school section participants in their meal plan.

Adolescent girls in the day school section consumed more meats than adolescents in the boarding school section. Day school section participants reported consuming chicken with skin more times/monthly (16%); weekly (51%); and almost daily (24%) compared with 15%, 60%, and 11% of the boarding school section respectively. Day school learners reported consuming more eggs in their meal plan than boarding school learners with 47% day school and 76% boarding school section reporting that they have not consumed eggs in a one month period.

Table 4.2 Frequency of foods consumed by adolescent girls aged 14-19 years

Food type	Day Frequency of food intake				Boarding Frequency of food intake			
	Never n(%)	Monthly n(%)	Weekly n(%)	Daily n(%)	Never n(%)	Monthly n(%)	Weekly n(%)	Daily n(%)
Starch Staples								
Bread/buns/rolls	5 (6)	11 (13.3)	44 (53)	23 (27.7)	1 (0.8)	6 (4.8)	95 (76)	23 (18.4)
Breakfast cereals; maize, cassava	11(13.3)	13 (15.7)	34 (41)	25 (30.1)	3 (2.4)	22 (17.6)	23 (18.4)	77 (61.6)
Potatoes; cooked, fried	40(48.2)	13 (15.7)	16 (19.3)	14 (16.9)	108(86.4)	11 (8.8)	2 (1.6)	4 (3.2)
Nshima; maize meal	10 (12)	5 (6)	20 (24.1)	48 (57.8)	8 (6.4)	16 (12.8)	16 (12.8)	85 (68)
Pulses								
Legumes; beans, soya	16(19.3)	10 (12)	35 (42.2)	22 (26.5)	4 (3.2)	16 (12.8)	43 (34.4)	62 (49.6)
Fruits								
Fresh Fruits	27(32.5)	16 (19.3)	25 (30.0)	15 (18.0)	87 (69.6)	27 (21.6)	5 (4.0)	6 (4.8)
Milk and Milk products								
Full cream	14 (16.9)	15 (18.1)	28 (33.7)	26 (31.3)	21 (16.8)	20 (16.0)	30 (24.0)	54 (43.2)
Meat								
Chicken with skin	8 (9.6)	13 (15.7)	42 (50.5)	20 (24.0)	17 (13.6)	19 (15.2)	75 (60.0)	14 (11.2)
Fried Fish	41 (49.4)	12 (14.5)	21 (25.2)	9 (10.8)	100(80.0)	11 (8.8)	9 (7.2)	5 (4.0)
Fats								
Eggs: scrambled	39 (47.0)	7 (8.4)	21 (25.3)	16 (19.2)	95 (76.0)	13 (10.4)	12 (9.6)	5 (4.0)
Soft Margarine	47 (56.6)	13 (15.7)	13 (15.7)	10 (12)	99 (79.2)	5 (4.0)	14 (11.2)	7 (5.6)
Mayonnaise	29 (34.9)	9 (10.8)	25 (30.0)	20 (24.0)	22 (17.6)	14 (11.2)	46 (36.8)	43 (34.4)
Fast Foods; pies, sausage rolls	42(50.6)`	17 (20.5)	13 (15.7)	11 (13.3)	101(80.8)	12 (9.6)	9 (7.2)	3 (2.4)

4.2.1 Comparison of food intake between day school and boarding school participants

To compare the frequency of food intake between day and boarding school participants, Mann-Whitney U test was used. Significant differences were observed in the frequencies of consumption of all foods consumed by girls in the day and boarding school section. The ranks are useful as they indicate which group is considered as having the higher frequency of food intake. Overall the group

with the highest mean rank connotes higher frequency of food intake. The p-value ($p<0.05$) shows the actual significance value of the test.

Table 4.2.1 shows that the frequency of intake of starch cereals (maize, cassava) was significantly lower for day group than for boarding group ($U=3099.5$, $p<0.001$) and the frequency of intake of potatoes was significantly higher for day group than for boarding group ($U=3085.5$, $p<0.001$). In the vegetable group, the frequency of fresh fruit intake was significantly higher for day than for boarding ($U=2886$, $p<0.001$).

Additionally, the frequency of intake of foods such as chicken with skin, fried fish, polony, organ meats, scrambled eggs, fast foods (such pies, potato chips), scones, Jam, honey and yoghurt was significantly higher in day than boarding group. Whereas the frequency of intake of legumes/pulses, tinned fish, mayonnaise, soft margarine, cookies for instance commercial biscuits, tomato sauce and peanut butter was significantly higher amongst boarding school adolescents.

Table 4.2.1 Comparison of food intake between day school and boarding school participants

Variable		Mean Rank	Sum of ranks	Mann Whitney U	P-value
Starch cereals (maize, cassava, etc)	Day School	79.34	6585.5	3099.5	0.000
	Boarding School	121.2	15150.5		
Potatoes: cooked, fried	Day School	129.83	10775.5	3080.5	0.000
	Boarding School	87.68	10960.5		
Legumes: beans	Day School	79.7	6615	3129	0.000
	Boarding School	120.97	15121		
Fresh fruit (any type)	Day School	132.23	10975	2886	0.000
	Boarding school	86.09	10761		
Chicken with skin	Day School	119.01	9877.5	3983.5	0.003
	Boarding school	94.87	11858.5		
Fried fish	Day School	124.87	10364	3497	0.000
	Boarding school	90.98	11372		
Tinned fish	Day School	90.11	7479.5	3993.5	0.004
	Boarding school	114.05	14256.5		
Cold meat e.g Polony	Day School	113.07	9385	4476	0.015
	Boarding school	98.81	12351		
Organ meat e.g liver	Day School	120.28	9983	3878	0.000
	Boarding school	94.02	11753		
Eggs: scrambled, fried	Day School	125.73	10435.5	3425.5	0.000
	Boarding school	90.4	11300.5		
Soft margarine (in a tube)	Day School	117.89	9784.5	4076.5	0.001
	Boarding school	95.6	11951.5		
Mayonnaise normal fat	Day School	91.19	7568.5	4082.5	0.008
	Boarding School	113.34	14167.5		

Fast Foods and takeaway	Day School	124.21	10309.5	3551.5	0.000
	Boarding School	91.41	11426.5		
Fast Foods Potatoes chips	Day School	132.63	11008.5	2852.5	0.000
	Boarding school	85.82	10727.5		
Fast Foods: Fried Chicken	Day School	116.86	9349	3891	0.006
	Boarding school	94.13	11766		
Scones, cake	Day School	126.64	10258	3188	0.000
	Boarding school	88.5	11063		
Cookies; commercial e.g biscuits	Day School	93.43	7567.5	4246.5	0.048
	Boarding school	110.03	13753.5		
Tomato sauce	Day School	88.96	7205.5	3884.5	0.004
	Boarding school	112.92	14115.5		
Peanut butter	Day School	84.67	6858	3537	0.000
	Boarding school	115.7	14463		
Jam, honey	Day School	120.18	9734.5	3711.5	0.000
	Boarding school	92.69	11586.5		
Drinking yoghurt	Day School	125.15	10137	3309	0.000
	Boarding school	89.47	11184		

4.3 Nutritional Status of Adolescent Girls Aged 14-19 years.

In Table 4.3, ninety-four percent (n=78) of adolescent girls in day school section were normal weight compared to (88%, n=110) in boarding school section. A total of (90%, N=188) were of normal weight. The prevalence of normal weight was reported to be higher in the day school section than the boarding school section. Overall, a higher prevalence of overweight was observed in the boarding school section (12%, n=15) than the day school section (5%, n=4); (9%, n=19) of the girls were overweight. However, only one percent of adolescent girls were obese representing the day school section.

The prevalence of stunting was higher in the day school section (3.6%, n=3) than the boarding school section (3.2%, n=4) and overall (0.5%, n=1) girls were severely stunted in the population. Ninety-five percent (n=79) of the girls in the day school section and 97% (n=121) in the boarding school section were of normal height.

Table 4.3 BMI for age of Adolescent Girls 14-19 years

Variable	Day n (%)	Boarding n (%)	Total N (%)
Body Mass Index z scores (kg/m^2)			
Underweight	0 (0.0)	0 (0.0)	0 (0)
Normal weight	78 (94.0)	110 (88.0)	188 (90.4)
Overweight	4 (5.0)	15 (12.0)	19 (9.0)
Obese	1 (1.0)	0 (0.0)	1 (0.5)
Height z score category (HAZ)			

Severely Stunted	1 (1.2)	0 (0.0)	1 (0.5)
Stunted	3 (3.6)	4 (3.2)	7 (3.4)
Normal	79 (95.2)	121 (96.8)	200 (96.2)

4.4 Relationship between Nutritional Status and Age at Menarche of Adolescent Girls.

In order to determine the relationship between nutritional status and age at menarche correlation analysis was performed using spearman rank order. Table 4.4 shows that there was a negative significant correlation between BMI-for age and age at menarche (rho = - 0.178, p = 0.010). However, no significant relationship between nutritional status of adolescent girls aged 14-19 years and their age (rho = 0.090, p = -0.197). The difference in the BMI could be as a result of the higher food intake in boarding school section than in day school section.

Table 4.4 Relationship between Nutritional Status and Age at Menarche

	BMI-for Age		
Variable	Correlation	P-Value	N
Age at menarche	-0.178	0.010	208
Age	0.090	0.197	208

4.5 Nutritional Status and Food Intake of Day vs Boarding School Participants

In order to compare the nutritional status of the two groups (day school section and boarding school section), the independent sample t-test was conducted using the BMI continuous variable. The mean BMI for the day school section participants (mean = 3.07, standard deviation = 0.304) was observed to be slightly lower compared to that of boarding school section (mean 3.12, standard deviation = 0.326) counterparts. No statistically significant difference in the mean BMI between the two groups (t= -1.061, p = 0.290) was observed. Therefore, it can be concluded that the two groups essentially are of the same nutritional status because the difference is so minimal such that it cannot be statistically quantified.

4.6 Determinants of Nutritional Status

In order to determine the influence of demographic factors, socio-economic factors and food groups on nutritional status, logistic (bivariate) regression analysis was conducted.

The odd (0.911) for age of adolescent girls as shown in Table 4.4 was shows that a unit increase in age leads to a decline of (0.911-1) x 100% = 8.9% in the odds of increase in BMI. Thus, a higher value in age is associated with a decrease in BMI. The odds (0.798), of age at menarche imply that a unit increase in age at menarche leads to a decline of (0.798-1) x 100% = 20.2% in the odds of increase in BMI. Thus, a high value in age at menarche is associated with a decrease in BMI.

The odds of being normal weight were higher in adolescent girls whose guardians' were employed than in those who had never been employed. However, guardian employment status (b= 0.497, p=0.696) did not significantly predict BMI. The odd (β) = (1.643) of guardian's employment status imply that a unit increase in guardians' employment leads to an increase of (1.643-1) x 100% = 64.3% in the odds of increase in BMI. Thus, a high value in guardian's employment status is associated with an increase in BMI.

All the food groups did not add significantly to the model. The results in Table 4.4 further shows that the odds in starches, milk products, meats, eggs, fats, fast food and beverage drinks were higher.

The odd of starch cereals (β) = (1.046) indicates that a unit increase in starch cereals intake leads to an increase of (1.046-1) x 100% = 4.6% in the odds of increase in BMI. Thus, a high value of starch cereals is associated with an increase in the BMI.

Table 4.5 Determinants of Adolescent girls' Nutritional Status

Variable	B	Standard Error	Wald	Df	P-value	Exp(B)
Socio-demographic						
Age	-0.093	0.233	0.159	1	0.690	0.911
Age at menarche	-0.226	0.256	0.776	1	0.378	0.798
Guardian highest educational level	-0.225	0.841	0.072	1	0.789	0.798
Guardian employment status	0.497	1.270	0.153	1	0.696	1.643
Food Groups						
Starches	0.045	0.062	0.518	1	0.472	1.046
Vegetables and fruits	-0.044	0.049	0.802	1	0.371	0.957
Milk products	0.104	0.092	1.279	1	0.258	1.109
Meats	0.061	0.043	2.021	1	0.155	1.063
Eggs	0.021	0.124	0.030	1	0.862	1.022
Fats	0.008	0.064	0.017	1	0.897	1.008
Fast foods	-0.234	0.128	3.342	1	0.068	0.791
Other foods	-0.066	0.037	3.253	1	0.071	0.936
Beverage Drinks	0.072	0.101	0.500	1	0.479	1.074

4.6 Relationship between socioeconomic factors and food intake of adolescent girls 14-19 years of age.

Spearman rank correlation was run to predict the relationship between consumption of food by guardian's highest educational level and employment status.

Table 4.6 shows that the frequency of starch (bread/buns/rolls) consumption was negatively related with education (rho= -0.078, p=0.260) while positively related with employment (rho= 0.167, p=0.016). The frequency of potato consumption related negatively with education (rho= -0.355, p<0.001) and positively with employment (rho= 0.359, p<0.001). The frequency of legumes consumption positively correlated with education (rho= 0.195, p=0.005) and negatively correlated with employment (rho= -0.191, p=0.006). The frequency of consuming vegetables with peanut sauce negatively related with education (rho= -0.109, p=0.118) and positively related with employment (rho= 0.015, p=0.834) with no significant association reported. Frequency of consuming fresh fruit was positively related to employment (rho= 0.244, p<0.001) while a negative relationship with education (rho= - 0.249, p<0.001) was reported.

The frequency of consumption of full cream (milk, sour milk) positively related with education (rho= 0.170, p=0.014) and negatively related with employment (rho= -0.152, p=0.028). No significant relationship was observed between the frequency in consumption of red meat and education (rho= -0.025, p=0.724). However, a positive relation was observed in the frequency of consumption of red meat and employment (rho=0.104, p= 0.133). Fried fish negatively related with education and positively with employment. The frequency of consumption of mayonnaise related positively with education (rho= 0.234, p=0.001) and negative with employment (rho= -0.314, p<0.001). The frequency of consumption of all fast foods (pies, potato chips fried chicken) negatively related with education and related positively with employment. There was a positive relationship between the frequency of consuming scones (cake) and employment (rho= 0.232, p=0.001). A positive relationship also existed between the frequency of consumption of cookies (biscuits) and education (rho= 0.221, p=0.001). The frequency of consumption of tomato sauce positively related with education (rho=0.260, p<0.001) and negatively related with employment (rho= -0.256, p<0.001). Further, results from a chi-square test showed that there was no significant association between the girls' nutritional status and the guardians' employment status (p=0.500) and guardians' educational status (p=0.491).

Table 4.6 Relationship between guardian's highest education and employment level and food intake of adolescent girls.

	Guardian's Education		Guardian Employment	
Food Variables	Spearman (rho)	P-value	Spearman (rho)	P-value
Starch (buns/buns/rolls)	-0.078	0.260	0.167	0.016
Starch cereals (maize, cassava)	0.065	0.348	-0.152	0.029
Potatoes: cooked, fried	-0.355	0.000	0.359	0.000

Nshima: breakfast meal etc	0.053	0.450	-0.067	0.338
Legumes/Pulses: beans, soya	0.194	0.005	-0.191	0.006
Vegetables (with peanut source)	-0.109	0.118	0.015	0.834
Fresh fruit (any type)	-0.249	0.000	0.244	0.000
Full cream (milk, sour milk)	0.170	0.014	-0.152	0.028
Red meat e.g beef without visible fat	-0.025	0.724	0.104	0.133
Red meat e.g game meat	-0.064	0.355	0.192	0.005
Chicken with skin	-0.046	0.505	-0.043	0.535
Fried fish	-0.267	0.000	0.282	0.000
Tinned fish	0.169	0.015	-0.149	0.031
Cold meat e.g Polony	-0.164	0.018	0.182	0.009
Organ meat e.g liver	-0.179	0.010	0.220	0.001
Eggs: scrambled, fried	-0.197	0.004	0.334	0.000
Soft margarine	-0.142	0.041	0.145	0.036
Mayonnaise: normal fat	0.234	0.001	-0.314	0.000
Fast food take away: pies	-0.218	0.002	0.203	0.003
Fast food: potato chips	-0.302	0.000	0.311	0.000
Fast food: fried chicken	-0.170	0.015	0.138	0.048
Scones, cake	-0.205	0.003	0.232	0.001
Cookies: commercial biscuits	0.221	0.001	-0.122	0.082
Tomato sauce	0.260	0.000	-0.256	0.000
Peanut butter	0.217	0.002	-0.168	0.015
Drinking Yoghurt	-0.168	0.016	0.212	0.002

CHAPTER FIVE: DISCUSSION

The current study was conducted to assess dietary intake and nutritional status of adolescent girls in a rural boarding and day secondary school.

5.1 Nutritional Status of Adolescent Girls Aged 14-19 Years

The findings in the present study show the overall prevalence of overweight in day school and boarding school learners at 19%. This could be as a result of consumption of certain foods such as fatty foods and fast foods which are known to contribute to obesity.

These results are not in harmony with the findings by Bwalya (2015) in a national study which revealed that 7.0% adolescent girls aged 15-19 years in Zambia were overweight. The current findings are inconsistent with the study findings by Audain, Veldman and Kassier (2015) who reveal that the overweight prevalence in urban school girls was 16.7% and 33.3% in peri-urban adolescent girls.

The findings are also inconsistent with the Zambia Demographic and health survey which reveals that 7.5% adolescent girls aged 15-19 years in Zambia were overweight (Central Statistical Office (CSO), Ministry of Health (MoH), 2014).

The study findings show that no girl was underweight. This finding is consistent with a study by Jaacks, L.M., Slining, M.M. and Popkin, B.M., (2015) which revealed that the rural areas of Zambia noted a negative 1.17% annual decrease in adolescent underweight. The Zambia Demographic and health Survey also shows that 16.4% adolescent girls aged 15-19 years were underweight (CSO et al, 2014) however this finding includes both rural and urban areas. A study in South Africa by Monyeki *et al* (2015) shows that undernutrition is attributed to food insecurity in rural areas and delayed puberty. In the same study, over nutrition was higher in adolescent girls due to lack of physical activity, access to fast foods and increased consumption of energy dense foods.

Low underweight prevalence in this study can be attributed to high guardian employment and education status which have an impact on socio economic changes which increases availability and access to a variety of foods.

The study findings show the prevalence of stunting was higher in the boarding school section and only one girl was severely stunted in day school. The stunting results in the current study is contrary to other findings in low-and-middle-income countries which indicate that stunting is a problem

amongst adolescents. For example, in a study to assess the prevalence of stunting among adolescent girls in Dibrugarh city, Boruah, Ahmed and Sarmah (2017) reveal that the prevalence of stunting was 42.2% and that guardian education attributed to this.

A study by Kola-Raji, Balogun and Odugbemi (2017) in Western Nigeria compared the nutritional status of adolescent girls and boys in a private and public boarding school; the results showed that 2.5% adolescents in private school and 8.4% adolescents in public school were stunted. The same authors reveal that 45.3% male adolescents in public school were underweight and various studies have shown that stunting in rural areas is evident amongst male adolescents.

In the present study, low prevalence of underweight and stunting signifies that chronic malnutrition is not a problem, this can be attributed to the fact that most of the adolescent girls have parents with a source of income and can afford to purchase food for them.

5.2 Relationship between Nutritional Status (BMI for age) and Age at Menarche of Adolescent Girls.

Nutrition plays an important role in age at menarche which can be arrived at earlier if adolescents are well nourished (Goyal, Mehta and Kaur, 2012). BMI and age at menarche are important indicators used to determine nutritional status of adolescent girls (Juliyatmi and Handayani, 2015). BMI is an important pointer for nutrition assessment in that early onset of puberty is often associated with a high BMI and delayed menstrual appearance leads to cycle ailments and conception problems as a result of low BMI (Juliyatmi and Handayani, 2015).

The findings of this study show a significant negative relationship between BAZ and age at menarche. A study of 350 adolescent girls in Kerala, India revealed a statistically significant association with BMI and age at menarche due to high guardian social economic status (Saritha and Vimala, 2015).

5.3 Dietary and Socioeconomic Factors Influencing Nutritional Status of Adolescent Girls Aged 14-19 years.

The findings reveal that day school learners consumed a variety of foods compared to boarding school participants because boarding school learners have limited access to food variety as they mostly consume foods provided by the school. The results are consistent with study findings by Ogunkunle and Oludele (2013) in South-West Nigeria, where the frequency of starchy staples consumption was 32.5% amongst adolescent girls and the consumption frequency of fruits and vegetables was 8.9% and 14.2% respectively.

Another study by Ceaser de Andrade *et al.*, (2016) revealed that adolescents have in recent years decreased consumption of fruits and vegetables and that there has been a decline in healthy foods as well as overconsumption of sugary beverages where more than 10% of total energy is obtained.

Socioeconomic factors such as, guardian education and employment influence consumption patterns of adolescents which in turn had an impact on the nutritional status of the adolescent girls in the study population. Studies have shown that socioeconomic status (SES) is an important determinant of dietary trends particularly in low-and middle-income countries (LMICs) (Robinson-Cohen *et al.*, 2011). Marques-vidal *et al.*, (2014) reveal that SES is the most important health determinant in LMICs and a distinction can be made by this factor in that, individuals of high-SES have a tendency to consume healthier diets that consist of whole grains, lean meats, fish, fruits and vegetables.

Guardian education and employment status had a positive outcome on high BAZ for adolescent girls in a study in Japan involving two cities and a study population of 2,968 adolescents (Mizuta, Fujiwara and Ojima, 2016). The same authors reveal that obesity was due to low SES and inversely, guardian employment was a determinant of the types of foods consumed by adolescents.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The study established a difference in dietary intake between the day and boarding school adolescent girls. In the day school section, consumption of bread, potatoes, meats, eggs, fruits and fast foods was higher and more frequent on a weekly bas Consumption trends of this nature can be a contributing factor to the prevalence of overweight in this population. Adolescents in the boarding school section consumed foods such as breakfast cereals, nshima, beans and tinned fish more frequently than learners in the day school section. Fruits and vegetables were rarely consumed by these adolescent girls which may result in micronutrient deficiency if measures are not put in place.

The study established that the adolescent girls in the study population had a normal weight status, the majority being in day school. Underweight status was not detected in the study. The study established a low prevalence of both overweight and obesity and overweight prevalence was higher in the boarding school section. The study also revealed a very low prevalence of stunting amongst adolescent girls, an indication that chronic malnutrition was not a problem in the study population.

Lastly, the study established a negative relationship between nutritional status and age at menarche, an indication that age at menarche had no impact on the nutritional status of adolescents in the study population.

6.2 Recommendations

Based on the findings of this study, the following recommendations are made; an introduction of nutrition education in schools that would aim at increasing knowledge of adopting healthy eating habits that discourage consumption of saturated fats and fast foods as these are detrimental to health in view of NCDs.

The study recommends future studies to compare dietary intake and nutritional status of adolescent girls in a rural and urban boarding school in order to assess which population is at risk of undernutrition. This study further recommends future studies to measure micronutrient levels such as iron in adolescent girls because micronutrients are important in the reproductive development of adolescents.

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APPENDICES

Appendix 1: Participant information Sheet

INFORMATION FOR ADOLESCENTS AGED 14-19 YEARS

Title of Study:

A Comparative Assessment of Day and Boarding Adolescent Girls on their Dietary Intake and Nutritional Status at Mukamambo II Girls Secondary School in Chongwe District, Lusaka Province, Zambia.

This information Sheet is for Adolescent Girls Aged 14-19 years attending Mukamambo II girls secondary school and who we are inviting to take part in this research study.

Introduction

I am an MSc Nutrition student at the University of Zambia whose aim is to promote health through nutrition. I would like to explore issues that affect access to adequate dietary needs and good nutrition for adolescent girls in Zambia.

I am inviting you to be part of this research because you are an adolescent girl aged between 14 and 19 years, and we believe your experiences will bring great insight on the topic of interest.

If there is anything you do not understand about the details of this project, please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can still ask me or any other member of the research team.

Purpose of the research

Poor nutrition is major challenge affecting adolescent girls in Zambia. However, information is lacking on barriers facing adolescent girls in accessing the key services and support for adequate nutrition. With our research we hope to gather information from adolescent girls that will help us understand the different constraints and barriers surrounding adequate nutrition for adolescent girls. This information will help in guiding programs that aim at giving girls better nutrition and healthier lives. To do that, we would like to ask you questions about types of foods consumed and how often these foods are consumed, questions pertaining to socioeconomic status that may influence dietary intake and nutritional status of adolescent girls.

Participant Selection

You are being invited to take part in this research because you are an adolescent girl, you live in the area of interest for the research and we feel that your answers will help us better understand issues surrounding nutrition in adolescents here in Zambia. Not all adolescent girls will participate in the study. Those selected have been selected purely by random. Every adolescent girl had an equal chance of being selected to participate.

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. The choice that you make will have no consequences on anything related to your life. You may change your mind later about participating even if you agreed earlier.

Right to Refuse or Withdraw

You may stop participating in the interview at any time that you wish without your life being affected in any way. You are free not to answer some that you do not want to answer or that you feel are too personal.

Duration

The research participation will take approximately 45 minutes to an hour for us to ask you questions.

Benefits

There may be no direct benefit to you, but your participation is likely to help us find out more about issues of nutrition support in adolescent girls in your community. This information may in the future help in ensuring that adolescents have better access to nutrition services and support, as well as adequate nutrition.

Reimbursements

You will not be provided any incentive for taking part in the research.

Confidentiality

The research being done in the community will get information from you about yourself and the community. We will not be sharing information about you to anyone outside of the research team. The information that we collect from this research project will be kept private. No identifying information will be collected or revealed.

Sharing the Results

Nothing that you tell us will be shared with anybody outside the research team and your name won't be linked to the information you share. The knowledge that we get from this research will be shared with the University of Zambia.

Who to Contact

If you have questions later, you may contact:

Wila Zambezi

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Great East Road Campus, Lusaka

Mobile: +260-975-361-868

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Appendix 2: Assent Form

ASSENT FORM FOR YOUNG ADOLESCENTS

Project title: *A Comparative Assessment of Day and Boarding Adolescent Girls on their Dietary Intake and Nutritional Status at Mukamambo II Girls Secondary School in Chongwe District, Lusaka Province, Zambia.*

The information has been read to me. I understand that the research project is trying to assess dietary intake and its effect on nutritional status of adolescent girls like me. I was given time to ask questions about it and any questions I have asked have been answered.

I understand that if I decide to participate in the study, I will be asked questions as an individual or with my friends on issues relating to diet and nutrition in adolescent girls.

I understand that it is I to decide whether or not to take part in the study. I also understand that my name will not be revealed in any way. I also understand that I'm free to withdraw from the study at any time if I do not want to continue with my participation. I'm also free not to answer any questions that I feel are too personal or sensitive.

I understand that if I want to talk to the people who are in charge of this project I can contact Ms. Wila Zambezi on +260975361868.

If I have any complaints or questions about the research during the study period, I can also call UNZABREC on numbers shown below.

Agreement

I have decided to take part in the study even though I know that I don't have to do it. The interviewer has answered all my questions.

Name of participant: _____

_____ _____

Signature of Study Participant Date

_____ _____

Signature of Researcher

Thumbprint of study participant Date

Wila Zambezi

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Appendix 3: Data Collection Tool

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF FOOD SCIENCE AND NUTRITION

A Comparative Assessment of Day and Boarding Adolescent Girls on their Dietary Intake and Nutritional Status at Mukamambo II Girls Secondary School in Chongwe District, Lusaka Province, Zambia.

QUESTIONNAIRE FOR ADOLESCENT GIRLS

Instructions

I. This questionnaire is to be administered to adolescent girls aged between 14 and 19 years old. Before administering the questionnaire to the girls, please do the following: i) Introduce yourself and state why you are there, ii) Ask her if she has any questions iii) Read the consent form to her and ask her if she has any questions. If not, ask her to sign the consent form, iv) Proceed with the interview.

Date of interview: _____

SECTION A: SOCIAL DEMOGRAPHIC CHARACTERISTICS

1. ID number of participant: _____
2. District
   (a) Chongwe
   (b) Lusaka
3. Type of residence
   (a) Rural
   (b) Urban
4. Name of Village or local geographical area: _____
5. Age of participant: _____years.
6. At what age did you get your first period? _____
7. What grade are you? _____
8. Are you married?
   (a) Yes
   (b) No
9. Who is keeping you at home?
   (a) Father and mother.
   (b) Father only.
   (c) Mother only.
   (d) Husband.
   (e) Myself.
   (f) A relative (uncle, aunt, grandparents, brother, sister, etc).
   (g) Other (e.g. family friend, church mate, etc).

10. What is the highest level of education attained by the person keeping you?

    (a) Primary (Grade 1 to 7)

    (b) Secondary (Grade 8 to 12)

    (c) Tertiary (College, university)

Personal factors related to adolescent eating behaviors

11. Is it a common practice here to have breakfast every morning?

    (a) Yes

    (a) No

12. Do you always have breakfast yourself every morning?

    (b) Yes

    (b) No

13. Do you prepare or buy any simple meals (snacks) for the times that you are in school?

    (c) Yes

    (c) No

14. Do you know how to choose healthy foods?

    (d) Yes

    (d) No

SECTION B: ANTHROPOMETRY

15. Height: ……..

16. Weight: …….

17. BMI: …….

SECTION C: FOOD FREQUENCY QUESTIONNAIRE

Instructions

- Look at the food item list (column 1)
- Think back carefully over the past month and determine how often you ate each item
- If you eat/drink a specific item less than once a month, mark the Never/<1/ month column.
- If you do eat/drink it more regularly, decide how often you eat it per month, OR per week, OR per day and make a cross (X) in the column which best applies to each item in the food list.
- Only make one cross (X) for each item in the list e.g. for each row in the table.

	Never/ <1/ month	**1-3/ month**	**1/ week**	**2-4/ week**	**5-6/ week**	**1/ day**	**2-3/ day**	**4-5/ day**	**6+/ day**
STARCHES									
White or brown bread and/or buns/ rolls									
Whole wheat, health, Low GI, seed bread and/or rolls etc.									
Breakfast cereals or porridge such as All Bran, Muesli, Weet-bix, Oats, etc.									
Breakfast cereals such as Rice Crispies, Cornflakes, Coco Pops, Fruit Loops, Maize meal porridge, Morevite etc.									
Rice, mealie rice, samp									
Pasta: macaroni, spaghetti, noodles									
Potato: cooked, baked, mashed									
Potato: cooked, baked, mashed with fat e.g. margarine added or potato salad									
Legumes e.g. baked beans, kidney beans, dried bean salad/soup, soya mince etc.									
VEGETABLES									

	Never/ <1/ month	1-3/ month	1/ week	2-4/ week	5-6/ week	1/ day	2-3/ day	4-5/ day	6+/ day
Cooked vegetables: any type. (no sugar/ fat/ sauce added)									
Vegetables: any type prepared with sugar/ fat/ sauces e.g. white sauce.									
Mixed salad: lettuce, cucumber, tomato, peppers, onions, mushrooms, carrots in any combination or alone.									
FRUIT									
Fresh fruit (any type)									
Dried fruit (any type)									
Fruit juice									
Fruit salad: fresh or tinned									
	Never/ <1/ month	**1-3/ month**	**1/ week**	**2-4/ week**	**5-6/ week**	**1/ day**	**2-3/ day**	**4-5/ day**	**6+/ day**
MILK, YOGHURT AND CHEESE									
Full cream: milk, yogurt, sour milk, powdered milk (e.g. Nido, Cowbell, Klim)									
Skimmed/ low fat/2%: milk, yogurt, sour milk (maas)									
Coffee creamer: in tea/coffee e.g. cremora									
Milk drinks: Milo, Nesquik, Cocoa									
Cheese: gouda, cheddar, cheese spread									
MEAT, FISH, CHICKEN									

	Never/ <1/ month	1-3/ month	1/ week	2-4/ week	5-6/ week	1/ day	2-3/ day	4-5/ day	6+/ day
Red meat e.g. beef, mutton, pork. (Eat meat and visible fat)									
Red meat e.g. beef, mutton, pork. (Eat meat, but remove visible fat)									
Red meat e.g. Game meat									
Chicken/turkey: with skin									
Chicken/turkey: without skin									
Fried fish in any fat or oil, with or without batter/crumbs.									
Fish: steamed, grilled, braaied (fire)									
Fish: tinned sardines, pilchards, salmon, tuna									
Sausages: Vienna's, Russians, frankfurter									
Cold meat: polony, salami, etc. & bacon									
Organ meat e.g. liver, kidney, tripe									
Eggs: cooked or poached									
Eggs: scrambled, baked, omelettes									
FATS									
Soft margarine (in a tub)									
Butter/hard margarine, ghee									
Cooking oil e.g. sunflower oil									

	Never/ <1/ month	1-3/ month	1/ week	2-4/ week	5-6/ week	1/ day	2-3/ day	4-5/ day	6+/ day
Dripping									
Fat e.g. Holsum									
Salad dressing, mayonnaise: normal fat									
Salad dressing, mayonnaise: lite/ low fat									
	Never/ <1/ month	**1-3/ month**	**1/ week**	**2-4/ week**	**5-6/ week**	**1/ day**	**2-3/ day**	**4-5/ day**	**6+/ day**
FAST FOODS AND TAKE AWAYS									
Pizza									
Pies & Sausage rolls									
Potato chips (French fries)									
Fried Chicken									
Fried fish									
Hot dogs									
Hamburgers (= bun and meat or chicken patty) etc.									
OTHER									
samoosas, meat pies, sausage rolls, dough-nuts									

	Never/ <1/ month	**1-3/ month**	**1/ week**	**2-4/ week**	**5-6/ week**	**1/ day**	**2-3/ day**	**4-5/ day**	**6+/ day**
Muffin, scones, cake									
Cookies: commercial or homemade: e.g. oat, crunchies, shortbread									
Chips: Nik naks, Lays, Simba etc.									
Energy bars, health bars, breakfast bars									
Chocolate									
Ice cream									
Cheese sauce, white sauce, meat sauces									
Tomato sauce, chutney, mustard, sweet chilli sauce									
Sweets e.g. jelly tots, sour worms									
Nuts and peanuts									
Peanut butter									
Chocolate spread									
Jam, syrup, honey									
	Never/ <1/ month	**1-3/ month**	**1/ week**	**2-4/ week**	**5-6/ week**	**1/ day**	**2-3/ day**	**4-5/ day**	**6+/ day**
DRINKS									
Beer, ciders, coolers e.g. castle, black label, hunters dry, Savanna, Smirnoff etc.									

	Never/ <1/ month	1-3/ month	1/ week	2-4/ week	5-6/ week	1/ day	2-3/ day	4-5/ day	6+/ day
Beer, cider, cooler diet/ light e.g. Savanna light									
Spirits: e.g. brandy, whisky, rum, vodka, gin.									
Cocktails									
Fizzy soft drinks: e.g. Coke, Fanta									
Fizzy diet soft drinks: e.g. Coke lite etc.									
Energy drinks e.g. Energade, Powerade									
Milkshake									
Drinking yoghurt									
EATING PLACE									
In general, how often do you eat out e.g. restaurant, take-aways, hotel, etc.									
Whilst in school, how often do you take food from your home with you to eat during the day.									
Whilst in school, how often do you buy food to eat during the day.									