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**THE ANALYSIS OF THE EVOLUTION OF MICROFINANCE
INSTITUTIONS IN GHANA**

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MALNUTRITION IN ADOLESCENT GIRLS IN GHANA

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Declaration

I confirm that work in this thesis titled “Malnutrition in Adolescent Girls in Ghana” is original and has been carried out by me as part of my programme of study. I also confirm that all secondary materials has been properly acknowledged by me and referenced in this work with the help of my supervisor.

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ABSTRACT

Malnutrition is one of the major health issues challenging sub Saharan Africa of which Ghana is included. Good nutrition in adolescent girls is important as it helps to determine the health status, physical growth and later progress in life. Proper nutrition is the right of every child for developing essentially and having a quality life. The issue of malnutrition does not only affect the nutritional status of an individual but also impede the economic and social development of a country. The adolescent girls of today are future potential mothers of very country, it of upmost importance that their wellbeing is greatly considered both on the household and national. The study was aimed at evaluating the weight and height of adolescents and also assess the dietary intake of the girls

Adolescent girls were selected randomly selected from three basic schools. A total of 120 adolescent age 10-15 years and 120 caregiver were surveyed for the study. Data was collected by administrating pre-tested questionnaires to both the adolescents and their caregivers. Height and weight were measured and dietary intake were obtained using the dietary questionnaire.

The result from the study indicated that there was on significant p (>0.034) on the caregivers knowledge on the BMI of adolescents. Adolescents had normal BMI but were stunted in accordance with the WHO scale. Age 10 had a mean BMI for 15.9 kg/m² and mean of height of 124.8 cm. Girls who were 11 years had a mean BMI and mean height of 17.3 kg/m² and 130.1 cm .The mean BMI and height for 12 years was 18.4kg/m² and 139.4 cm, who were those 13 years had a mean BMI and height of 19 .1 kg/m² and 144.3 cm. The group of 14 years mean BMI of 18.8 kg/m² and that of mean height was 145.1 cm, mean BMI and height for 15 years was 18.4 kg/m² and 149.6 cm. Diets lack diversity, carbohydrate was the most consumed food commodity. This may contribute to nutrient deficiency. It is recommended that there should be a nationwide awareness on malnutrition in adolescent girls.

Keywords: Adolescent, Malnutrition, Caregiver, BMI, Weight, Height, Dietary, Knowledge, Ghana.

CONTENTS

1. INTRODUCTION	1
1.2 LITERATURE REVIEW	2
1.2.1 Defining Malnutrition	2
1.2.2 Causes of Malnutrition.....	3
1.2.3 Undernutrition.....	7
1.2.4 Protein Energy Malnutrition (PEM)	8
1.2.5 Micronutrient deficiencies	9
1.3 Adolescent girls in developing countries	10
1.3.1 Menarche.....	11
1.3.2 Nutritional needs of adolescent girls.....	11
1.4 Macronutrient requirements for adolescent girls	12
1.4.1 Carbohydrates	13
1.4.2 Protein.....	13
1.4.3 Fat	14
1.4.4 Fibre.....	14
1.4.5 Water.....	15
1.5 Micronutrient requirements and food sources of adolescent girls	15
1.5.1 Vitamin A.....	15
1.5.2 Vitamin B6.....	16
1.5.3 Vitamin B12 (Cobalamin).....	16
1.5.4 Vitamin C.....	16
1.5.5 Vitamin D (Calciferol).....	17
1.5.6 Iron (Fe)	17
1.5.7 Calcium (Ca).....	17
1.5.8 Phosphorus (P)	18
1.5.9 Iodine	18
1.5.10 Zinc	18
1.6 Methods of determining the nutritional status of adolescents.....	19
1.6.1 Anthropometry	19
1.6.2 Body mass index (BMI).....	19
1.6.2 Height measurements.....	19
1.7 Overview of malnutrition in Ghana	19

2. AIMS OF THE THESIS	21
3. MATERIALS AND METHODS.....	22
3.1 Participants.....	22
3.2 Sample selection	22
3.3 Study area.....	22
3.4 Data collection techniques	23
3.4.1 Socio-economic data	23
3.4.2 Dietary intake.....	24
3.5 Anthropometry measurements	24
3.5.1 Weight measurements	24
3.5.2 Height measurement	24
3.6 Data analysis and presentation.....	26
4. RESULTS	27
4.1 Adolescents menarche	27
4.2 Knowledge on malnutrition	28
4.3 Caregivers	29
4.4 Iodized meal and meal frequency	29
4.5 Response of food consumption.....	31
4.6 Occupation and educational level of caregiver	32
4.7 Empirical analysis of caregiver knowledge of malnutrition on body mass index	34
4.7.1 Anthropometry data	35
5. DISCUSSION.....	36
6. CONCLUSIONS.....	40
7. REFERENCES	41
APPENDICES	Error! Bookmark not defined.

LIST OF FIGURES AND TABLES

LIST OF FIGURES

Figure 1: Map of Greater Accra	23
Figure 2: Number of adolescents at menarche from questionnaire according to the ages.....	28
Figure 3: Adolescent knowledge on malnutrition	28
Figure 4: Caregivers of the adolescents	29
Figure 6: Caregivers occupation from questionnaires.....	32
Figure 7: Basic nutrients knowledge by caregivers from questionnaire	33

LIST OF TABLES

Table 1: Examples of fibres	14
Table 2: Number of adolescents at menarche.....	27
Table 3: Use of iodized salt in meals from questionnaires	30
Table 4 Number of meals taken in a day from questionnaires	30
Table 5: Meals taken at home from questionnaires	30
Table 6: Response of food consumption from questionnaires	31
Table 7: Educational level of caregivers from questionnaires	33
Table 8: Knowledge of caregivers on malnutrition from questionnaires	33
Table 9: Chi-Square analysis of caregivers knowledge of malnutrition on the BMI of adolescents	34
Table 10: BMI (kg/m ²) and height (cm) of adolescents	35

LIST OF ABBREVIATION

AI	Adequate intake
BMI	Body Mass Index
Ca	Calcium
CBOs	Community Based Organisations
CHO	Carbohydrates
Cm	Centimetre
CVD	Cardiovascular disease
DRI	Dietary Reference Intake
EAR	Estimated Average Requirement
FAO	Food Agricultural Organisation
Fe	Iron
G	Gram
IOM	Institute of Medicine
IQ	Intelligence Quotient
JHS	Junior High School
Kg	Kilogram
m ²	Meters squared
MDGs	Millennium Development Goals
MSCL	Middle School Leaving Certificates
NCDs	Non Communicable Diseases
NICUS	Nutrition Information Centre University of Stellenbosch
O ²	Oxygen
PEM	Protein Energy Malnutrition
PPS	Portable Physician Scales
PUFAs	Polyunsaturated fatty acids
RDA	Recommended Dietary Allowance
SDs	Standard Deviations
SPSS	Statistical Package for Social Sciences

UL	Upper intake level
UN	United Nations
UNICEF	United Nations International Children's Fund
USA	United States of America
WHO	World Health Organisation

1. INTRODUCTION

Malnutrition is a global and a daunting health challenge Leenstra, (2006), its warning signs are only visible during the advanced stage and confirmation about severity needs to be detected by suitable (biochemical) indicators. The term malnutrition refers both to under nutrition and over-nutrition. Under nutrition is perceived by stunting (short for age), wasting (thin for height), and underweight (low weight for age). Most developing countries like Ghana usually suffer from adolescent malnutrition which may include stuntedness, underweight and deficiencies in vitamins and minerals. This period is a time of tremendous growth and development, during which 20% of final adult height, 45% of increments in bone mass and 50% of adult weight are attained (Chen et al., 2012). Girls achieve tremendous physical, mental and emotional maturity during this period. Overall, the nutritional status of female adolescents is critical given close associations that their growth status and reproductive health have with birth outcomes and child survival (Chen et al., 2012). The causes of malnutrition are many, diverse and interrelated with political, social, cultural or economic factors (Fotso, 2006). Some other factors that contribute to malnutrition are education status of the population, urbanisation, prevalence of infectious diseases and the effectiveness of nutrition programs.

Malnutrition as stated by the World Bank (2012) undermines economic growth, perpetuates poverty and deprives the children's right to enjoy life to their full potential, making them vulnerable to abuse and exploitation. Several studies that have been conducted in Ghana have concentrated more on the overall maternal and child nutritional status; and very little has been done on adolescent nutritional status (Bwalya, 2013). Researchers confirm that the seriousness of malnutrition of in life and the outcome is generational and irreparable (Atinmo et al., 2009).

This may be due to the fact that adolescents have been considered a low risk group for poor health and nutrition and often receive scant attention. As a result, all resources directed to children and mothers especially pregnant women (Mulugeta et al., 2009). One way to break the intergenerational cycle of malnutrition is to improve the nutrition of female adolescents prior to conception. The vicious cycle of malnutrition, if not broken, can go on resulting in more severe consequences.

Most developing countries, maternal underweight which may have been avoided during adolescence is the leading risk factor for preventable deaths and diseases (WHO, 2012). Lack of factual knowledge concerning the nutritional status of adolescents from the developing world makes it difficult to know the actual situation. According to the Ghana Demographic And Health 2014 survey in relation to attainment of the MDGs, mother and child mortality has only been reduced by one third but still little is being done to address female adolescent malnutrition. This poses an intergenerational trap for adolescent malnutrition for the foreseeable future as the girl child will grow into undernourished mothers. It is hoped that the information that will be generated will be used to help Ghana and other relevant stakeholders dealing in food and nutrition to incorporate adolescent nutrition as part of their agenda, so that intergenerational malnutrition will be a thing of the past.

1.2 LITERATURE REVIEW

This chapter aims to review existing literature on the above mentioned topic. It will review literature on the relevance of the nutrition of adolescent girls. An overview of previous survey findings of child nutritional status. Most nutrition related studies have investigated the nutritional status of younger children, but not much has been reported about nutritional and health status of adolescents. Poor nutritional status at the adolescent stage is an important determinant of health outcomes at a later stage of life. Several countries in Sub Saharan Africa, including processing, preparation and poor dietary habits. Malnutrition is, therefore, an ultimate manifestation of the interplay of various factors in society. Ghana continues to combat the problem of malnutrition. The malnutrition that prevails is mainly a consequence of inadequate food consumption, lack of knowledge on malnutrition food.

1.2.1 Defining Malnutrition

Diet and health are the most significant immediate risk factors of child malnutrition but both are rooted in underlying household issues such as food security, poor sanitation, maternal and childcare practices (Lesiapeto et al., 2010). Malnutrition is not necessarily a shortage of food, but micronutrient deficiency, poor sanitation, infectious diseases, lack of exclusive breastfeeding also impact on it. It is also described as the disorder due to inappropriate intake of adequate nutrients necessary for the bodily function. Malnutrition has become endemic in both poor and richer countries; the economically disadvantaged in these countries are the victims of the circumstances. According to the World Health Organisation WHO (2012), the

two main causes of malnutrition have been PEM and micronutrient deficiencies. To them malnutrition is a matter of urgency; it hinders peoples' productivity, economic growth and poverty eradication. Children generally suffer as their requirements for nutrients are high. MacKeown et al.,(2007) declared Africa as the leading continent with malnutrition prevalence, with no or little progress of the situation. According to Müller et al., (2010), 300 000 deaths a year are directly linked to malnutrition, mostly affected are inhabitants in developing countries. In South Asia 3 million of 38 million children born die prematurely due to malnutrition. Over twenty million infants are born with low birth weight globally and more than 95 % are born in least developed countries (UNICEF, 2011; WHO, 2012). In agreement with the statement, Muller et al., (2010) also argued that malnutrition prevalence in children deteriorates remarkably and Millennium Development Goals will not be achieved in 2015 as agreed. It is a tragic fact that in an age of technology and scientific knowledge, there are many people in many parts of Africa whose health and quality of life suffer through a lack of food. Not ignoring other factors, food insecurity is the leading cause of malnutrition and poor health, although further analyses of the situation reveal that ignorance, illiteracy and attitudes are other factors which perpetuate malnutrition (David et al. 2008). As described Shih, (2007) malnutrition as the overall term encompassing undernutrition and over nutrition which is either shortage, excess or imbalance of body building and energy giving nutrients. When these nutrients are not consumed sufficiently, the body's ability to function efficiently is compromised, while the immune system becomes weaker, resulting in the victim being vulnerable to diseases that may eventually lead to a premature death.

1.2.2 Causes of Malnutrition

Poor nutrition among adolescents is an important determinant of health outcomes at a later stage of life. According to Mulugeta et al. (2009), the common causes of malnutrition among adolescents in the poor community are less access to food and inadequate knowledge about dietary requirements. In addition, the following factors such as food security, gender inequality, social and economic status, healthcare facilities, availability of water, proper sanitation, women's education status and housing that contribute to the nutritional status of any community need to be taken into consideration (Anwer and Awan, 2003). Adolescents are considered as a low risk group for poor health and nutrition and often receive little or no attention. Some of the causes of malnutrition are described below.

1.2.2.1 Inadequate dietary intake

Dietary patterns are defined by Alarm et al., (2010) as the distribution of foods by frequency and/or quantities in the habitual diet. They stated that inadequate dietary intake is associated with family income, education and food-shortage from time to time. Several other factors such as loss of appetite, religious restrictions or beliefs, sickness, chewing related to dental problems and weight loss obsession add to inadequate intake. These aforementioned factors are common during teenage years. Keski-Rahkonen et al., (2013) reported that teenage girls are not meeting the RDI for B-vitamins, fiber and other minerals. This indicates poor milk, meat and fruit and vegetables consumption. Breakfast skipping is another health compromising behavior and unhealthy lifestyle adopted by most adolescent girls. Breakfast is an essential meal to provide energy to perform daily activities. The continual trend of adolescent's poor eating habits increases the consumption of high fat content, low, refined starch and added and such a diet is associated with weight gain.

The following authors, Neumark-Sztainer et al., (2003), believe that family meals improve adolescents' dietary quality, though practicality might be impossible due to parents' busy schedule. However, it remains essential to establish sensible dietary patterns for children at an early age which will form the basis of a healthy diet throughout life.

1.2.2.2 Education and ignorance

Malnutrition violates a child's human right to lead a healthy life. Malnourished children are prone to infection and diseases. Nutritional knowledge influences quality of life and impacts positively on individuals' nutritional status. Adequate dietary knowledge and access to resources are crucial to improve health and nutrition in a sustainable way. People die due to a lack of knowledge and are often unaware of the health and nutrition programs available. David et al., (2008) believed that when the mind is adequately fed with necessary information to produce good food is more effective in battling poverty and hunger. MacKeown et al., (2007) strongly believe in nutrition education as one of the fundamental tools in promoting health, improving eating habits and fighting diseases. Chopra et al., (2006) declared that women need to be empowered and capacitated with the relevant knowledge to provide basic motherhood needs such as hygiene, breastfeeding and weaning guidelines.

When mothers are educated as affirmed by Chopra et al., (2006), these women are in a rightful position to monitor, provide, care and seek medical attention for the health of the

children. Walsh et al. (2013) added that inadequate food intake and unhygienic dietary practices are due to food ignorance and poor knowledge. He further added that, people resort to poor eating habits even when they are aware of the right eating habits to adopt. These authors further commented on the fact that adequate knowledge alone does not lead to behaviour change, therefore, suggesting never ending awareness campaigns to introduce practical guidelines of healthy eating.

1.2.2.3 Lack of nutritional education at school level

Nutrition education as David et al., (2008) described, is a way by which people acquire the right knowledge, skills and attitude that are required for developing good dietary habits. One-third of children's day are spent in school, thus providing a practical environment for education about healthy food preferences. Peres Rodrigo and Aranceta (2011) argue that schools have the capacity to reach out to children at a critical age when eating habits are still forming and pave a way for healthy dietary habits to adulthood. The authors study indicated that schools can positively influence the lives of most children and offer numerous opportunities for teaching children about healthy diets and physical activity. According to Silangwe (2012), children who are already at risk due to health nutritional problems come to school tired, hungry and unable to cope with learning demands or benefit from the lessons. Silangwe (2012) stated that, the curriculum based nutrition programs would significantly improve children's nutrition knowledge and dietary behaviour, hence the necessity for schools to develop school wellness policies and limit access to unhealthier food should be every schools priority. In 1996, the World Food Summit, recognised the importance of public education on nutrition as part of the efforts for the elimination of food insecurity and poverty (Silangwe, 2012)

1.2.2.4 Urbanisation

Economic pressures and political factors have resulted in mass migration from rural areas to urban centers to improve the socio-economic conditions (Serfontein et al., 2010). Urbanisation as described by Mulugeta et al., (2009), is an episode that leads to nutrition transition that brings significant dietary changes from fiber-rich diets which are also low in fats to western diets which are highly refined. Urbanisation is associated with diet and lifestyle changes characterized by increased consumption of high calorie and low nutrient diet, ready-to eat food, high sugar and salt content food items which subsequently increases

the risk of obesity and other NCDs as compared to rural diets. The group mostly affected by malnutrition and the shift from rural to urban in South Africa are the native Africans. People in some rural areas have free access to green leafy vegetables where it can be harvested from either unplanted land or home gardens and urban people are deprived of that opportunity. This rapid movement has produced massive shanty town in cities of least developed countries, where inhabitants lack secure tenure and may not have access to basic human services. Dannhauser et al., (2000) reported on the same situation that South Africans moved to cities to settle in informal settlements along the roadsides in search of greener pastures in low-income neighborhoods, high population density, poor housing structures, non-functional or nonexistent garbage collection and health facilities are everyday challenges facing the people in this population group. The speedy influx of people from rural areas to cities affects the economy to the extent that the government falls short in providing basic services and job opportunities to the increasing number of urban population (Fotso, 2006). Urbanisation has had effects on food habits and health patterns usually resulting in societal changes. In the past the traditional African diet was based on harvested products and hunted animals. This form of diet was rich in carbohydrates, fiber, and low in fats and sugar. That has subsequently changed due to Urbanisation and socioeconomic transition. The author believed that the abandonment of the traditional habits negatively impacted the diet which was known to be ideal, especially in the prevention of NCDs.

1.2.2.5 Cultural beliefs, traditions and religion

Globalization allows inhabitants to interact with people from different religions and cultures from across the world. According to Dannhauser et al, (2000), culture is dynamic, continually changing and a difficult concept to define. Every culture has its own food preferences, eating patterns and style of cooking. Cultural groups often socialize teenagers to adopt certain types of eating habits. Food consumed by people is determined by many factors, especially locally available foods. The cultural beliefs and nutritional related behaviour are intertwined and people automatically partake in purchasing and preparing food in a traditional way in order to preserve traditions. Culture also influences when, how and which foods to be prepared. Special foods for special occasions are important to a culture's identity. Often, food choices and food habits are embedded in culture and religion. The cultural and religious beliefs determine what should be eaten in communities; however, the food chosen in a cultural perspective does not always provide the optimum nutrient intake required. Culture and

religion influences how food is prepared and mothers use such opportunities to introduce culture, meanings and traditions of ethnic meal preparation to teenage girls (Serfontein et al, 2010). Different cultures have different traditions, beliefs and values. Traditions are often associated with social events such as death, births and weddings. Each tradition performs its own rituals that often involve food in terms of fasting, feasting or observing certain religious days. Food taboos exist in many cultural groups that prescribe what is to be eaten (Viljoen et al., 2005). Religious beliefs have great influence in many people. Some religions forbid certain foods, such as food of animal origin. In such instances, children are often socialised in a way to follow the belief system of the family. Other religious groups have certain superstitions and taboos about food such as the belief that fertilised eggs are more nutritious. So children growing up with such a belief will continue with this in their choice of food. Some churches forbid church members to eat certain traditional foods; others persuade members not to eat breakfast on Sundays in preparation for the Holy Communion. According to Kim (2007), religious teachings encourage healthy diet habits and an increase in physical activity as a form of worshiping God. Somehow people need to be encouraged and convinced that African traditional foods remain the best diet for good health and lowers the risk of food related diseases. Social and gender discrimination in countries like Pakistan shows that girls are served smaller amounts of food than boys and are completely deprived when there is insufficiency, whereas boys are served special and quality food. In addition to that, girls' health is often ignored and less money is spent on health (Anwer and Awan, 2003).

1.2.3 Undernutrition

Undernutrition has been an inherent characteristic of impoverished populations throughout the world. Studies indicate that diet is crucial in the prevention of chronic diseases. Undernutrition is a condition where there is insufficient food intake to meet energy and nutrient needs. Undernutrition as explained Halweil and Nierenberg (2011) exists as a result of food deficit and lack of dietary diversity. The most recent report by the FAO indicates that, 925 million people worldwide are undernourished Factors associated with Undernutrition have serious effects on child brain development and intelligence level (World Bank, 2012). The outcomes of Undernutrition can include irreversible changes in child development. Children Undernourished are prone to infection, and are more likely to die from respiratory infections, diarrhoea and other childhood diseases. Undernutrition is known as a Z score below 2SD and severe Undernutrition as a Z scores below 3SD. The extent of Child

Undernutrition manifest in diverse ways, based on the duration, severity and cause. (Halweil and Nierenberg 2011)

The three major measures of childhood undernutrition are:

- stunting – low height for age
- wasting – low weight for height
- underweight – low weight for age (von Grebmer et al., 2010)

Other researchers described Undernutrition as a ‘hidden hunger’ indicating that most of the time the sickness is undetected (Faber, 2007).

To Vieira et al., (2007), poor nutrition compromises the effective functioning of the immune system making the sufferer vulnerable to infectious diseases. This impacts the body’s ability to absorb nutrients appropriately. The consequences of under nutrition are perceived in premature death of children due to malfunctioning of the body system (Halweil and Nierenburg 2011). Thus De Onis et al. (2012) made an announcement for quick reaction to be taken in reducing children’s death. Worldwide, undernutrition prevalence is perpetuated by political violence, food insecurity, diseases and provincial and national government failure to deliver basic human needs. In the years 2000-2002, approximately 852 million people were undernourished globally (Müller and Krawinkel 2010). The pandemic had been acknowledged and targeted to receive special attention by 2015, and by then underweight prevalence of children up to the age 5 will be reduced by 50% De Onis et al.(2012). In some countries, stunting as stated by Black et al (2008) is more prevalent where a large proportion of rural poor population live. Despite the endeavor made to alleviate poverty, many are still victims of hunger and poverty which opens a doorway to malnutrition.

1.2.4 Protein Energy Malnutrition (PEM)

The most life threatening form of malnutrition is severe protein energy malnutrition which is further broken down into three categories: kwashiorkor, marasmus and marasmic kwashiorkor (Beck, 2007). While poor growth can be due to a variety of nutritional deficiencies and underlying diseases, an insufficient intake of protein is thought to be the most important cause. As described by Müller and Krawinkel (2010), PEM is the imbalance of nutrients supplied and nutrients requirement needed to support growth. A diet lacking in macronutrients (energy rich foods) carbohydrates, protein and fats (which are required in large quantities by the body) leads to PEM. PEM is a problem that affects infants from 6

months through to the age of two. Rapid growth and mental development in children occurs at this period. Most children suffering from energy malnutrition are likely to be stunted or wasted teenagers (Anwer and Awan, 2003). The school aged children are the vulnerable group mostly affected by PEM and physical retardation and mental development are often reported with either non enrolment or inability to finish school. To maintain a healthy balanced diet the energy giving nutrients should be consumed in correct proportion. The symptoms of PEM manifest itself in children younger than 2 years old due to early weaning practices, absence or a low protein diet (Müller and Krawinkel, 2010). Protein energy malnutrition can result in marasmas and kwashiorkor, hence, in Burkino Faso, misola and spirulina is used to improve the condition of undernourishment in children.

1.2.5 Micronutrient deficiencies

Micronutrient malnutrition affects all age groups. Most young girls and women of reproductive age are prone to developing deficiencies. The micronutrients consumed in small amount by this group may have the negative impact on the growth, development and general health Cogill and Richardson (2008). Micronutrient deficiencies as mentioned by the authors occur when individuals have inadequate access to essential micronutrients or when the human body becomes unable to absorb or retain micronutrients due to disease or infection. Noted by Black et al., (2008) is that micronutrient deficiencies not only weaken the immune system and health but also hinder the country's progress socially and economically. Micronutrient deficiencies during childhood affect growth, compromise immunity and, in severe cases, lead to brain damage, chronic disabilities and mortality. Without addressing micronutrient deficiencies, the vicious cycle of intergenerational undernutrition, chronic diseases, and poverty continues.

Minerals and vitamins are important nutrients required in small amount in a diet to help regulate and control functions in cell metabolism and protect the body against sickness however, insufficient intake of these nutrients leads to deficiencies which are of critical concern worldwide. Welch and Graham (2008) states that, a shortage of one of these nutrients may cause poor health. Black et al., (2008) outlined that micronutrient deficiencies are as a risk factor which compromises the lives of low and middle income groups by weakening individuals' immune system, making them prone to infectious diseases, growth and mental development. Black et al., (2008) stated that low weight for age and micronutrient deficiencies are closely related. In 2005, over 30 % of children under the age of five years in

developing countries were stunted, 30 % were underweight and 10 % were wasted, while millions died from diseases directly related to micronutrient deficiencies, especially iodine, iron, zinc and vitamin A deficiencies.

1.3 Adolescent girls in developing countries

Girls, of ages ten and nineteen years are termed as adolescents by (WHO, 2012), stand at the threshold of moving into adult stage of life. In 2009, the adolescent population in the world stood at 1.2 billion, out of this number, half were girls (UNICEF, 2011). The vast majority (88 %) of adolescents live in developing countries (UNICEF, 2011). However, adolescents in least developed countries remain largely neglected. It is difficult to reach and measure the adolescent population by this, their needs are often ignored (WHO, 2012).

Dietary needs increase during this stage because of menarche and pubertal growth (Ahmed et al 2008). Nutrient needs are parallel to the amount of growth, with the largest nutrient demands occurring during peak growth velocity. At the apex of growth spurt, the nutritional needs may be twice or high just the remaining period of adolescence (Story et al., 2008).

A healthy diet must meet the changing nutritional requirement of adolescents' growth. Vitamins, protein, energy and minerals needs are increased (Story et al., 2008). Therefore, if not adequate, nutritional deficiencies have far reaching consequences, most especially in female adolescents. Overall, the nutritional status of female adolescents is critical, given close associations that their growth status and reproductive health have with birth outcomes and child survival (Chen et al., 2012). However, malnutrition has been observed among many adolescent girls in developing countries due to poverty and gender bias. The direct cause of malnutrition is dietary inadequacy, with immediate and long-term complications including underweight, short adult height and delayed sexual maturation. Therefore, accelerated growth among adolescent girls may be particularly influenced by dietary inadequacy, although the impact of the timing, duration, and severity of food deprivation that lead to compromised adult growth remains unclear. Delayed sexual maturity (delayed menarche) is one of the main problem recognized following malnutrition (WHO, 2012).

1.3.1 Menarche

Menarche, defined by the first menses, it signifies the onset of reproduction in the life of every female. The average timing of menarche varies, it ranges from year 12.5 in developed countries, to 13 years and above in developing countries. The factors likely to be involved in this variance are many, out of which nutritional status is considered to be a major one (Beck, 2007).

Generally, it is believed that the accumulation of a critical degree of fatness triggers the onset of menses (Leenstra, 2006). Estrogen which is the female hormone plays a vital role in menarche, as well as in epiphyseal maturation among pre pubertal girls. Estrogen is produced primarily by the ovaries, with significant quantities also released from fat cells. Thus, variability in the degree of fatness influences peripherally produced estrogen levels, which might explain why menarche can be delayed in undernourished girls compared to those who are better nourished (WHO, 2012). A recent longitudinal study in Ethiopia found that food insecure girls had menarche one year later than their food secure peers. Low iron stores throughout childhood may also contribute to delays in the onset of menarche (Brain, 2007).

Menarche is considered a late marker of sexual maturation (Marshall and Tanner, 2009). There is a large body of literature on growth and menarche. The growth spurt in girls typically occurs between 12 and 18 months before the onset of menarche, with much slower growth in height continuing for up to 7 subsequent years. Growth of pelvic bones continued for another 2-3 years after final height is reached. Menarche is considered a valid indicator of pubertal attainment in adolescent girls.

1.3.2 Nutritional needs of adolescent girls

Belachew and Hadley (2011) described a proper balanced diet as a diet containing all essential nutrients in the correct amounts to meet all the nutritional needs required for a person's life, maintenance, repairing, physical and mental development.

1.3.2.1 Dietary Reference Intake (DRIs)

Dietary reference intake as proposed by the Food and Nutrition Board of IOM is a measure of an estimated quantity used in the planning of nutrient intake and ascertaining diets for healthy people. This measure is categorized on four levels which includes; Estimated Average

Requirement, Adequate Intake, Tolerable Upper Intake Level and Recommended Dietary Allowance used as nutrient reference values (Story et al., 2008). The dietary reference intake estimate was formulated to take the place of previously used recommended daily allowance estimate usually found on labels of food. The dietary reference intake estimate is used in assessing and planning healthy foods for both individuals and groups.

1.3.2.2 Estimated Average Requirements (EARs)

It is said to the daily value of nutrient intake estimated to meet the 50 % requirement of healthy individuals in a gender group and specified age. The dietary adequacy is determined of populations by the use of EARs and not for individuals (Story et al., 2008).

1.3.2.3 Recommended Dietary Allowances (RDAs)

This is the daily average intake level required to meet (97- 98 %) of nutritional requirement of healthy individuals in age and gender-specific group. The RDA is applicable to individuals not a group

1.3.2.4 Adequate Intake (AI)

The recommended intake value based on observation or experiment to determine the estimates of nutrients intake by a group of healthy people that are considered to be adequate is termed Adequate Intake. It is usually used in the situation where the RDA cannot be determined (Story et al., 2008).

1.3.2.5 Upper Intake Levels (UL)

Upper intake level describes the optimum daily intake of adequate nutrient that is essential to keep all individuals in a population against undesirable health risks. A daily intake that exceeds the UL poses a potential risk of an increase in adverse effects (Story et al., 2008).

1.4 Macronutrient requirements for adolescent girls

Nutritional deficiency especially among adolescent girls is known to reaching higher consequences. To sustain life and maintain health, humans require different nutrients. Carbohydrates, proteins fats and fiber are known as macronutrients and are required in large amounts as they are energy giving foods (Story et al., 2008). Anyika et al., (2009) noted that

adolescents remain a neglected population; consequently, the needs of this group are often ignored. To ensure proper growth, development and maturation adolescents need an adequate energy intake. Story et al., (2008) referred to teenager's basal metabolic rate, physical activity and pubertal growth as the factors influencing their energy needs.

1.4.1 Carbohydrates

CHO (sugars, starches, dietary fibers) are the main sources of energy. CHO are found in abundance in foods of plant origin such as cereals, vegetables, legumes and fruits (SalasSalvadó et al. 2006). The adolescence period requires a higher energy intake owing to the rapid physical growth (Elmo, 2009). Skeletal development, sexual maturation and growth spurts increase the demand for energy requirements, as well as replacing energy lost in physical and mental activities. The DRI for energy is based on the level of physical activity, however, the EARs for adolescents is 100g/day (Institute of Medicine (IOM), 2013). Physically active adolescents require additional energy to meet the daily caloric needs. The teenager's source of CHO includes soft drinks, milk, ready-to-eat cereal and sugary foods such as cakes, cookies, doughnuts, sugars, syrups and jams (Story et al., 2008). Adolescents' source of CHO and preference is energy foods high in saturated fat and salts with no nutritional value resulting in minimum consumption of balanced diet from all food groups. Elmo (2009) recommended that family meals should be an opportunity for parents to demonstrate healthful choices and be an example of healthy consumption.

1.4.2 Protein

These are amino acids building blocks, they are categorized into complete and incomplete protein. Complete proteins are from the animal origin (poultry and products, fish, red meat and it products). Those from the plants (legumes, grains, nuts and some vegetables) are known as incomplete protein because they lack one or two amino acids. Proteins are generally responsible for the maintenance, repair of worn out tissues and skin. The incomplete proteins need to be eaten together with the complete to provide the body with it full functions. An average of 46 g/d is needed to be supplemented in diet to meet the functions stated (Elmo 2009).

1.4.3 Fat

The adolescent's fat and sugar intake is a concern in many countries as it appears to exceed the recommended amount. Story et al., (2008) recommended that 25 % to 30 % of total daily fat kJ should be derived from unsaturated fat and less than 10 % of saturated fat. There is no AI or RDA set for total fat. Dietary fat plays a significant role as an energy source and a significant cell structural component during the adolescent period. According to Nishida et al., (2008), 6- 10 % of daily energy intake should come from polyunsaturated fatty acids (PUFAs) as this type of fat has the capability to reduce the incidence of cardiovascular diseases. Joyce et al. (2008) have confirmed the existing coordination between dietary fat intake and CVD. The sources of saturated fat intakes mostly consumed by adolescents include milk, beef, cheese, margarine and foods such as cakes, cookies and doughnuts.

1.4.4 Fibre

The insufficient dietary fiber intake contributes to non-communicable diseases (Anderson et al 2009). Adequate amounts of fiber not only lessen the possibility of the NCDs but aid in maintaining normal blood glucose as well as freeing the bowels. An amount of 14 g/1000 kcal is needed for by adolescents for proper growth (Nishida et al.,2008). According to their behavior in water, dietary fiber are grouped into. The table below are the types and the examples.

Table 1: Examples of fibres

TYPE	EXAMPLES
Insoluble fibre	Cellulose, lignin and some hemicelluloses: abundant in wholegrain cereals gums, mucilages and pectins: contained specially in fresh vegetables, legumes and fruit, and the beta-glucans, present in oats, barley and some yeasts.
Soluble fibre	

Source: Adopted from Anderson et al (2009)

1.4.5 Water

Water is an essential nutrient and critical for the function of all organs for all ages and for maintaining health in general (Kant et al., 2010). Therefore, water intake should not rely on thirst alone. According to UNICEF (2011), water is a scarce resource which is subject to abuse and pollution, the most likely pollutant is human faeces that have not been disposed correctly. However, water is a necessity as the body cannot generate enough itself to fulfil its need and many metabolic reactions that occur in the body are dependent on it (Kendrick, 2009). Maintaining adequate water intake is necessary to replace water lost during perspiration especially in hot weather like Ghana.

1.5 Micronutrient requirements and food sources of adolescent girls

The nutritional status is often poor during early life and gets worse as the adolescent growth spurt occurs. Micronutrients are vital for general wellbeing and each nutrient is essential as the deficiency of one nutrient may cause the dysfunction of the body. The micronutrients are required in smaller amounts compared to macro nutrients; they do not provide energy but are essential for good quality life (NICUS, 2003). Steyn et al., (2007) highlighted the alarming (two billion) number of people suffering from micronutrient deficiencies in developing countries, mostly women and children. The global progress reported 35 % of people lacking adequate iodine in the world, 40 % iron sufferers in the developing countries and more than 40 % children with vitamin A deficiency (World Bank, 2012). Micronutrient deficiency as articulated by Ma et al, (2007) does not only negatively impact the health of people, but also delays the social and economic development of the countries. The common nutrition problems affecting the youth population worldwide as stipulated by Shahid et al., (2009) include under nutrition, iron deficiency anemia; deficiency of Vitamin and iodine

1.5.1 Vitamin A

The body tissues require vitamin A for growth and for repairing worn out tissue, as well as appropriate functioning of the immune system (Weingärtner, 2004). Rotondi and Khobzi (2010) reported vitamin A deficiency as a global health concern alarm affecting about 250 million preschool children and many of these children go blind every year (Rotondi and Khobzi, 2010). Vitamin A is necessary for reproduction, growth and immune function (Story et al. 2008). The estimated average requirement for adolescents is 485 micrograms per day

(IOM, 2013). Sufficient consumption is important for the prevention of night blindness, loss of appetite, measles and diarrhoea. Parasitic infections, for example, *ascaris lumbricoides* and *giardia lamblia* may interfere with the absorption thus affecting the status and the effectiveness of vitamin A (Nojilana et al., 2007).

Sources: Animal source of foods such as dairy products, liver and eggs are known as the right source of Vitamin A as it contains the form retinol that can be easily absorbed by the body. Fruits and vegetables contain Vitamine A in the form of β -carotene but is secondary to animal foods. (Gopalan, 2008)

1.5.2 Vitamin B6

The Estimated Average Requirement for vitamin B6 in this age group is 1.0 milligram per day (IOM, 2013).

Sources: The rich sources of vitamin B6 are fortified cereals, dried beans, liver, chicken, pork, fish, organ meats, milk, eggs, avocados, bananas and potatoes (Perveen et al., 2009).

1.5.3 Vitamin B12 (Cobalamin)

Two micrograms per day is the dietary requirement of vitamin B12 for adolescents (IOM, 2003). Vegetarians as cited by Perveen et al, (2009) should consider other means for supplementation since vitamin B12 is not naturally present in plant food and, therefore, dietary deficiencies are likely to occur in people on a strict vegetarian diet. However, vitamin B12 is essential for the formation of red blood cells and function of the nervous system.

Sources: Organ meats, meat, fish, eggs, poultry and milk

1.5.4 Vitamin C

Vitamin C is important for production of connective tissue which aids in binding the body cells together. Vitamin C is essential for iron absorption and hemoglobin formation in the human body (Kabir et al., 2010). A total of 56 – 65 mg of vitamin C is needed per day for 10-45 micrograms per day for adolescents' year. A maximum of 10 milligram of vitamin C is needed per day to preventive scurvy (Lykkesfeld and Poulsen 2009).

Sources: About 90 % of vitamin C are found in fruit and vegetables such as guavas, citrus fruits, pawpaw, tomatoes, green and red peppers, spinach, cauliflower, bean sprouts. (Story et al., 2008).

2.7.5 Vitamin D (Calciferol)

It is recommended for calcium absorption, formation and growth of bones during childhood and adolescents (Gordon, 2008). According to Sullivan et al. (2010), failure to obtain it prevent mineralization of bone and subsequently calcium absorption in the small intestine. Lehtonen-Veromaa et al, (2008) commented that for vitamin D has a unique role in the maintenance of the skin and the membrane.

Sources: Primary source of food include milk, fortified dairy products, liver and fatty fish such as mackerel, herring, tuna, and salmon, and oils from fish, including cod liver oil (Holick, 2008).

1.5.6 Iron (Fe)

Due the loss of blood during menstruation requirements of iron are higher in the adolescence phase (O'Connor et al., 2009). Iron is required for hemoglobin formation of, which carries oxygen (O²) to the various parts of the body from the lungs .Iron also helps in fighting illnesses, functioning and development of the brain. Iron requirements is 8-15 milligrams per day for adolescents (Story et al. 2008).

Sources: World Health Organization in (2012), rated iron the ninth disability risk factor in human health, and Fe rich diet is the solution (Hoppe et al., 2008). Rich sources of Fe are green leafy vegetables, legumes, whole grains, eggs, poultry and red lean meat.

1.5.7 Calcium (Ca)

Calcium requirement during the adolescent period is significantly higher than any other stage of life due to the spurt of growth and the development of the body ramework. Story et al., (2008) commented approximately 45 % of bone mass is achieve at this critical stage. Adequate Ca is required to prevent the possible development of cancer, formation of teeth and strong bones and also aids in the proper absorption of vitamin B12. Chemaly et al, (2009) commented AI calcium intake for adolescent is 1300 milligrams per day, but it is unclear how

much should be the limit Story et al., (2008) recorded that out of 10 adolescent girls only 9 % or 2 are able to meet the required calcium requirements.

Sources: Milk and other dairy products are best natural sources of calcium and most milk and some yoghurt are fortified with Vitamin D (Nicklas, 2013). Other sources include selected low oxalate vegetables, legumes, nuts and fortified foods.

1.5.8 Phosphorus (P)

For effective metabolism and bone formation phosphorus and calcium are upmost essential. The presence of phosphorus is needed for the structure and functioning of the cellular .In adequate supply can cause deficiency in health of adolescents as it aids in a functions it perform in the body.115 milligrams is the EAR for adolescents per day (IOM 2013).

Sources: egg yolk, cereals, meat, cheese milk and wholegrain.

1.5.9 Iodine

Institute of Medicine (2013) stated that 95 micrograms of iodine is needed per day. In the USA and Europe small quantities of salt is used in preparing bread enhances iodine status (Jooste, 2008).Dietary iodine is best obtain from seafood. Witten et al., (2007) commented in a survey held in South Africa that most population living far away from the sea suffer from goiter.

Sources: iodized salt, seafood.

1.5.10 Zinc

Estimated Average Requirement for adolescents is 7.5 milligrams per day. It is one of the foundations for growth which is needed for adequate functioning of the immune system. Zinc is essentially required in pregnancy for development and expansion of maternal tissues (Chandyo et al, 2009). The absence of zinc in diet is one of the contributing factor to high mortality rate in most developing countries due to problems associated with proper measurement of the nutrient intake (Stein et al.2006).

1.6 Methods of determining the nutritional status of adolescents

1.6.1 Anthropometry

According to the WHO (2012), the nutritional status of adolescents has been determined over the years using anthropometry methods. These comprise the measurements of various body parts as the height; weight, head circumference, skin fold and so on. Faber and Wenhold, (2007) indicated the measurements taken from the individual are used to assess the whether they are under nutrient or over nutrient. It use reflect the general wellbeing and health status of not only adolescents alone but also that of adults and children (McDowell et al., 2008).

1.6.2 Body mass index (BMI)

The WHO (2008) terms it as a person's weight with height. It is a validated measure use to assess the both under and over nutrition in adolescents and adults (Nambiar et al.,2008).The body mass index is measured by the formula $\text{Weight in kg} \div \text{height in meters square}$. The obtain values are then checked with that of the WHO scale which has the ages with their corresponding BMI.

1.6.2 Height measurements

This is used together with other anthropometric measurements. These are obtain either by the direct or indirect approach, the direct approach make use of the stadiometer or measuring rod to obtain result. in the case where the individual cannot stand due to sickness or old age the indirect method is used. The arm span and recumbent length person stays in bed and a tape measure is used (WHO, 2012)

1.7 Overview of malnutrition in Ghana

The health and the economic gains of Ghana has witness a great improvement, currently effort are underway to sustain this this achievement. Data shows indicate a high rate of undernutrition. This include low weight for height (wasting), low-height for age (stunting) and micronutrient deficiency (iron, iodine, vitamin B and calcium) Ghana Statistical Service, 2010; Assibey et al. 2007). Children and women are the most affected in this situation. GHS (2009) estimated that the level of children mortality below the age of 5 years is as a result of

Undernutrition and in some case it impair the immune system putting them at a high risk of diseases. Annually 12,000 children die of low weight, from the year 2011-2020 it is said that 97,000 death of in children under 5 will be caused by stunting.

Economic productivity and growth of the country is undermined by Undernutrition in a lot of ways. Presently an estimate of 32 % of Ghanaian children of age two are said to be severely and moderately stunted. These children grow in stunted adults with one significant characteristic, which is low productivity and reduced physical capacity. In terms of schooling, these children start school later than the usual time due to their age, the IQ becomes low and this lead to frequent absenteeism from school Ghana profile (2011). Demographic and Health Survey of Ghana noted that from 2011-2020 productivity will be loose an amount of 5 billion due stunting caused by decreased productivity by working staff (DHS, 2008).

A typical Ghanaian diet comprise of a great proportion of carbohydrates or starch (maize, yam, cassava). Three quarters of dietary energy is supplied by carbohydrates whiles dietary diversity remains very low. Protein intake does not meet the recommended intake. Also, access to safe drinking water, proper health services and sanitation is low.

2. AIMS OF THE THESIS

Malnutrition is one of the intergenerational issues pertaining to adolescent girls in most developing countries. There is limited information concerning adolescent girls in terms of nutritional status in Ghana. This study is aimed at evaluating the BMI and height of adolescents with regard to the nutritional status of adolescent girls of age category 10-15 and their dietary intake in Adenta Municipality, Ghana.

Hypothesis

To fulfill the aims of the study, the following hypotheses was formed:

H₁: There is a significant relationship between malnutrition knowledge of care givers and BMI of girl adolescents.

3. MATERIALS AND METHODS

This part of the chapter deals with how the data was collected to achieve the aims of the thesis and the instruments used. It comprises of participants, study area, data collection techniques and sample selection.

3.1 Participants

The study recruited 120 adolescent age 10-15 years in three basic schools and 120 caregivers in the Adenta Municipality. Permission was sorted from the municipality educational service. The head teachers of the three schools randomly selected also granted permission to conduct the survey and use the study classroom. Letters explaining the nature of the survey and the purpose were sent to caregivers seeking their consent; confidentiality of the results of the study was assured. Caregivers of the selected adolescents were invited for information session.

3.2 Sample selection

Participant's ages were obtained from the information in the schools register. Girls in each age group were asked to pick folded papers with the inscription yes or no. Only girls who picked yes in their respective age groups were chosen to participate in the survey. Girls who were absent at the time of data collection were not allowed to part take in the survey.

3.3 Study area

The study was conducted in the Adenta municipality a suburb of the Accra Region of Ghana. This area was chosen due to it the large number of government schools and has a total population of 78,215 (GSS, 2010). The Figure 1 below illustration the map of the Greater Accra, with the arrow shows the research area.

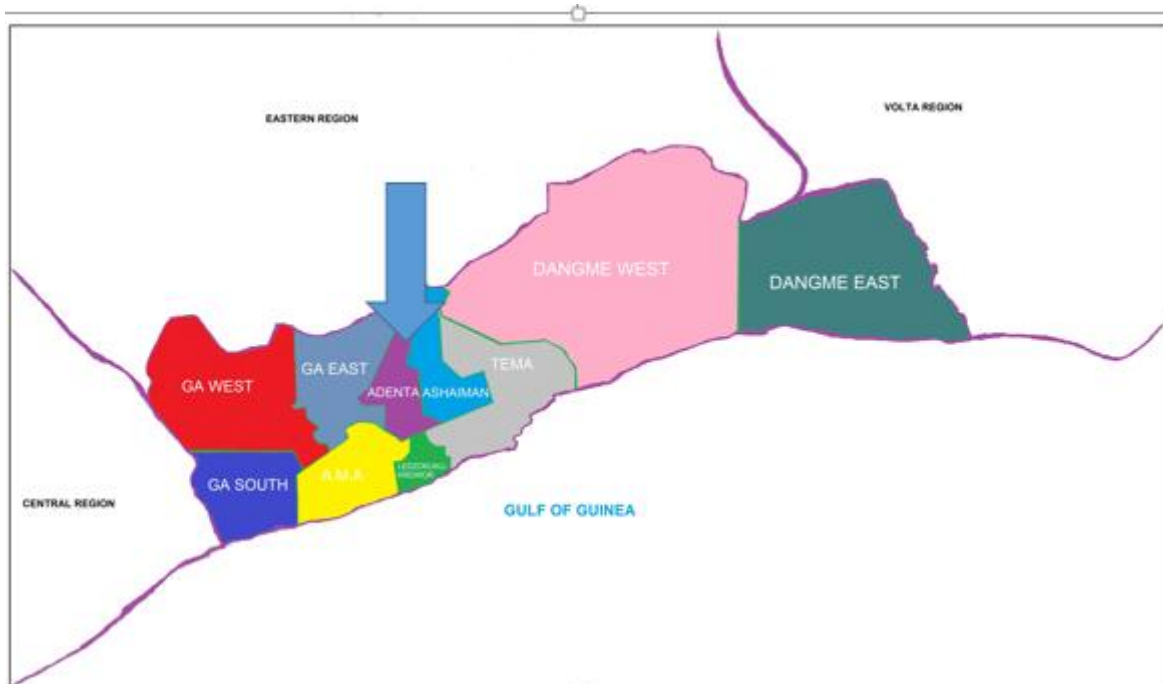


Figure 1: Map of Greater Accra Source: Ghana statistical service (2010)

3.4 Data collection techniques

The survey adopted the use of both primary and secondary data source. Secondary data was obtained from reviewing related literature, articles and journals as well as relevant books. Also information from the Ghana health service was used.

Primary data was collected from November 2015 to January 2016. In needed was obtained using questionnaires. This was administered to both the adolescents and their caregivers. The data taken was categorized as socio-economic status and dietary intake. Anthropometry data was also taken from the each adolescent girl in each age group. The questionnaires were pretested before used in the survey and each questionnaire was checked to see if all the variables have been answered fully.

3.4.1 Socio-economic data

Both adolescents and their caregivers had their own questions. Adolescents responded to some questions such as knowledge on malnutrition, meals eaten at home, and who was their caregivers menarche. Occupation, educational level, knowledge on malnutrition, basic nutrients knowledge is also some of the few questions answered by the caregivers.

3.4.2 Dietary intake

A quantified food frequency which gives a recall of average amount of food consumed on daily and weekly bases was used as a reference point for the 24 hour recall question. This helps to determine the energy intake and nutrients of an individual; Baba this method was taken from (Oldewage-Theron, 2008). Participants were asked to provide information on the frequency of selected local food commodities but had problems in the portion size so it was unable to provide the amount of consumption. A total of nine food commodities were used.

3.5 Anthropometry measurements

This is the pinpoint for evaluation or accessing weight and stunting of an individual (nutritional status).It requires age, gender weight and height. Measure was taken over light clothing with shoes on. It was taken on three different occasion of each participants and the average was used to indicate underweight and stunting.

3.5.1 Weight measurements

A weighing scale was used in the measuring the weight in kilograms to the nearest 0.5 kg. A calibrated scale **Portable Physician Scales** (PPS) according (WHO, 2012). It was placed on a levelled floor. It was checked for accuracy on every five measurements, weighing scale was placed on an even uncarpeted floor in the adolescents classroom. Measurements were read from 0.0 kg and participant was told to take off their socks and shoes as well as anything that can add extra weight. Adolescents stood straight with head up in the middle of the scale with body weight equally distributed from head to toe and the participants stand still till the measurements were recorded. Weight was written to 2 decimal places in kilograms.

3.5.2 Height measurement

Height of every participant was measured using a portable stadiometer with a sliding headpiece. The measurements were in to 2 decimal places. Steps in height measurements are as follows. The stadiometer was placed on an even floor. Socks and shoes were removed Participant were asked to stand with legs put together, and arms to the side. Adolescents were asked to relaxed shoulders, head was put on the Frankfort horizontal plane. Shoulder blades, buttocks and heels had to be touching the measuring rod. The headpiece slid was lowered on

the highest point of the head with adequate. The measurements were taken and read to two decimal places in meters.

Body Mass Index (BMI)

This the criteria use in the evaluating on underweight as well as the prediction of health risks. The weight and height from the survey was use to determining the body mass index (BMI) of each adolescents Anthropometric measurements of the adolescent girls were used for calculating the BMI. This was then expressed in the ratio of weight (kg) to height in meter square.

$$\text{BMI (kg /m}^2\text{)} = \frac{\textit{Weight kg}}{\textit{Height*hieght}}$$

After calculation the BMI and find the means for each group the z scores was determined for each to know which category they fall, that is from severe thinness to obesity according to the WHO scale. The same procedure was followed to determine which group was severely stunted or stunted. Below is the formula used in calculating the Z score

$$Z_i = \frac{x_i - \bar{x}}{S}$$

Legend:

Z_i is the z score

X₁ is the sample score

X is the sample mean

S is the standard deviation

3.6 Data analysis and presentation

The research employed the use of both qualitative and quantitative research design to analyze the data collected. Computer programs Excel (version 2010) and statistical Package for Social Sciences V 20 (SPSS) was used for the analysis obtained from the field survey. Response from questionnaires were edited, coded and calculated before the processing it in the form of quality analysis.

4. RESULTS

A total of two hundred and forty participant were involved thus hundred and twenty adolescent school girl and hundred and twenty caregivers of the adolescents. They were all residing in the Adenta municipality.

4.1 Adolescents menarche

Out of a total 120 respondents, 55 answered “yes” to have reached menstruation while 65 said “no” representing 45.8 % and 54.2 % respectively (Table 1). Most of girls in the age group of 10 and 11 years had their first menarche earlier than the age 12 which is the onset of menarche, more than half of the girls in age 12 which is the supposed age of the onset at the time of the field survey have not experience menarche some girls of age 13-15 were also in the same situation (Figure 1)

Table 2: Number of adolescents at menarche

Menarche	Frequency	Percent (%)
Yes	55	45.8
No	65	54.2
Total	120	100.0

Source: Authors field survey

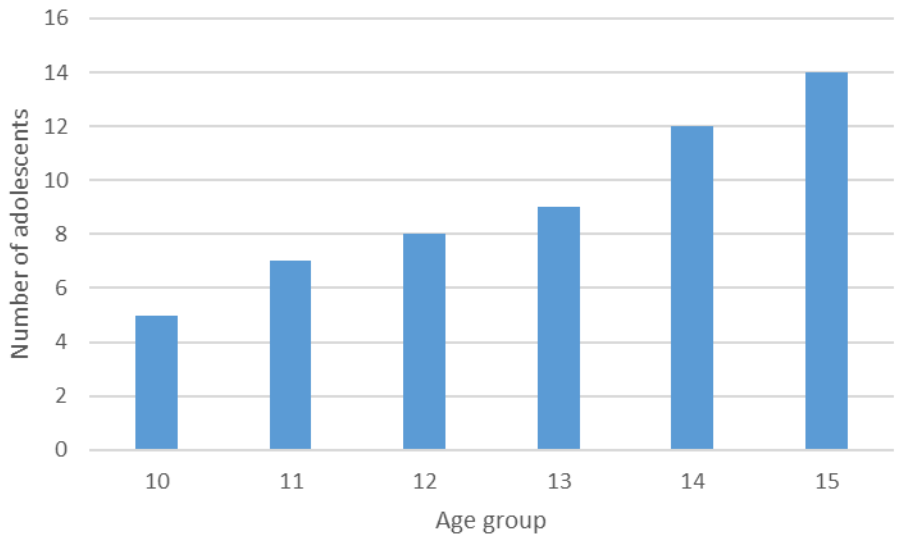


Figure 2: Number of adolescents at menarche from questionnaire according to the ages

4.2 Knowledge on malnutrition

With regard to the knowledge on malnutrition 34 (28.3 %) girls had knowledge for malnutrition and the rest 86 (71.7 %) had no knowledge at all about malnutrition (Figure 2). This indicate that the highest number of adolescent girls do not know about malnutrition and the possible future effect on their health and the next generation.

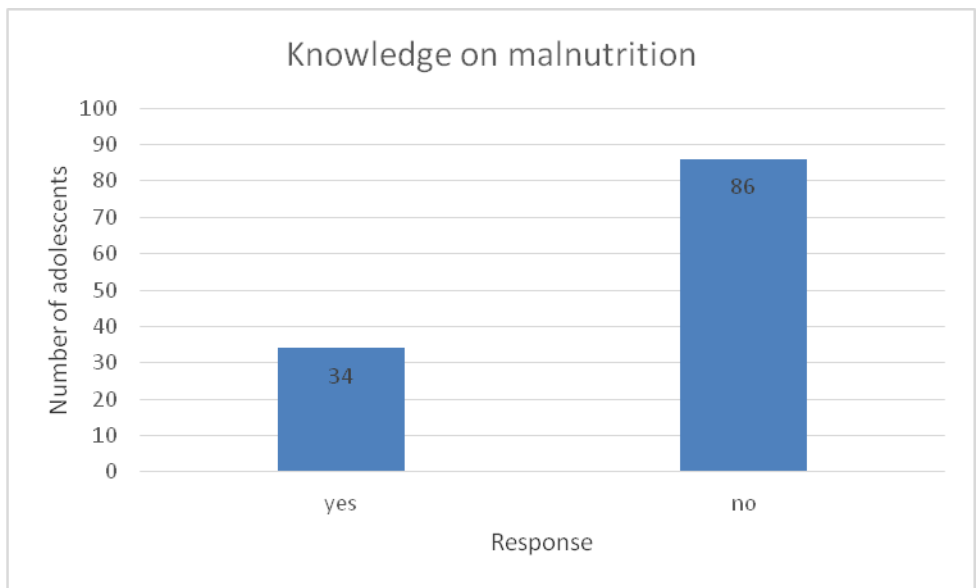


Figure 3: Adolescent knowledge on malnutrition

4.3 Caregivers

The figure below indicates that the caregiver of the adolescents. The highest number of the girls were staying with both parents 68, those with their mothers were 27, girls residing with their fathers were 17 and finally 9 were with guardians. This implies a larger portion of the participants have both parents catering for them and the rate of malnutrition is likely to low.

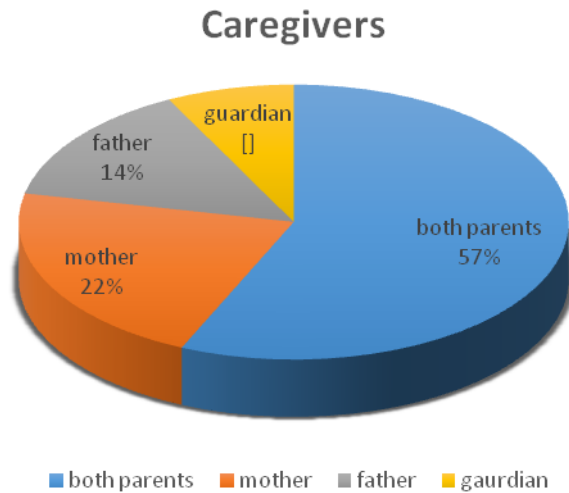


Figure 4: Caregivers of the adolescents

4.4 Iodized meal and meal frequency

About 41.7 % of adolescents recalled the use of iodated salt in the preparation of meals by their caregiver while 58.3 % reported the use of locally mined salt with the fortification of iodine (Table 2). A breakdown shows that most of the girls may not get the required iodine they need for proper growth. With regards to the meal frequency 80 out of the 120 respondents indicating 66.7 % eat twice a day, the rest of the 40 representing 33.3 % eat three times a day (Table 3). According to the data collected out of 120 adolescent girls 20 % of them only eats breakfast, 61.7 % eats supper and 18.3 % takes breakfast and supper at home and the rest of the days meal are eaten at school (Table 4).

Table 3: Use of iodized salt in meals from questionnaires

Iodized salt	Frequency	Percent (%)
Yes	50	41.7
No	70	58.3
Total	120	100.0

Source: Authors field survey

Table 4 Number of meals taken in a day from questionnaires

Number of meal times	Frequency	Percent
2 times	80	66.7
3 times	40	33.3
Total	120	100.0

Source: Authors field survey

Table 5: Meals taken at home from questionnaires

	Frequency	Percent
Meal taken at home		
Breakfast	24	20.0
Supper	74	61.7
breakfast & supper	22	18.3
Total	120	100.0

Source: Authors survey

4.5 Response of food consumption

From table 5, the consumption of maize by the adolescent girl's 2-3 times a week was 62 %, once a week was 28 % while 9.2 % of girls take maize seldomly. 66 participants eat beans 2-3 times a day, 46 once a week and 8 was seldom respectively. Milk intake had low response as 32 of the respondents took milk two to three times per week, 63 participants recall taking it once a week while 25 took it seldom. Frequency on beef showed that 33 took it two to three times per week; intake for once times per week was 63 and seldom was recorded as 20. Both the consumption of fish and chicken two to three times per week and once a week was the same in each case with a recall of 56 each followed by 12 who took it seldom. 73 adolescent girls took cereals in their diet 2-3 times per week, 40 once a week and 7 was seldom respectively. Fat consumption was the highest among all the food commodities two to three times was 87, once a week was 32 only one person took it seldom. Number of 50 participants ate green vegetables 2-3 times a week, followed by once a week with 53 and seldom recorded was 9. Less than half of the respondents who is 48 took fruits 2-3 times a week, 65 took it once a week while 7 seldom.

Table 6: Response of food consumption from questionnaires

Commodity	2-3 times week		Once a week		Seldom	
	adolescents	Percentage	Frequency	Percentage	Frequency	Percentage
Maize	75	62	34	28.8	11	9.2
Beans	66	55	46	38.3	8	6.7
Milk	32	26.7	63	52.2	25	20.8
Beef	33	27.5	63	51.3	24	20.0
Fish and chicken	52	43.3	56	46.7	12	10.0
Cereals	73	60.8	40	33.4	7	5.8
Fat	87	72.5	32	26.7	1	0.8
Green vegetable	50	41.7	61	50.8	9	7.5
Fruits	48	40.0	65	54.2	7	5.8

Source: Authors field survey

4.6 Occupation and educational level of caregiver

With regards to the occupation of the caregivers about half of the caregiver representing 59 out of the total 120 were into petty trading as at the time as at the time of the survey, those unemployed were 32 and 29 were salaried worker (Figure 4). The level of education of this caregivers was different in which 18 % of them are degree holders, 14.2 % with diploma, 19.2 % MSLC/JHS, 1.7 % school certificate, 26.7 % primary and 20 % non-formal education (Table 6). The knowledge of caregivers on adolescent malnutrition was 43(35.8 %) while those with no knowledge were 77 (64.2 %). It indicates that though a large number of caregivers have some level of education but only a few of them knew about malnutrition in adolescents and this can affect the nutritional status of adolescent girls (Table 7). Adding to this only 34 % of caregivers know basic nutrients for balance diet in meal preparation (Figure 5). This shows that approximately half of the caregivers prepared meals without any basic information on the right food commodities for a healthy and balanced meal.

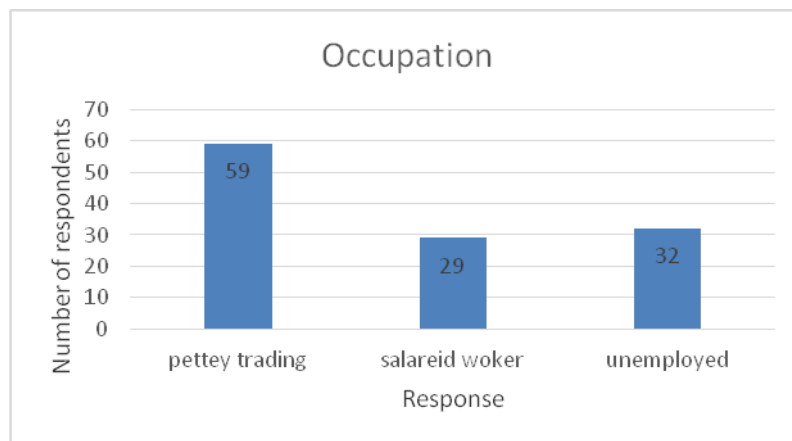


Figure 6: Caregivers occupation from questionnaires

Table 7: Educational level of caregivers from questionnaires

Education	Frequency	Percent
primary	32	26.7
MSCL/JHS	23	19.2
School certificate	2	1.7
diploma	17	14.2
degree	22	18.3
No formal education	24	20.0
Total	120	100.0

Table 8: Knowledge of caregivers on malnutrition from questionnaires

knowledge of caregiver	Adolescent	Percent (%)
Yes	43	35.8
No	77	64.2
Total	120	100.0

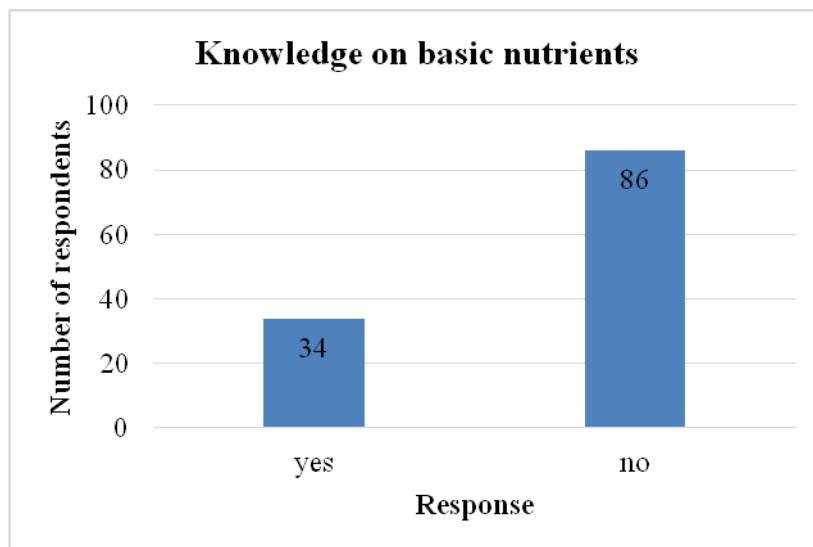


Figure 7: Basic nutrients knowledge by caregivers from questionnaire

4.7 Empirical analysis of caregiver knowledge of malnutrition on body mass index

To answer the research hypothesis the study employed the use of Chi-Square statistical tool. The study found out that caregivers knowledge on malnutrition was very low, therefore it sought to out find if this has any effect on the BMI of the adolescents.

Hypothesis (null and alternative)

H₀: there is no significant effect of caregivers knowledge of malnutrition on the BMI of adolescents.

H₁: there is significant effect of caregivers knowledge of malnutrition on the BMI of adolescents.

Decision Rule

If p calculated $< p$ at 0.05 significance level, we reject the null hypothesis (H₀) and accept the alternative hypothesis, otherwise, we accept it.

The table above represents the Chi-Square analysis of caregiver knowledge of malnutrition on the BMI of adolescents. From the table, a look at the two-sided asymptotic significance of the chi-square statistic reaches 0.340 and thus is more than level of confidence at p (0.05). This statistically confirms there is no relationship between the caregivers knowledge of malnutrition on the body mass index of the adolescents, we thus accept the null hypothesis. We therefore conclude that, there is no effect of caregivers knowledge on the body mass index of adolescents.

Table 9: Chi-Square analysis of caregivers knowledge of malnutrition on the BMI of adolescents

	Value	Significance Level
Pearson Chi-Square	101.154 ^a	0.340
Significant at p (0.05) **		

4.7.1 Anthropometry data

With regard to BMI for age and the height for age (Z scores) of the girls .The BMI was to evaluate the weather the girls had normal weight or not .Each group had a Z score of $>-2SD$ to $<+1SD$ signifying that the girls were normal. With regards to height for age girls in the age of ten (10 years) had a Z score of $>-3SD$ to $<-2SD$.Ages 11-15 years had Z score of $>-2SD$ to $<+1SD$.Each case was rated as stunted according to the WHO scale for adolescent girls.

Table 10: BMI (kg/m²) and height (cm) of adolescents

Age	Mean BMI	Z score	Interpretation	Mean Height	Z score	Interpretation
10	15.9	$>-2 SD$ to $<+1SD$	Normal	124.8	$>-3SD$ to $<-2SD$	Stunted
11	17.3	$>-2 SD$ to $<+1SD$	Normal	130.1	$>-SD$ to $<+1SD$	Stunted
12	18.4	$>-2 SD$ to $<+1SD$	Normal	139.4	$>-SD$ to $<+1SD$	Stunted
13	19.1	$>-2 SD$ to $<+1SD$	Normal	144.3	$>-SD$ to $<+1SD$	Stunted
14	18.8	$>-2 SD$ to $<+1SD$	Normal	145.1	$>-SD$ to $<+1SD$	Stunted
15	18.4	$>-2 SD$ to $<+1SD$	Normal	149.9	$>-SD$ to $<+1SD$	Stunted

5. DISCUSSION

Generally the overview of malnutrition indicates that a complex concept with a wide range of causes, with food accessibility as one of them. The global financial crisis and its consequence high prices of food affected several underlying factors of malnutrition. The nutritional status of individuals is dependent not only on the quantity but also quality of food readily available to them. Household economic resource define accessibility the food and the level distribution. Even though nutritional status is influence by intake of food, on the whole it is not the only critical factor responsible for malnutrition, especially among adolescents. Living standards, water and sanitation, weaning practices and mothers' education level are a few contributory factors which have been identified from research conducted (Rasoul, 2010).

The present study was undertaken to evaluate BMI and height of adolescent girl. It targeted adolescent girls of 10 to 15 years with the reason being that, this is the period for massive transformation into adulthood and also the beginning of their reproductive lives. Questionnaires were constructed to obtain socio-economic data, dietary intake as well as anthropometric data.

The hypothesis of the study were that caregivers knowledge on malnutrition has an effect on the body mass index of the adolescent girls .From the data obtain and statistically analyzed it is possible to say that the caregivers knowledge on malnutrition has no significant effect on the body mass index of the adolescent girls ($P>0.05$).This is in accordance with Silangwe (2012) in a similar research in South Africa on adolescents girl, the author found that the level of knowledge with regards to nutrition did not have any significance on the body mass index on the girl. Another study by Chen (2012) in the Kilosa District of Tanzania expressed this same findings but in this case the research was on older adolescents of age groups 17-19 years. Similarly Kruger et al. (2007) also reported this in his findings that weather a caregiver has knowledge malnutrition or not this has got nothing to do with childhood BMI malnutrition.

Menarche as describe earlier in the literature is very important in the life of an adolescent girls since as it is one of the indicators of puberty. As reveal by the results some of the girls in age of 10-11 have undergone adrenarche, onset of menarche earlier than the normal age as observed by Parker (2009) in a similar research, he found out that this was caused by strenuous physical activities that these girls undergo in the home. Apart from the above

statement, the research outlined that most of the participant in age 12-15 years have not undergo menarche, this is in accordance to similar researcher done by Ali (2009) in Bangladesh. Similarly Chen (2012) in Tanzania stated that this outcome has greatly got to do with lack dietary inadequacy.

Caregivers were those with whom the adolescents were residing with and responsible for their daily upkeep during the research period. Intiful et al. (2006) on primary pupils concluded those staying with both parents are well feed. A study held in Jamaica by Bronte-Tinkew et al (2008) who evaluated the influence of household and resource scarcity characteristics on nutritional status on adolescents girls resulted that staying with a single parent has a high influence on the stuntedness of children. They also concluded that girls with low height-for-age were from families with low income rate (Bronte-Tinkew et al., 2008). Accessing nutritional status and household patterns of children in South Africa unveiled that girls from households headed men problems with chronic malnutrition. Similarly, Cataldo et al. (2011) mentioned that households with single parents having women as the lower means of income in running the home said that single parent households which are predominantly headed by women with mean lower income and small amount of money to purchase were better as compared to those with men as the head.

A majority of the caregivers had low and no level educational level which in tune had an influence on the type of occupation they do earn income for the family. This situation is optimal and makes it difficult for households to fulfil all or most of the obligations due to the low income of such occupations. The socio-economic condition of the households is, therefore, linked to the occupation and income of the parents/caregivers, which ultimately influences the food intake. Deshmukh et al. (2006) reported that lower family income is an important predictor of underweight. More frequently food insecurity limits the choice and access to healthy food (Abedi, 2009). The socio-economic conditions of a population is essential for an individual's quality of life, however, the conditions in which the participants live indicates inadequacy in terms of money available which lead to food insufficiency.

The results in our study indicate the paucity of dietary diversity, which therefore contributes to nutrient deficiency. **Food intake**, in the survey, was considerably low with respect to protein (beef, milk, fish and chicken). A large number of respondents had a low protein intake compared to the required quantities; however, this is the time in the adolescents energy needs are needed for (Alam et al, 2010) physical growth. Maize intake

frequency shows that consumption by girls was very high. This pattern is in line with the work of Kruger et al. (2007) who found out that carbohydrates forms the basis of majority of the diet. Lack of high protein intake definitely affect the recommended iron intake ,calcium, intake and that of zinc since most of these micronutrients are densely found in meat and other meat products. Less iron leads to anemia which is one of the major problems faced by adolescents, regarding low zinc in the diet, stunting is usually the outcome later as one grows. Calcium at this stage is crucial as it is needed for bone mass formation, obtaining full genetic potential and the prevention of possible osteoporosis (Anderson et al., 2009).

From the study, vitamin A intake was high and this could be due to the frequent intake of palm oil in sauce and palm fruits in the preparation of soups. It is actively known in the provision of good eyesight in households that are economically deprived (WHO, 2014; FAO, 2000). Palm oil has a good amount of tocopherol and carotenoids Fruits and green vegetables was observed to have a low consumption in adolescent dietary intake. It is rich in minerals, dietary fiber, complex carbohydrates and vitamins. Sufficient intake of fruits and vegetables leads to a decrease risk of chronic respiratory diseases, cancer of the colon, stomach and esophagus as this was outlined in survey by (Dauchet et al., 2009).

Type of meals eaten at home and the meals taken in a day did not yield a good results. This means that adolescent's take most of their meals out from home. Ghana, like any other developing country has children school taken breakfast and most of their lunch from the school canteen or from food vendors near the school compound. The meals sold at these places, are very low in nutrients and quality, aside this poor hygiene and high prices is a major problem. The quantity of food served depends on how much money adolescents have to purchase the food, in cases where there is no money available it means that they will not eat. This result in reduction of the number of taken in a day leading to weight loss or not attaining the daily energy gains of an individual (Baba, 2013). Other authors, Verity et al. (2009) also came across the same findings in a separate survey.

The study generally recommends that, the Ministry of Health and Ghana Health Service should give equal attention to adolescent nutrition just as attention is given to mother and child nutrition. Also, the District Education Service and the Districts Health Service should educate caregivers and guardians on the need for a health feeding. Ghana Education Service should inculcate the teaching of nutrition in the syllabus for basic school. There should be a nationwide awareness on malnutrition in adolescent girls. Adding to this, during Parent

Teachers Association meeting there should be session to discuss topic on nutrition at the household level. Ghana Education Service and Ghana Health Service should establish canteen on government cluster of school to .This will enhance the effective implementation programs such as the school feeding program.

6. CONCLUSIONS

The aim of the thesis was to evaluate the weight and height among adolescent girls age 10-15 years and also determine the dietary diversity intake of the adolescent girls. The present study showed that there was no significance in the malnutrition knowledge of the caregiver in relation to the BMI of adolescents. The body mass index was normal in all the age group. It was noted that adolescents diet lacked diversity, meal were mostly made up of maize and other cereals without considering the other the food sources or balancing their diet. It was recorded that iodized salt was not used in meal preparation by most participants.

The survey found that the socio-economic household from which these girls come are low in resources. The level of education was greatly not high therefore, affecting the kind occupation most of the caregivers do. Petty trading which was the main job of the caregivers. It was good to record from the survey that more than half of the girls were with both parents. The number of meals consumed in a day was low and this could affect the health status of the girls. Caregiver's knowledge of malnutrition and that of basic nutrient was low. Menarche which is a was reached earlier than required age for some 10 and 12 years girls while it was late for girl who were 12-15 years. Supper was the taken by most girls at home the rest of the meals were eaten outside the home.

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