PJN

$\mathbf{N}$PAKISTAN JOURNAL OF $\mathbf{N}$UTRITION

Effects of Dietary Patterns on the Nutritional Status of Upper Primary School Children in Tamale Metropolis

Adamu Abiba, Adjei Naa Kai Grace and Kubuga Clement Kubreziga
Department of Community Nutrition, University for Development Studies,
Box TL 1883, Tamale, Ghana, West Africa

Abstract: Unhealthy eating increases the risk of malnutrition. This study was therefore carried out to determine the effects of dietary patterns on the nutritional status of upper primary school children in the Tamale metropolis. A cross-sectional study was carried out; hundred (100) participants were randomly selected from five basic schools. Data collection tools and techniques included: anthropometry, dietary assessment, interviews and observations. Food frequency questionnaires were administered to assess dietary intake over a period of two weeks. Results from the study revealed that, the prevalence of underweight was relatively low among participants (10%) as compared to other developing countries. 7% were at a risk of becoming overweight whilst 4% were overweight. Foods consumed were basically from local staples. Variability was however lacking in the diet for most (65%). Consumption of animal protein was also low. 73% of participants did not consume eggs whereas fish and meat were consumed occasionally. Most meals were eaten at home and parents mostly determined what is eaten at each meal time. 37% snack twice a day. 56% of the participants consumed both light and heavy meals as snacks. Snacking was frequent among the overweight and those at risk of becoming overweight than the underweight. General nutrition knowledge of respondents was poor. Conclusively, snacking is more likely to influence respondent's nutritional status. Moreover, sedentary lifestyles may be implicated for the prevalence of overweight and risk of becoming overweight. The risk of pernicious anemia could also be high since animal protein consumption was low.

Key words: Dietary pattern, nutritional status, school children, Tamale

INTRODUCTION

Upper primary school children are mostly those between the ages of 9-12, even though there may be some who are younger or older than the required age for the class. Based on WHO's definition of an adolescent, that is, a person between 10-19 years of age, it can be said that most of these pupils are in their early adolescence.

People have various definitions for adolescence. To some, it is a stage of maturation between childhood and adulthood. A commonly accepted definition of adolescence according to Erikson (1968), it is a period during which young people try hard to understand the questions of who they are as well as who they will become.

Generally, puberty has been linked with teenagers and the onset of adolescent development. It is said to be a period in which rapid physical growth and psychological changes occur, climaxing in sexual maturity (Christie and Viner, 2005). The average onset of puberty is at 10 for girls and 12 for boys (PAMF, 2001). Individuals' timetable for puberty is however influenced primarily by heredity, although other factors like diet and exercise also count. A unique period in life, adolescence is one of intense physical, psychosocial and cognitive development. Adolescence is the only time following

infancy when the rate of growth actually increases. Adolescents gain up to 50% of their adult weight, 50% of their adult skeletal mass and more than 20% of their adult height during this period (WHO, 2006a).

Adolescents of both sexes and in all income and racial/ethnic groups can be at risk for dietary excesses and deficiencies. Many boys and girls in developing countries enter adolescence undernourished, making them more vulnerable to disease and early death (MO-NUPA, 2011). On the other hand, dietary excesses of total fat, saturated fat, cholesterol, sodium and sugar occur leading to overweight and obesity - another form of malnutrition with serious health consequences - is increasing among other young people in both low- and high-income countries. Globally in 2010 the number of overweight children under the age of five is estimated to be over 42 million, of which 35 million of these are living developing countries (WHO, 2011a). During adolescence, lifestyles and food habits change, which affects both nutrient needs and intake. There is also a high susceptibility to nutrition deficiencies. This is partially due to the fact that the development of eating disorders is very prominent during this time. Overweight and obese children are likely to stay obese into adulthood and more likely to develop non communicable

Corresponding Author: Kubuga Clement Kubreziga, Department of Community Nutrition, University for Development Studies, Box TL 1883, Tamale, Ghana, West Africa

diseases like type 2 diabetes and cardiovascular disease. Adequate nutrition and healthy eating and physical exercise habits at this age are foundations for good health in adulthood (WHO, 2011b).

Problem statement: Unlike preschoolers and lower primary school children, most parents of upper primary school children have lesser control over what they eat. This is because at this stage, less attention is paid to them as it assumed they can take care of themselves. Most parents do not provide packed lunches or snacks like the preschoolers. What is been eaten is predetermined largely by: peer influence, school environment including what is available to them in the school premises or what is provided by the school canteen and also what is provided at home. The main problem however arises when the nutritive value of the food, the hygienic condition under which it has been prepared and the portion size of food being taken are compromised. This however is not certain and unclear among upper primary school children in our setting. Malnutrition is a known major contributor to the total global disease burden and the possibility of these school children becoming malnourished is very high.

Justification: The nutritional needs for this delicate period of adolescence cannot be over emphasized. More attention therefore needs to be paid to this group because they are in a transitional period where puberty begins to set in. The need for extra nutrients to support the rapid growth spurts associated with puberty is very crucial in order to prevent complications later in life. Also the development of eating disorders is very prominent during this stage of life, which is carried into adulthood. Moreover information on the nutritional status of adolescents is scarce and the growth references for this age group are inadequate thus when more information is gathered, it will add up to the existing information which could serve as a guide for research works in this area or a similar area.

Research questions:
• What is the relationship between the dietary patterns of upper primary school children and their nutritional status?
• How do the dietary patterns of upper primary school children affect their nutritional status?
• Do upper primary school children have any basic knowledge on good eating habits?
• What influences the choice of food of upper primary school children?

Objectives
General objective: To determine the impact of dietary patterns on the nutritional status of upper primary school children in the Tamale Metropolis.

Specific objectives:
• Assessing the dietary patterns and nutritional status of upper primary school children
• Identifying how the dietary patterns of these individuals may affect their health
• Assessing the basic knowledge they have on good nutrition
• Identifying factors that influence their choice of food

Literature review
Introduction: Nutrition is said to be the science of nourishing the body and deals with foods and their effects on health. Good nutrition is therefore fundamental and an important prerequisite to good health.
Health as defined by WHO (1948) is said to be a state of complete physical, social and mental well being and not just the absence of disease or infirmities. Nutrition is an important avenue through which the indicators for good health can be achieved. This is because proper nutrition promotes a good nutritional status thus satisfies the requirement for good physical health. Moreover food can help foster good social relationships and open avenues for business opportunities. Once a person is food and nutrition secured, he or she has the peace of mind to divert energy into more profitable areas since the basic needs have been satisfied. A person healthy in all these three areas of health will increase production and in a way stop the vicious cycle of poverty.
Due to the important role nutrition plays in health, a lot of individuals, groups and organizations have embarked on several studies in this area. However, according to World Bank (2003a), "adolescents have typically been considered a low risk group for poor health and often receive few health care resources and scant attention". This is very dismaying because, it is one of the critical stages of life and whatever lifestyles are developed will be carried on into later life.

Dietary patterns and the nutritional status of adolescents: Basically, under consumption and over consumption of calories tend to result in malnutrition. For one to have a very good or optimum nutritional status, one must be both food and nutrition secured, however most people are on borderline nutrition because nutrition security is difficult to achieve (Williams and Schlenker, 2003). Therefore even though a person may be food secured, he or she may not necessarily be nutrition secured. Individual nutritional status depends on the interaction between food that is eaten, the overall state of health and the physical environment (WHO, 2001).
A model developed by UNICEF (1997) provides a widely accepted framework that shows the most likely causes of malnutrition. This framework indicates that malnutrition, as an outcome is as a result of immediate,

underlying and basic causes in a hierarchal manner. Food, health and care are major requirements for nutritional well being.

However, food preferences that are developed early in life influence adult food preference. Furthermore, it is during this period that they experiment and start developing dietary habits. Poor dietary patterns once developed eventually become permanent dietary habits (Birch, 1999).

As described by WHO (2001), "malnutrition essentially means bad nourishment. It concerns not enough, as well as too much food, the wrong types of food and the body's response to a wide range of infections that result in mal absorption of nutrients or the inability to use nutrients properly to maintain health". Though malnutrition is in two forms: over nutrition and under nutrition. Most people however associate malnutrition to under nutrition only.

Based on WHO's description (2001), one might consider factors such as famine, starvation, fasting, economic instability, skipping meals as potent reasons why one would not have enough food or eat less which will thus lead to bad nourishment or under nutrition specifically. During such times, dietary patterns change. People tend to reduce the amount and number of times they eat as well as the quality of food. However, in over nutrition one might consider factors such as over eating nutrient dense foods or physical inactivity levels. The researchers have considered the dietary patterns in various countries and these are cited below:

America: A study conducted in the United States by Wang *et al.* (2010) to determine the dietary intake pattern of low income urban African American adolescents described their dietary patterns based on caloric intake, nutrients, food groups and diet quality. 382 African American adolescents were included in the study. The study revealed that there was high energy intake among the participants with most of the participants consuming calorie dense foods as well as foods that are low in nutrient such as snacks, fried foods and sweetened beverage. They also found out that more than half of the participants consumed one or more servings of sweetened beverage and fried foods per day. Dietary patterns just like snacking often on energy dense foods are known to be common among adolescents of the developed countries (Dennison and Shepherd, 1995; Spear, 2002). The results also revealed that snacking rates were high with three quarters of the participants consuming snacks thrice or more times per day. Dietary patterns among these African-American adolescents were unhealthy.

Another study conducted in Canada by Janssen *et al.* (2004) to present overweight and obesity prevalence rates for 11-16 year old Canadian youth and to examine associations between overweight and obesity with dietary habits and leisure-time physical activities revealed that the rate of overweight (pre obese) was greater in boys than in girls but did not vary according to age. Moreover, they also found out that physical inactivity levels and television viewing times recorded were higher in overweight and obese boys and girls than those who were normal. From the results it can be said that sedentary lifestyle as well as physical inactivity are more likely to have an influence on the obesity rate among Canadian adolescents.

In yet another study conducted in Jamaica by Samms-Vaughan *et al.* (2000), to determine the nutritional status of a cohort of 11-12 year old and ascertain social and demographic factors associated with under- and overweight in early adolescence, results revealed that 10% of the participants had body mass index values below the 5th percentile and were thus considered to be underweight. This prevalence rate was considered to be low as compared to other developing countries. A decline in the prevalence of under nutrition in developing countries has also been clearly identified (Olumaikaiye *et al.*, 2010). The prevalence of overweight was rather high (19.3%).

Europe: A research conducted in Nordic countries (Denmark, Finland. Norway and Sweden) by Samuelson (2000) involving adolescents aged 13-18 years indicated that their meal patterns were irregular. They found out that, breakfast was the meal often skipped by the participants especially in females than males. Lunch was also sometimes skipped whiles most of them have dinner. Their results also revealed that snacking and light meals were very common. This discovery is similar to the finding of Wang *et al.* (2010) in the United States were they also found out that snacking was very common. The study also showed many of the participants spent less time in doing physical activity but rather spent a lot of time in watching television as well as playing computer games. This can also be compared to the physical inactivity levels and sedentary lifestyles found among the Canadian adolescents by Janssen *et al.* (2004).

However in contrast to the rate of snacking found among the adolescents in the United States and the Nordic countries, a review of food consumption and nutritional status of adolescents in Southern European countries performed by Professor Dr. J.A. Amorim Cruz in March 2000 revealed that they are snacking less frequently and the rate at which they eat out in fast food restaurants is much lower than in the USA and in some Nordic Countries. He however found out that the prevalence of overweight/obesity was still high. The results of this study and that of the study conducted in Jamaica can be said to be similar in the sense that, prevalence of overweight/ obesity amongst the Jamaican adolescents and Southern European adolescents is high.

Asia: A study conducted in Xi'an City, China by Li *et al.* (2004) explored the association between dietary habits and overweight and obesity in adolescents. Results revealed that consumption of foods and beverages outside three main meals was more popular in boys than in girls, while girls consumed more fried food and soft drinks than boys. Snacking can therefore be said to be popular among Chinese adolescents. Moreover, it is important to note that the rate of snacking among these Chinese adolescents can be compared to the snacking rates of adolescents in Nordic countries as well as those in the United States. The report also stated that overweight and obesity were found among those who did not eat breakfast at home, but rather bought food from outside and also those who consume soft drinks. Consumption of soft drinks (carbonated and non-carbonated) is known to be a major contributor to the risk of overweight and obesity.

Also Faruk *et al.* (2000) conducted another study in Bangladesh to investigate the dietary patterns and nutritional status of adolescent girls attending school in Dhaka City. Their studies revealed that a large number of the girls did not eat eggs, milk or dark green leafy vegetables but a larger proportion consumed meat and fish at least four times in a week. Conclusively, they reported that the diets of the girls were inadequate in both micronutrients and macronutrients.

A study in Nepalese schoolchildren showed that fast foods (ready to eat snacks, chips etc) were preferred by more than two-third of adolescents (World Bank, 2003b).

Africa: In Nigeria, a study conducted by Olumaikaiye *et al.* (2010) on food consumption patterns of Nigerian adolescents and effects on body weight to determine the association between nutritional status of adolescents and food consumption pattern showed that more than half of the participants ate three meals daily. They realized that the rate of underweight was higher among those who did not take snacks but ate three meals a day, but least among those who ate snacks twice a day in addition to their three main meals. They concluded that snacking was important in improving nutritional status.

Anthropometric measurements of malnutrition: Anthropometric measurements are always used to indicate malnutrition. Dudek Susan (2010) explain anthropometry as the science of measuring the size, weight and height of a human body. Height and weight measured usually vary according to the person's age and sex and these measurements are used to derive indices such as body mass index, weight-for-age, weight-for-height as well as height-for- age. This index can be used to determine under weight, wasting and stunting respectively.

Body mass index: Body mass index is an index that is used to indicate underweight, overweight and obesity in individuals. It can be used to assess the nutritional status of children and adolescents as well as adults. However, unlike the BMI cut off points for adult which remain the same for both sexes regardless of age, the BMI for growing children varies with age and sex. It is calculated as weight in kilograms divided by square of the height in meters. The recommended cut offs for BMI for age are $\geq$ 95th percentile for overweight, 85th to <95th percentile for risk of overweight, 5th-84th percentile for normal and <5th percentile for underweight (CDC 2000 growth reference).

Effects of dietary patterns on health: Health and nutrition are known to be closely related. Nutrition can have an effect on one's health either by improving it, or making it deteriorate, likewise health can also affect nutrition by either improving the individual's appetite or making it deteriorate. During adolescence there is high incidence of nutrition deficiencies and poor eating habits which exposes them to many risk factors leading to the development of chronic diseases such as diabetes, osteoporosis, hypertension, heart diseases, chronic kidney failure, cancer and many others. The leading causes of mortality and disease burden include risk factors for communicable, maternal, perinatal and nutritional conditions such as under nutrition. They also include risk factors for non communicable diseases and injuries such as high blood pressure and cholesterol, smoking, alcohol use and overweight and obesity which affect most regions (Lopez *et al.*, 2006).

They continue to further state that, "the ten leading causes of death in people between the ages of 15-59 are: diabetes mellitus, breast cancer, colon and rectal cancers, stomach cancers, cirrhosis of the liver, cerebrovascular disease, ischemic heart disease, trachea, bronchus and lung cancer, road traffic accidents and self inflicted injuries" (p 71). From this it can be deduced that seven out of these leading causes of death can be directly or indirectly associated with diet.

Also according to de Onis *et al.* (2004) as cited by Lopez *et al.* (2006), "Under nutrition is the single leading global cause of health loss, as it was in 1990 (the 2001 results disaggregate under nutrition into underweight and micronutrient deficiencies)". They continue to state that even though the prevalence of underweight has decreased in most regions in the past decade, it has increased in Sub Saharan Africa. From their research conducted in Sub Saharan Africa to determine the leading causes of death in the region, Chalapati *et al.* (2006) also buttress this point in their statement that "the results suggested that malaria, diarrheal diseases and malnutrition were the leading causes of death among school-age children".

Nutrition related non communicable diseases such as obesity, hypertension, diabetes mellitus, chronic renal failure, cancer and gout are major contributors to the global disease burden. Though some of these conditions may not necessarily originate from diet, they require dietary management to improve quality of life and reduce mortality. The burden of these diseases on health is astronomical. The effect on quality of life and money spent on health care is greatly significant.

According to WHO (2010), out of a total of 57 million deaths in 2008, 36 million were from non communicable diseases. Also according to the Broad Income Group (2001) as at 2001, the ten leading causes of deaths worldwide were Ischemic heart disease, self inflicted injuries, road traffic accidents, trachea, bronchus and lung cancer, cerebrovascular disease, cirrhosis of the liver, breast cancer, colon and rectal cancer, diabetes mellitus and stomach cancer. Seven of these are directly or indirectly associated with diet.

In the United States also, five of the ten leading causes of death are directly associated with diet thus; diabetes, cancer, heart disease, cerebrovascular disease (stroke) and kidney disease, with cancer being the top most cause (U.S Center for Disease Control, 2007). Also in the U.S according to the National Center for Health Statistics (2005) as at the year 2002, out of the 20 leading causes of deaths in young teens (those from 10-14 years), about ten of these causes are linked directly or indirectly to diet. They are malignant neoplasm causing 12.95% of all deaths, heart disease causing 3.94%, cerebrovascular disease causing 1.4%, benign neoplasm causing 1.09%, diabetes mellitus causing 0.7%, anemia causing 0.58%, HIV causing 0.51%, nephritis causing 0.29% and liver disease causing 0.12% of all deaths.

Likewise in South Africa among the 10 leading causes of death 5 can also be linked to diet in one way or the other, these are diabetes, hypertension, stroke, diarrheal disease and heart diseases (Norman, 2011). HIV/AIDS was the leading cause of death in South Africa in the year 2000. However HIV is a condition that if properly managed with diet can slow the progression of the disease. Besides it is important to note the food-drug interaction in HIV therapeutic management. In palliative care of HIV positive patients, adequate dietary management is considered to manage the side effects of the drugs.

Experts have tried to identify the risk factors for non communicable diseases. Many of the chronic disease risk factors and the diseases themselves overlap. One disease can increase the risk or serve as a risk factor for yet another disease. Below are some disease and their possible risk factors:

Cancer: In the developed countries, cancer is known to be the second largest cause of death after cardiovascular disease (WHO, 2003). According to Ellen

G. White (2010) as cited by Pamplona (2006), "the most important of the causal factors of cancer is improper diet". He further stated that diet accounts for 35% of all cancers.

The World Health Organization has identified some causes of cancer as well as factors that will reduce the risk of cancer. Factors that are convincingly known to increase the risk for cancer by WHO (2003) are overweight and obesity, alcohol, Chinese style salted fish and aflatoxins. Those known to be the probable cause are preserved meat, salted preserved foods and salted very hot drinks. But there are also possible or insufficient causes which include animal fats, heterocyclic amines, polycyclic aromatic hydrocarbons, nitrosamines.

According to Pamplona (2006), "all alcoholic beverages promote cancer, even those considered to have medicinal value such as wine or beer. These do not require large doses to induce cancer. This effect is present even with moderate consumption. One glass of wine a day increases the risk of breast cancer by 250%".

Hypertension: Hypertension is as a result of the extra effort needed to circulate blood due to excess fat or plaque buildup in the veins. Diet amongst other factors such physical inactivity, lifestyle; age, family history, as well as stress are all risk factors of hypertension. Poor dietary habits can lead to obesity or overweight as well as sedentary lifestyles and physical inactivity. Children and adolescents who are obese have a greater risk of hypertension when they reach adulthood (Stabouli *et al.*, 2005). Salt and potassium are other factors that need to be taken into consideration in the diet. This is because too much salt (sodium) can cause hypertension in some people (CFNI, 2004). Low potassium in the diet too can increase sodium levels in the body. These two minerals are important for fluid regulations in the cells.

Cardiovascular disease: Cardiovascular Disease (CVD) is known to be one of the major causes of death worldwide. It occurs as a result of malfunctioning of the heart, arteries and veins which carry oxygen to vital organs like the brain. Risk factors for cardiovascular diseases include, overweight, physical inactivity, smoking, hypertension, diabetes (NCHS, 1990).

60% of the world's heart disease cases in 2010 were recorded from India (Norton, 2010). A separate recent study found that people in India and other South Asian countries suffer their first myocardial infarction at age 53 on average, 6 years earlier than the rest of the world. However, heart disease doesn't just kill the elderly; it is the leading cause of death for ALL Americans age 35 and older.

Cerebrovascular disease: Stroke occurs when blood flow to a region of the brain is obstructed, causing brain tissue death. Ischemic stroke is usually caused by a

blood clot in an artery that supplies blood to the brain. Heart disease and hypertension are major contributors to stroke. Other risk factors include diabetes, atherosclerosis, high cholesterol levels and family history. According to Swierzewski (2010), "maintaining healthy blood pressure through diet, exercise and medication, if necessary, can decrease the risk for stroke".

Osteoporosis: Nutrition supplies the structural components of bone and supports a number of metabolic processes needed to maintain bone. Nutrients like, calcium, vitamin D, protein, vitamins B12 are required for maximizing bone density. However, vitamin D and calcium remain the two most vital nutrients.

Adolescents gain up to 50% of skeletal mass during this stage of life (WHO, 2006b). This is further elaborated by Pamela (2009), who explains that maximal bone density occurs by the late teen years for girls and early twenties for boys and once they pass this stage, they do not get the chance again.

The availability of many beverage options has increased the risk for osteoporosis. Soft drinks are suspected of leading to lower calcium levels and higher phosphate levels in the blood (Murray and Pizzorno, 2005). When phosphate levels are high and calcium levels are low, calcium is pulled out of the bones (James, 2008). The phosphate content of soft drinks is very high and they contain virtually no calcium. High protein intakes increase the need for calcium; therefore people consuming high protein have a higher calcium requirement (Michael Latham, 1997).

Diabetes: Diabetes is a chronic condition, in which there is high blood glucose level in the blood as results of the body's inability to either make or use insulin. Studies in the United States on obesity in children identified that type II diabetes is on the increase in teenagers (American Diabetes Association, 2000). Other risk factors that account for this condition are hypertension, sedentary lifestyle and family history. Diabetes has long been linked to obesity or being overweight and research at the Harvard School of Public Health showed that the single best predictor of type 2 diabetes is being obese or overweight. The CDC estimates in 2004 showed that, more than one out of every four Americans is obese, having a BMI of 30 to 39.9 and 6% of Americans have clinically severe obesity, having a BMI of 40 or greater (CDC, 2004).

Another problem faced by adolescents is eating disorders. In the Western countries, the number of adolescents with diagnosed anorexia or bulimia nervosa is growing and many adolescents with various eating disorders and disordered eating behaviors remain undiagnosed. Many of these teenagers who manipulate their weight to be models, entertainers, dancers and other athletes also suffer from long-term effects of chronic malnutrition whether they do or do not meet the criteria for anorexia so they are categorized as having an eating disorder. Food related behaviors and associated deviation in body weight are two obvious characteristics of these disorders. Amenorrhea may also set in as a result of eating disorders.

Iron deficiency anemia is also another problem faced by adolescent girls whose iron intake is inadequate.

Basic knowledge on good nutrition: Among the numerous factors that influence dietary choices, nutrition knowledge about foods and health is the most amenable to change. Several studies have been conducted in this area.

A study conducted in rural Bangladesh by the Institute of Public Health Nutrition in 2004 to identify the nutritional status, knowledge and practices of unmarried adolescent girls revealed that adolescent knowledge regarding the nutritional value of different types of food items was limited. Less than half of the participants were able to correctly identify energy dense foods and protein rich foods. However, their knowledge about vitamin- and mineral-rich foods was better with more than half of the participants being able to correctly mention vitamin and mineral-rich foods.

Another study conducted by Netra and D'Amico (1999) in U.S, to determine whether lack of nutrition knowledge correlate to obesity in adolescents revealed that of 292 students contacted 26% were obese. There were no significant differences in nutrition knowledge between the obese and non-obese students other than the fact that obese students were better able to identify fiber rich foods. The obese adolescents were more likely to eat outsides. There were no significant differences in nutrition behaviors or food preferences of the obese and non-obese adolescents. They concluded that the overall nutrition knowledge did not differ between obese and non-obese adolescents.

In yet another study conducted by Caupisti *et al.* (2010) to determine the nutrition knowledge and dietary composition of Italian adolescent female athletes and non athletes the researchers concluded that the overall recalled dietary intake and nutrition knowledge of the studied adolescent females show some misconceptions and nutrient deficiencies, but the results in athletes are quite better than in non-athletes, suggesting a favorable role of sport practice on dietary habits and nutrition knowledge.

Factors that influence choice of food: Adolescents at this stage in their lives, begin to gain some amount of control in decisions concerning their lives especially in their choice of friends and the kind of foods they eat outside their homes. Though they have the right to

choose what they want to eat, there are other factors that influence their choices, many of which can improve their choices or adversely affect them. Some of these factors that influence their choices of food include socioeconomic status of parents (specifically income and educational level of parents), peer pressure, cultural practices and advertisement.

Socio economic factors: Socio economic status is known to be a great determinant of health and nutritional status. This is buttressed by WHO (2006a), as cited in Chen (1979), in his explanation of the factors that account for adequate nutrition. According to him, the first factor is the adequate availability of food in terms of quantity as well as quality, which depends on socioeconomic status, food practices, cultural traditions and allocation of the food in the household. He stated the second factor to be physiologically related in terms of digestion, absorption and utilization the food.

The main settings that influences the way children and adolescents grow up include families, neighborhoods and schools. The quality of these settings and whether they are supportive and nurturing or dangerous and destructive, has a profound influence on adolescents' chances for leading successful adult lives. Family income is perhaps the single most important factor in determining the quality of these settings (National Research Council, 1995) and the nutritional and health status of both children and adolescents. What is eaten by the family is solely dependent on the income of the parents.

Low income families tend to either purchase less nutritious cheap food items as a means to cope with the situation or reduce intake of food. The less nutritious cheap food items will certainly not meet the nutritional requirement of the household particularly the vulnerable groups of which adolescents are included. Nutritional requirement increases during adolescent where females require 2200 Cal./day and males 2500-3000 calorie and all the other nutrients needed for the growth and development. Therefore adolescents from low income families are more likely to have nutritional deficiencies than their peers.

Moreover, adolescents from poor and low income families are more likely to have emotional problems, face both financial and non financial barriers to adequate food, medical care and have limited care from their parent since much of their time is focused on earning income for the family. Therefore socioeconomic status of parent specifically income, have an adverse effect on adolescent's health. This is supported by an updated study in the United States on the association between socioeconomic status (income) on health care and health status of adolescents (Newacheck *et al.*, 2003) which is in consistence with the findings of a study conducted by (Montgomery *et al.*, 1996; Bearman and Moody, 1999).

Family income has an adverse effect on child's health especially in the early childhood since it is a crucial stage of development, where a deficiency or any health problem that occurs is carried on to adulthood. Children from low income families suffer from worse health with different nutritional deficiencies and metabolic dysfunctions than children from high income families. Case *et al.* (2002) findings on the relationship between family income and health status among toddlers in the U.S showed a positive association.

Poverty is considered the prime factor determining food consumption; however, some researchers suggest that cultural factors play a stronger role than socioeconomic conditions in determining allocation of food and nutritional adequacy (WHO, 2006a as cited in Sendrowitz, 1995) especially in countries where gender discrimination plays an important role in intra household food allocation.

Parental educational level, in particular the mothers, showed the highest impact on the adolescents' health-related dietary habits since they cook family meal. Mostly educated mothers are cautious of what the family eats than uneducated mothers.

Advertisement: Advertising products by manufactures is the best medium to get their product to the population. The most commonly used mediums are television, radio and magazines. Television is the favorite medium most widely used by food manufacturers because it can reach large audiences and instill brand name recognition. Much television advertising is also aimed toward people who do not read newspapers, such as children and adolescent. Mostly this advertisement focuses on highly processed and highly packaged foods which do not meet the nutritional requirement for both children and adolescent. According to WHO (2006b) as cited in Phyu Phyu Aung 2002), "advertising, probably TV and magazines, influenced preferences in 80% of Nepalese adolescents". Also another food study he conducted in Myanmar also showed that about half of the participants consume snacks that are advertised.

Cultural and religious factors: Culture is known to have both positive and negative influences on the kinds of food people consume. The nutritional advantages of traditional foods cannot be repudiated. Michael Latham (1997) buttresses this point in his statement that "the traditional use of certain green leaves by rural people is a beneficial practice that should be encouraged".

Another example of how culture positively affects food consumption is again cited by Michael Latham (1997). According to him, many societies in Indonesia and parts of Africa partly ferment foods before consumption. Scientifically, fermentation is known to improve nutritional quality of food as well as reduce bacterial contamination (Marquis Robert, 2007).

Conversely certain taboos have negative influences on the foods people consume. According to Michael Latham (1997), "many taboos concern the consumption of protein rich foods often by those groups of the community most in need of protein". A common taboo in Africa is against the consumption of eggs. Certain religions also forbid their members from consuming certain foods. Jewish and Moslems are forbidden from taking pork.

Peer pressure: Parents have lesser control on what adolescents eat especially when they go to school. However what their friends eat in the school and what is available to them in the school environment may have an impact on their food preference. This point is reinforced by the International Food Information Foundation Council (2009). According to the council, social pressure has a major influence on teenagers' food choices because that is the time they want to gain peer acceptance or insist on independence from parental authority.

Also according to Neill *et al.* (1997) what children eat at school is dependent on many factors, including the cafeteria environment, peer pressure, administrative support, teacher participation, cafeteria staff and the quality of food choices offered. Peer pressure can thus be an important determinant in one's choice of food.

MATERIALS AND METHODS
Diverse research techniques were used to enable answer the various research questions as illustrated below:

Research Location and size: Tamale metropolis is located in the northern part of Ghana and it is the administrative capital of the Northern Region. It is bounded to the north, south, east and west by; Savelugu-Nanton district, West Mamprusi district, East Gonja and Tolon Kunbungu respectively. It covers a land mass of approximately 922sq/km. Tamale has a total population of 293,881 of which males are 146,979 and females are 146,902 constituting 50.01% and 49.99% respectively of the total population (Ghana Statiscal Service, 2000). The indigenes are Dagombas and area predominantly Muslims. The Tamale metropolis is divided into six sub districts.

Vegetation and climate: The vegetation of Tamale falls within Savannah grassland and it is characterized by tall grasses and short scattered tress such as shea nut, baobab, dawadawa and nim. These are mostly drought resistant. The grass which is predominantly elephant grass is usually used for roofing. The metropolis experiences one rainy season starting from April/May to September/October with a peak season in July/August. The mean annual rainfall is 1100 mm within 95 days of intense rainfall. Consequently, staple crop farming is highly restricted by the short rainfall duration.

The dry season is usually from November to March. It is influenced by the dry North-Eastern (Harmattan) winds while the rainy season is influenced by the moist South Westerly winds. The mean day temperatures range from 33 Celsius to 39 Celsius while mean night temperature range from 20 Celsius to 22 Celsius. The mean annual day sunshine is approximately 7.5 hrs (Meteorological Service Department, 2011).

Education: Tamale is the principal center of education in the north of Ghana. Currently there are a total of 742 basic schools within the metropolis. This comprises 94 kindergartens, 304 primaries, 112 Junior High and 10 Senior High Schools. The rest are technical/vocational institutions, two (2) colleges of Education, a polytechnic and two universities-one public and the other private. In the Education Ridge neighborhood in the northwestern party of the city and covering an area of about 3 km, 20 schools ranging from kindergartens through junior high and senior high.

Below is a map of Tamale
Target population: The target population of this study is upper primary school children and it thus cover pupils in class 4, 5 and 6 in the Tamale Metropolis.

Study population: 100 pupils out of a total of 1271 pupils from 6 selected schools were sampled due to time and resource constraints.

Sampling frame: The total population of upper primary school children in five selected basic schools namely; Elsie Lund Schools, Choggu Nuri Islamic Primary, Dahin Sheli M/A Primary, Lamashegu M/A Primary B and Faith Hill Community School formed the sampling frame. The researchers used convenience sampling in this study to select the schools based on proximity and also due to resource constraints.

Sampling design: Probability proportional to size was used to select the sample size of 120 pupils. A proportion of the total sample size was allocated to each of the selected schools based on the total population of upper primary school children in each school. This was done using simple ratio and proportion. Out of the total sample size of 120, 41 pupils were selected from Dahin Sheli M/A Primary, 8 from Faith Hill Community School, 11 from Elsie Lund Schools, 14 from Choggu Nuri Islamic Primary School and 26 from Lamashegu Primary B.

Random sampling was then used to select the required number from each school to prevent bias. The researchers numbered all the names in the three upper primary class registers in each school. The numbers were then written on pieces of paper and one was selected randomly. The name that corresponded to the number was selected to be the starting point. The total

number of upper primary pupils was then divided by the required number of participants needed from that particular school. That number served as the interval based on which subsequent participants will be selected. This procedure was repeated in each school.

Methods of data collection: Both primary and secondary data collection procedures were employed in the data collection. The following data collection methods were employed: anthropometry, dietary assessment, interviews and observations. For each method the following procedures enumerated below was used:

Anthropometry: The nutritional status of each participant was assessed using weight, height, sex and age as the variables. For their weights, each participant stood on a mechanical analog weighing scale after it had been zeroed and had removed his or her sandals and any other heavy objects. The weight was then recorded to the nearest 0.1 kg. The scale was carefully handled and periodically calibrated by placing a pre-weighed object on it as a standard to ascertain accuracy. When the scale weight did not match the standard weight of the object, the calibration screw of the scale was adjusted whilst the pre-weighed object was on it. Their heights were also measured using a microtoise. Each participant stood vertically against the wall on which the microtoise had been attached barefooted and asked to look straight ahead, after which the measurement was read off and recorded to the nearest 0.1 cm. To avoid variability in data collectors, the same measurers were employed. Their body mass index was then calculated from the figures using the formula weight/height^2. This was then compared to the international standard to assess if their body weights conform to their ages.

Dietary assessment: A food frequency questionnaire was used to find out their dietary intake over a period of two weeks. This was recorded for each participant by the researchers on one-on-one basis. Also closed ended questionnaires were issued out to participants to find out their dietary patterns. The participants in each school were put in a group and the questions read out to them, after which necessary explanations were given where needed.

Pre-testing of questionnaires: The questionnaire was pre-tested on five upper primary school children who were not eligible to take part in the study. They were selected from Dungu M/A Primary School. Subsequently the questionnaire was revised and the final version created for the study.

Interview: An informal interview was conducted for food vendors in and around the schools. Some of the pupils were also interviewed to allow them to freely express themselves since the questionnaires were closed ended.

Observation: The researchers observed the sanitation in the schools, food hygiene practiced by food vendors, cooks as well as the pupils themselves. The personal hygiene of pupils was also observed. Also the researchers physically examined the participants.

Statistical analysis: The data collected at the end of the study was edited. The completed questionnaires were serially coded and the final analysis tabulated. Since the researchers used both descriptive and analytic research design, the main statistical tools that were used for analyzing the data was Statistical Package for Social Sciences (SPSS) version 16 and Epi Info version 3.4.3.

Limitations: The researchers were unable to assess the nutrient density of foods consumed by participants. Also the food list provided in the food frequency questionnaire was not representative of all the foods consumed by the participants. Moreover, because diet assessment relied on memory, some of the participants found it difficult remembering all the foods consumed over the two weeks period. Furthermore, some of the participants found it difficult to tell the exact portion sizes of foods consumed.

Even though the English language was used during the research, some participants found it difficult understanding some of the questions and the researchers therefore had to employ translators.

RESULTS

The analysis of the data gave the various outcomes as shown below:

Socio demographic characteristics: Out of the 100 respondents, 56% were females and 44% were males. Most of the participants (54%) were 12 years and above. Also majority of the participants (78%) were Muslims and 56% were from families having 6-10 members. The disparity in age, sex, religion and family size are illustrated in Table 1, Fig. 1, 2 and 3 respectively.

The Fig. 3 illustrates the family size distribution of respondents. More than half of the respondents (56%) are from families that have 6-10 members, 23% are from families that have more than 10 members whiles 21% are from smaller families having 5 or less members.

Foods consumed: Table 2 shows the list of foods usually consumed by the respondents. The very common foods consumed are porridge and "koose"/ "masa"/"kulikuli"/bread having 94%, tea and bread with 85%, T.Z and soup, "banku" and soup, "fufu" and soup, boiled yam and stew, rice and stew and drinks all having 100%, fried yam and "kulikulizim"/pepper with 69% and biscuits with 96%. The common ones are "wasawasa", "waakye", "gari" and beans, rice balls and soup and ice cream with 58%, 62%, 33%, 38% and 57% respectively.

Table 1: Age distribution of respondents

Age (years)	Frequency	Percentage (%)
9	3	3.0
10	16	16.0
11	27	27.0
12 and above	54	54.0
Total	100	100.0

Source: Researchers' field survey, 2011

□ Male ■ Female
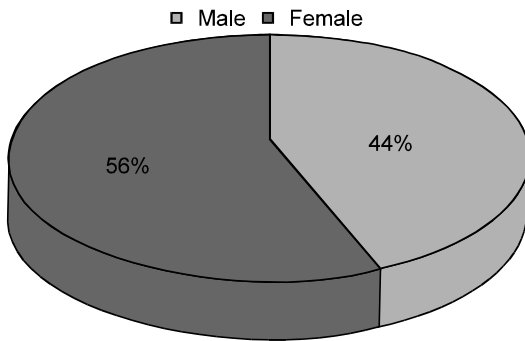
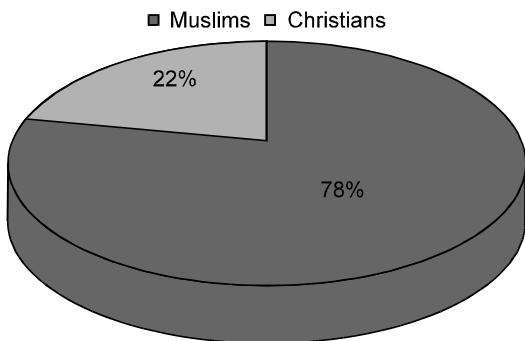Fig. 1: Sex distributions of respondents. Source: Researchers' field survey, 2011

■ Muslims □ Christians

Fig. 2: Religion of respondents. Source: Researchers' field survey, 2011

□ 5 and below ■ From 6 to 10 ■ Above 10
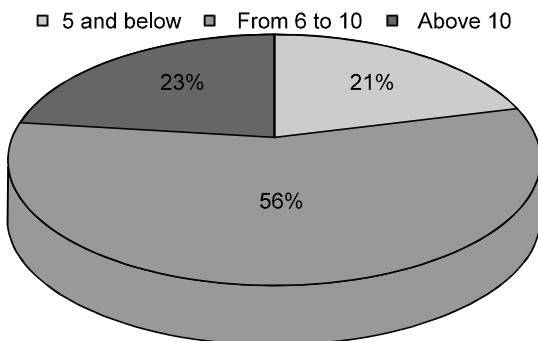
Fig. 3: Results for family size. Source: Researchers' field survey, 2011

Other foods such as rice porridge and bread, "tubani", yam puddings, "kenkey" with pepper and spaghetti with stew are some of the rare ones consume.

Table 2: Foods consumed by respondents

Foods	VC	C	R
Porridge with koose/masa/kulikuli/bread	94	–	–
Tea and bread	85	–	–
Rice porridge and bread	–	–	11
Tubani	–	–	24
Wasawasa	–	58	–
T.Z with soup	100	–	–
Banku with soup/stew	100	–	–
Fufu with soup	100	–	–
Boiled yam with stew	100	–	–
Rice and stew	100	–	–
Fried yam and kulikulizim/pepper	69	–	–
Waakye and stew	–	62	–
Yam pudding	–	–	5
Beans and gari	–	33	–
Rice balls and soup	–	38	–
Kenkey with pepper	–	–	25
Spaghetti with stew	–	–	29
Drinks	100	–	–
Biscuits	96	–	–
Ice cream	–	57	–

Source: Researchers' field Survey, 2011. VC = Very Common; C = Common; R = Rare

Table 3: Frequency of breakfast in a week

No. of times	Frequency	Percent
Every day	70	70.0
3 Times	13	13.0
4 or more times	8	8.0
Occasionally	9	9.0
Total	100	100.0

Source: Researchers' field survey, 2011

Table 4: Responses on breakfast times

Times	Frequency	Percent (%)
Before 7 am	80	80.0
Between 7 and 8 am	16	16.0
Between 8 and 9 am	1	1.0
After 9 am	3	3.0
Total	100	100.0

Source: Researchers' field survey, 2011

Daily meals: Table 3 shows the frequency of breakfast taken in a week. It can be seen that, majority of the respondents (pupils) that is 70% take breakfast every day and the least being 8%, take breakfast four or more times.

The time breakfast is taken as shown in Table 4 indicates that most of the respondents, that is, 80% take their breakfast before 7 am, 16% take it between 7 and 8 am, 1% takes it between 8 and 9 am and the rest of the 3% take breakfast after 9 am.

Fig. 4 shows that most respondents do not have control over what they eat for breakfast. Only 14% of the respondents decide what they want to eat for breakfast whereas 69% have their parents making the decision.

It can be seen from the Table 5 that majority of the respondents, representing 76.8% take lunch every day and a few, representing 6.1% take it occasionally.
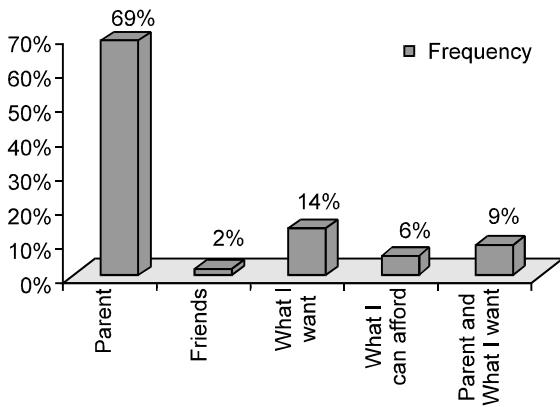
Fig. 4: Responses on factors that influence breakfast choice. Source: Researchers' field survey, 2011
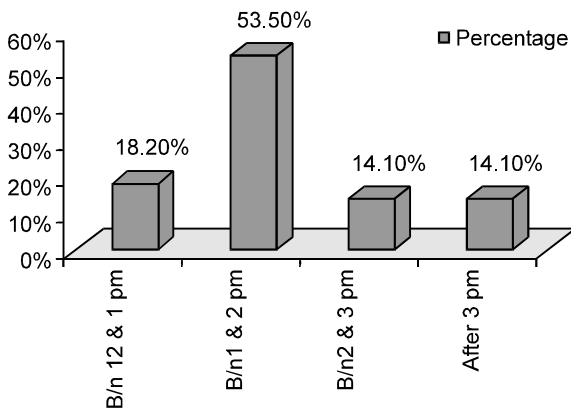

Fig. 5: Responses on lunch times. Source: Researchers' field survey, 2011

Table 5: Frequency of lunch in a week

No. of times	Frequency	Percent (%)
Every day	76	76.8
3 times	7	7.1
4 or more times	10	10.1
Occasionally	6	6.1
Total	99	100.0

Source: Researchers' field survey, 2011

Table 6: Frequency of supper in a week

No. of times	Frequency	Percent (%)
Every day	91	91.9
3 times	2	2.0
4 or more times	6	6.1
Total	99	100.0

Source: Researchers' field survey, 2011

The Fig. 5 for lunch time reveals that more than half of the respondents representing 53.5% take their lunch between 1 and 2 pm, 14% take their lunch between 2 and 3 and a similar number also take theirs after 3 pm. From Fig. 6 it can be said that most of the food choices for lunch are decided by parents, representing
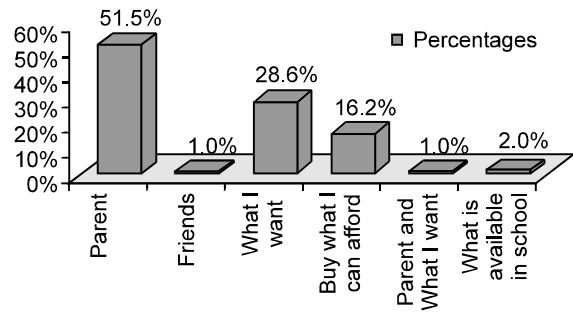

Fig. 6: Responses on factors that influence lunch choice. Source: Researchers' field survey, 2011
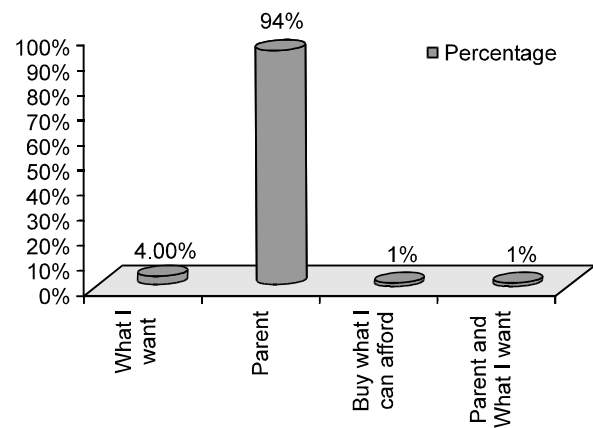

Fig. 7: Responses on factors that influence supper choice. Source: Researchers' field survey, 2011

Table 7: Responses on supper times

Time	Frequency	Percent (%)
Before 6 pm	10	10.1
Between 6 and 7 pm	73	73.7
After 8 pm	16	16.2
Total	99	100.0

Source: Researchers' field survey, 2011

51.5%, the respondents who actually choose what to eat represent 28.6% and those who buy what they can afford for lunch represents 16.2%.

The Table 6 discloses that most of the respondents that is 91.9% take supper everyday of the week, 6.1% take it four or more times and the rest of the 2% take supper three times in a week.

The results as shown in Table 7 indicates that majority of the respondents (73.7%) take supper between 6 and 7 pm, with 16.2% taking it after 8 pm and the remaining 10.1% take supper before 6 pm.

On the whole, 94% of the respondents' food choices for supper are made by their parents and only 4% eat what they want for supper (Fig. 7).

In all, 51% of the respondents take their snacks between breakfast, lunch and supper. 36% take their snack between breakfast and lunch, 10% take it between lunch

Table 8: Responses on snack times

Time	F	P (%)
Before breakfast	2	2.0
Between breakfast and lunch	36	36.0
Between lunch and supper	10	10.0
Between supper and bed time	1	1.0
Between breakfast, lunch and supper	51	51.0
Total	100	100.0

Source: Researchers' field survey, 2011. F = Frequency; P = Percentage

Table 9: Responses on the number of times snacks are taken in a day

No. of times in a day	Frequency	Percentages (%)
Once	32	32.0
Twice	37	37.0
Thrice	14	14.0
More than thrice	17	17.0
Total	100	100.0

Source: Researchers' field survey, 2011

Table 10: Responses for the intake of meat and fish

	Meat		Fish	
Size	F	P	F	P
Large	0	0.0	2	2.4
Average	42	42.0	34	41.5
Small	58	58.0	46	56.1
Total	100	100.0	82	100.0

Source: Researchers' field survey, 2011. F = Frequency; P = Percentage

Table 11: Responses on how often fruits are taken in a week

No. of times	Frequency	Percentage (%)
Every day	20	20.4
3 times	27	27.6
4 or more times	25	25.5
Occasionally	26	26.5
Total	98	100.0

Source: Researchers' field survey, 2011

and supper, 2% take snacks before breakfast and the remaining 1% take it between supper and bed time (Table 8).

It was revealed during the study that, 37% of the respondents take snacks twice in a day, 32% taking snacks once, 14% snacking thrice with the remaining 17% snacking more than thrice daily (Table 9).

From the study conducted, it was realized that out of the hundred respondents 42% take average size meat, 58% take small size meat. None of the respondents takes large meat sizes. However, 2.4% of the respondents take large size fish, 41.5% take average size fish and 56.1 take small size fish out of the 82 respondents who take fish (Table 10).

It can be seen from Table 11 that 20.4% of the respondents take fruit every day, 27.6% take it three times in a week, 25.5% take it four or more times in a week and 26.5% take it occasionally.

Some of the reasons given for disliking certain foods presented in Table 12 indicate that, majority of the
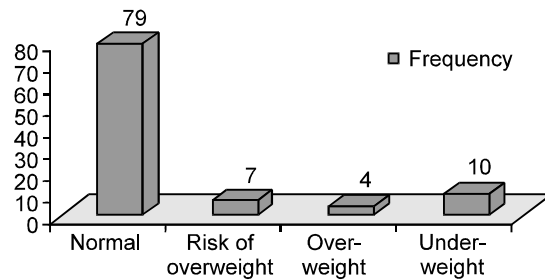

Fig. 8: Body mass index (BMI) of respondents. Source: Researchers' field survey, 2011
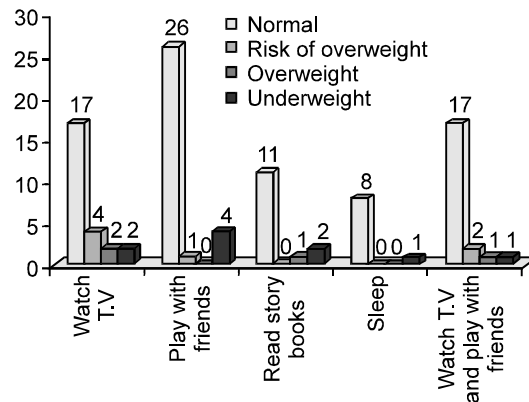

Fig. 9: Illustrating BMI and activities done during leisure times. Source: Researchers' field survey, 2011

Table 12: Reasons why they dislike certain foods

Reason	Frequency	Percentage (%)
Uncomfortable	12	13.3
Religion	34	37.8
Don't like the taste and aroma	3	3.3
Religion and uncomfortable	31	34.4
Religion and aroma	10	11.1
Total	90	100.0

Source: Researchers' field survey, 2011

respondents (37.8%) dislike a particular food because of religion, 34.4% dislike certain foods because of religion and it making them uncomfortable. Also 12% owed their reasons to uncomfortableness alone whiles 3% said they do not like the taste and aroma. The remaining 10% gave religion and aroma as the reason for disliking certain foods (Table 12).

Nutritional status: BMI of the respondents calculated to know their nutritional status shows that 79% were normal, 7% were at risk of becoming overweight, 4% were overweight and 10% were underweight (Fig. 8).

Figure 9 illustrates activities done during leisure times and their BMIs. Out of the 79 respondents who were normal, 17 watch T.V at their leisure time, 26 play with their friends, 11 read story books, 8 sleep and 17 watch T.V or at times play with their friends at their leisure time.
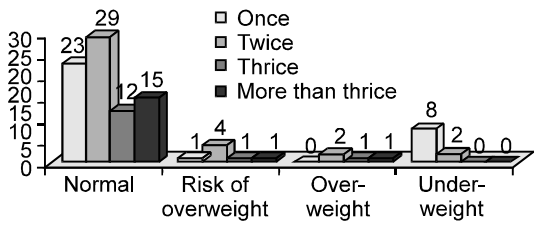
Fig. 10: Illustration of BMI and how often snacks are taken in a day. Source: Researchers' field survey, 2011
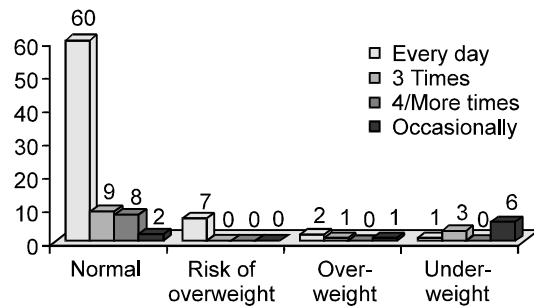
Table 13: Cross tabulation of BMI and family size

	Body Mass Index (BMI)				
Family size	Normal	Risk of overweight	Over-weight	Under-weight	Total
5 and below	17	0	1	3	21
6 to 10	42	7	3	4	56
Above 10	20	0	0	3	23
Total	79	7	4	10	100

Source: Researchers' field survey, 2011

4 out of the 7 respondents at risk of becoming overweight watch T.V at their leisure time, 1 plays with friends and the remaining 2 either watch T.V or play with their friends.

2 of those who were overweight said they watch T.V at their leisure time, with 1 out of the remaining 2 reading story book and the other one watching T.V or playing with friends. Out of 10 underweight respondents, 2 watch T.V, 4 plays with their friends, 2 read story books, 1 sleeps and the remaining 1 either watches T.V or play with their friends at their leisure time.

From Fig. 10, it can be seen that 23 of the normal respondents snack once in a day, with 27 snacking twice, 12 snacking thrice and 15 snacking more than thrice in a day.

1 out of those at risk of becoming overweight snacks once, 4 respondents snack twice, 1 snacks thrice and the other 1 snacks more than thrice in a day. None of the overweight respondents snack once. However 2 snack twice, 1 snacks thrice and the last person snacks more than thrice in a day. 8 out of the underweight respondents snack once whereas 2 snack twice in a day.

The study conducted revealed that 17 of the normal respondents came from a family of 5 and below, 42 from a family size of 6 to 10 and 20 from a family size above 10. But all the 7 respondents at risk of becoming overweight are from a family with the size of 6 to 10.

3 out of the 4 overweight respondents are from a family with the size of 6 to 10, with the other 1 from a family with the size of 5 and below (Table 13).

3 of the underweight respondents were from a family with the size of 5 or below, 4 from a family size of 6 to 10 and the remaining 3 from a family size above 10.

Fig. 11: Illustrating BMI and Frequency of breakfast in a week. Source: Researchers' field survey, 2011
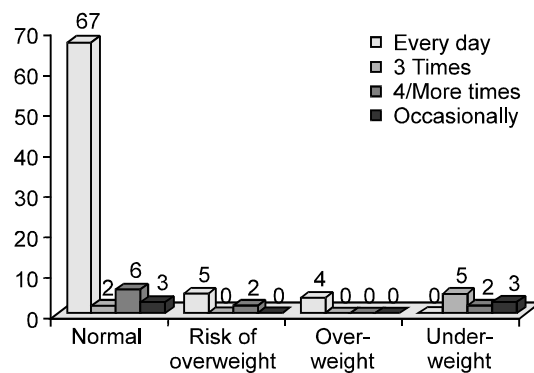

Fig. 12: Illustrating BMI and frequency of lunch in a week. Source: Researchers field survey, 2011

From the Fig. 11, it can be said that 60 and all those at risk of overweight take breakfast everyday with 2 of the overweight and 1 of the underweight respondents taking breakfast every day. The Table also shows 6 of the underweight respondents take breakfast occasionally with only 2 of the normal and 1 of the overweight respondents taking breakfast occasionally.9 of the normal respondents with 1 and 3 overweight and underweight respectively, also take breakfast three times in a week. Also 8 of the normal respondents take breakfast four or more times with none of the overweight, risk of overweight and underweight respondents taking breakfast four or more times in a week.

Comparing their nutritional status and the frequency of lunch taken in a week, it can be seen from the Fig. 12 that more than half of the normal respondents (67) take lunch every day with only 3 of them taking it occasionally. 5 out of the 7 respondents at risk of overweight and 4 of the overweight respondents take lunch every day.

None of the underweight respondents takes lunch every day with 5 taking it three times and 3 taking it occasionally.

The Fig. 13 shows that 73 normal respondents take supper every day, 2 take supper three times and 3 take supper four or more times in a week. 6 out of the 7 respondents at risk of overweight takes supper every day
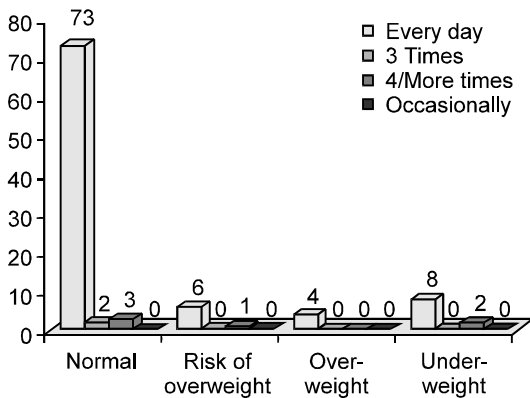
Fig. 13: Illustrating BMI and frequency of supper in a week. Source: Researchers' field survey, 2011

and the other 1 taking it four or more times in a week. 8 of the underweight respondents take supper every day with 2 taking it four or more times in a week.

DISCUSSION
Dietary patterns and the nutritional status of upper primary school children
Foods consumed: From the food frequency questionnaire issued out to participants to assess their dietary patterns over a period of two weeks, the result revealed about 65% of the participants consumed the same kind of foods within the two weeks period whilst the remaining 35% consumed foods slightly different from the ones they consumed in the first week (they either added new foods or did not repeat some of the foods eaten in the second week).

The study also revealed that all participants consumed T.Z with soup, "banku" with stew/soup, as well as "fufu" with soup. 94% also consumed porridge with "koose"/ "masa"/"kulikuli"/bread and 85% consumed tea with bread for breakfast. All these foods were very common because more than two thirds of the participants consumed them. Foods that were not very common included "wasawasa", beans with gari and oil, "waakye" with stew and rice balls with soup. These foods were consumed by more than one third of the participants. Consumption of rice porridge, "tubani", "kenkey" with pepper, spaghetti with stew and yam pudding were rare.

Less than one third of the participants consumed these foods. All the participants take drinks/sweetened beverages and 96% consume biscuits as snack whereas 57% of the participants consume ice cream occasionally. This finding is similar to what Wang *et al.* (2010) discovered from their research in the United States that most of the African-American adolescents consumed sweetened beverages. Sweetened beverages consumed by respondents include "poha" (tamarind drink), "zunkom", "light" as well as fruit drinks. Consumption of soft drinks was rare. Table 2 illustrates the foods consumed.

66% of the participants eat large portions of the main meal whilst 31% eat average portions with average servings of soup and stews; the remaining 3% eat small portions of both the main meal and the accompaniment. Majority of the respondents (73%) do not consume eggs. This is not encouraging because eggs are known to be nutrient dense and will help with growth and development at this critical stage. This discovery is comparable to the results obtained from the study in Bangladesh by Faruk *et al.* (2000) where they also discovered that a large number of the participants did not eat eggs. Furthermore, most of the respondents consume meat and fish occasionally. The portion size of meat consumed by majority (58%) was rather small (less than 3 ounces or 84 g). Most meals were eaten without meat and fish. This is in contrast to the finding in Bangladesh by Faruk *et al.* that a larger proportion of their participants consumed meat and fish at least four times in a week. This reveals that animal protein consumption is poor.

98% of the respondents consume fruits whilst the remaining 2% do not eat fruits, their reason being that they just do not like fruits. Out of the 98 respondents who consume fruits, 28% eat fruits 3 times a week, 20% consume fruits everyday, 25% consume 4 or more times whilst 27% consume fruits occasionally (Table 11 illustrates the consumption of fruits in a week). The consumption of fruits is always based on the season. Consumption of mango was very common due to the season.

Concisely, foods consumed are basically from staples like maize, yam, millet and sorghum although variability in diets for most of the participants is lacking. Animal protein consumption is poor whereas seasonality determines the kinds of fruits consumed.

Eating habits: Most of the respondents (59%) do not always spread margarine on their bread whiles 16% always add margarine, 4% never use margarine and the remaining 21% never add any spread to their bread. Most reasons given for not using spread were attributed to money. Margarine can be a good source of vitamin A, however trans fatty acids formed during production gives rise to concern. These trans fatty acids increase LDL (harmful cholesterol) whilst reducing HDL the beneficial cholesterol. This increases the risk of arteriosclerosis and coronary heart disease (George Pamplona, 2006). It is therefore encouraging to know that most of the respondents do not always use margarine. Other spreads mentioned included groundnut paste and jam. Most of the respondents (91%) always eat the skin on cooked poultry whiles 7% sometimes take off the skin. The human body produces sufficient cholesterol for its needs and therefore does not need an external source. The skin of poultry is known to be high in cholesterol (Chris Iliades, 2010). Consumption of the skin is not very alarming in this case considering the fact that animal protein consumption is low. Furthermore, 91% of

participants always eat their meat or fish boiled, fried or roasted whereas 4% of the participants consume their meat or fish always fried. Fried foods are high in calories and can therefore increase the caloric density of the diet especially for those who are underweight. However, eating too much fried foods can become dangerous especially for those who are physically inactive. Fried foods are known to be unhealthy (Shereen Jegtvig, 2008).

The research revealed that more than half of the participants (61%) prepared their meals with vegetable oil, shea butter or groundnut oil. One third of the participants (33%) use the same oils in addition to palm kernel oil and coconut oil. However, a few people (6%) use only palm kernel oil and coconut oil. Although these oils contain saturated fatty acids, they do not increase cholesterol levels because they contain short and medium chain fatty acids unlike the predominantly long chain saturated fatty acids found in animals (George Pamplona, 2006).

The study also revealed that, more than two thirds of the respondents (89%) consume both cooked and raw vegetables. This is very commendable since raw vegetables are more nutritious. Mixed raw vegetables are mostly bought from food vendors. However, the hygienic condition under which these salads are prepared is very questionable. Some of the food vendors in the various schools had their salads uncovered. Meanwhile the rest of the respondents (11%) always eat their vegetables cooked.

A large proportion of respondents (78%) skip meals occasionally, reasons given included the fact that money is a major determinant in whether meals will be skipped or not. Some also skip meals when they are sick, do not feel hungry or like the taste or aroma of the food available. The remaining 28% of respondents never skip meals. Majority of the respondents (90%) do not like certain foods with a significant number (34%) of these respondents owing their reasons to allergy and religion. 38% also owed their reasons to religion alone, 13% to allergy alone whereas the rest of the respondents (15%) owed their reasons to unpleasantness of the food due to the aroma or taste.

Daily meals: 98% of the participants consume three main meals and snacks whilst the remaining 2% consume two main meals and snacks (they either skip lunch or supper). This discovery is similar to the findings by Olumaikaiye *et al.* (2010) in their study conducted in Nigeria to determine the food consumption patterns of Nigerian adolescents where they stated that more than half of their respondents consume three main meals daily. It is very important for adolescents to eat properly and at meal times at this stage of life in order to achieve optimum growth (Jang *et al.*, 2005).

Breakfast: All the respondents consume breakfast. Most of them (70%) eat breakfast every day. Table 3 indicates

the frequency of breakfast taken in a week. This is contrary to Samuelson G's findings in his study conducted in the Nordic countries where he stated that many adolescents skip breakfast. 64% of respondents consume both heavy and light meals for breakfast, 34% consume light meals for breakfast whilst the remaining 2% consume heavy foods for breakfast. Heavy meals (foods high in calories especially from carbohydrate and fats) taken for breakfast are usually left over foods from previous day's supper. Majority of the respondents (86%) eat their breakfast at home with about 80% eating their breakfast before 7 am.

Lunch: Looking at lunch the second main meal of the day, 99% of the respondents eat lunch whereas the remaining 1% never eats lunch. Snacking frequently after breakfast and eating an early supper accounted for why some respondents occasionally skipped lunch. Out of the 99 people, majority (77%) eat their lunch every day. Table 5 indicates the frequency of lunch taken in a week. Most of the school children (60%) take their lunch at home after school closes with the rest either eating in the school premises before going home (22%) or buying food by the roadside (18%) and most of them (54%) eat between 1 pm and 2 pm.

Supper: For supper, 99% of respondents consume supper with 73% of this number eating between 6pm and 7 pm and 16% eating after 8 pm. The remaining 1% never eats supper. Reasons why supper was skipped was attributed to the fact that eating late lunches prevented them from eating at supper time since they did not feel hungry. 92% of those who consume supper take it every day. Majority of those who take supper (98%) eat at home, while the remaining 2% buy food from the roadside.

Snack: All the participants snack, with 44% snacking every day. 51% of the participants snack between all the three main meals. They usually snack between breakfast and lunch (during their school break times) and also after lunch whilst waiting for the evening meal. A significant number (36%) also snack only between breakfast and lunch, also during their school break times (Table 8). All the schools visited have two break times. They usually buy foods that are available in the school premises during the break, whereas those who do not buy have snacks packed for them from home. More than half of the respondents (56%) consume both light and heavy meals as snack. Snacks mentioned by respondents included rice and stew, beans with "gari" and oil, fried yam, spaghetti, "wasawasa", sweetened beverages, biscuits, ice cream, fruits. Contrary to the results of the study by Wang *et al.* (2010) in the United States, where he stated that majority of his participants snack three or more times in a day, respondents in this study mostly snack twice a day. 37% snack twice a day, 32% snack once a day, 14% thrice a day whereas the remaining 17% snack more than thrice in a day.

In a nutshell, most of the respondents do not skip meals, snacking is very common and most meals are eaten at home.

Nutritional status: More than two thirds of the respondents (79%) are normal, 4% are overweight, 7% are at risk of becoming overweight and 10% fell below the 5th percentile and are therefore underweight.

Skipping meals is more likely to have an influence on their nutritional status. The results revealed that 6 out of the 10 underweight participants eat breakfast occasionally. For lunch also, 5 out of the 10 underweight participants eat lunch 3 times a week whilst 3 of them eat lunch occasionally. However, most of the respondents who are normal, at risk of becoming overweight and those who are overweight do not skip meals often.

33% of those who are normal are physically active. They play outdoor games with their friends during their leisure times. Sedentary lifestyle was seen to be common amongst those who are overweight and those who are at a risk of becoming overweight. Unlike those who are normal, they watch television, read story books or occasionally play with their friends. This discovery is similar to the findings of Janssen *et al.* (2004) in their study in Canada where they also discovered that physical inactivity levels and television viewing times were higher in overweight and obese boys and girls than normal-weight youth. Figure 10 illustrates the cross tabulation of things they do in their leisure times and their BMI.

Large family size is less likely to be related to the condition of underweight. This is because most of the respondents who are normal are from large families as well as those who are overweight and at risk of becoming overweight.

However, snacking is more likely to have an influence on their nutritional status. Most of those who are underweight(8) snack just once in a day whereas those who are normal, overweight or are at risk of becoming overweight snack twice or more in a day.

It is however important to note that, the immediate causes of malnutrition as indicated by the conceptual framework of malnutrition (UNICEF, 1997) shows that not only poor dietary intake can lead to malnutrition, but ones state of health also has an influence. Basic causes such as inadequate maternal care and poor sanitation can also be attributed to the cause. Besides, a significant number of the respondents appeared unkempt.

Effects of dietary patterns on health: Among the respondents observed, a significant number had dry skins, skin rashes and thin brittle hair. All these are suspected to be due to the fact that protein consumption is low. The low consumption of protein might lead to

protein deficiency diseases. Also there could be high risk of developing pernicious anemia since vitamin B_{12} is solely from animal source of food.

Soft drinks are high in phosphate (Murray and Pizzorno, 2005). Consumption of these drinks increases phosphate levels in the system. This however reduces calcium level due to the calcium-phosphorus imbalance and when this happens calcium is pulled out of the bones. This will thus increase the risk of osteoporosis. However, considering the fact that soft drink consumption is low among respondents, the possibility of them developing osteoporosis from that particular risk factor is very minimal (James, 2008). Overweight and obesity were mentioned by WHO (2003) as factors that are convincingly known to increase the risk for cancer. These same conditions are known to influence hypertension, diabetes as well as cardiovascular and cerebrovascular diseases. It is therefore quite alarming to know that some of the respondents are already overweight at this stage. There is a possibility of these individuals developing these conditions if care is not taken. For those who are underweight, their immune systems are already compromised and are more likely to suffer poor health.

Basic knowledge on good nutrition: The knowledge of respondents on nutrition and health was tested. For basic hygiene they had a fair idea. More than two thirds of the participants (92%) correctly gave reasons why there is the need to wash fruits, wash their hands before and after eating and also after visiting the lavatory. In addition they were able to identify habits that are good for their health, although there were a few others who could not answer correctly.

However, unlike their good knowledge in hygiene, most of the respondents had poor nutrition knowledge. Knowledge on carbohydrates was however good with about two thirds of participants (66%) correctly mentioning foods that contain carbohydrate whereas knowledge on foods containing protein, fats and oil and vitamins and minerals nutrient was poor. More than half of the respondents (52%) lacked knowledge on protein rich foods with an even greater number (65%) lacking knowledge on fats and oils as well as vitamins and minerals rich foods. The knowledge of respondents can be said to be similar to the knowledge of the participants in the study conducted in rural Bangladesh by the Institute of Public Health Nutrition in 2004 where it was also discovered that the adolescents' nutrition knowledge is limited.

In summary, their knowledge in basic hygiene was far better than their knowledge in nutrition.

Factors that influence choice of food: Except for meals eaten in school during break times, most meals are eaten at home. 69% have their parents deciding what is

to be eaten for breakfast, 9% sometimes decide on what to eat whilst 14% always decide what they want to eat in the morning. The financial states of parents determine what is to be eaten.

For lunch, even though more than half of respondents (52) said their parents decide what is to be eaten, a significant number (29%) also said they decide what they want to eat. Those who take lunch outside their homes also said they only buy foods that the money available to them can afford. The socio economic status of parents may come into play at this point because the amount of money they give to their wards perhaps determines the kind of food they buy. This point is buttressed by the National Research Council (1995) in their statement that, "family income is perhaps the single most important factor in determining the quality of the nutritional and health status of both children and adolescents".

Almost all the respondents said choice of supper is determined by their parents.

Furthermore for meals that are eaten during break time, the amount of money given to them by their parents determines the kind of food they buy and the quantity. 3% of respondents also buy whatever their friends buy during break time in the school premises.

About two thirds of respondents (66%) said they get nutrition information as well as foods that are good for them from the television as well as their parents, friends and teachers. This also implies that advertisement has an influence on the kind of snacks they buy.

Most of the respondents (78%) also said they do not eat pork; this is due to the fact that they are Muslims.

Concisely, it can be said that the socioeconomic status of parents is the main determinants of choice of food, whilst advertisement, religion and peers also serve as contributing factors.

Conclusion: Based on the findings of the survey and the discussion being made, the following conclusion could be drawn:

- Variability in diet was lacking for most participants.
- Consumption of animal protein was low among participants
- There could be high risk of pernicious anemia among participants due to lack of vitamin B_{12} in their diets
- Seasonality of fruits determined the kinds of fruits that were consumed
- Skipping meals was common among those who were underweight and also among those who snack just before the next main meal.
- Sedentary lifestyles had an influence on those who were overweight and those at risk of becoming overweight
- Family size was less likely to influence nutritional status of respondents

- The knowledge of participants in basic hygiene was far better than their knowledge in nutrition
- The factors that determined the food choices of participants included the socio economic status of parents, religious background and advertisements.

Recommendations: The following recommendations have been made based on the findings and conclusions of the study:

- The Ministry of Health should carry out educative programs for parents on the need for good nutrition in adolescence and also encourage variability in diets and consumption of animal protein since parents have major influence on food choices.
- The existing School lunch program should be extended to all the schools in the metropolis by government and other benevolent Non Governmental Organizations to supplement food intake.
- Nutrition and health education programs should also be carried out periodically in the various basic schools in the metropolis and this should be in cooperated into the educational curricula in the long round.
- All pupils should be encouraged to take part in Physical Education (PE) classes to involve all pupils in physical activity at least once in a week.
- Proper child care and good sanitation should be maintained both in schools and homes so as to reduce the prevalence of malnutrition since they are underlying causes of malnutrition.
- Further research should be conducted on the nutrient/energy values and bacterial loads of food sold in the premises of schools in the metropolis.
- Further research should be conducted on nutrients deficiencies (Vitamin B_{12}, Iron and vitamin A) among upper primary school children in the metropolis.

REFERENCES

American Diabetes Association, 2000. Type 2 diabetes in children and adolescents. Care, 23: 381-389.

Amorim Cruz, J.A., 2000. Dietary habits and nutritional status in adolescents over Europe-Southern Europe. Eur. J. Clin. Nutr., 54 (Suppl I): S29-S35.

Bearman, P.S. and J. Moody, 1999 Foregone health care among adolescents. http://www.ncbi.nlm.nih.gov/pubmed/10605974 Accessed on 17th April, 2011.

Birch, L.L., 1999. Development of food preferences. Annu. Rev. Nutr., 19: 41-62.

Broad Income Group, 2001. Ten leading causes of deaths worldwide. Retrieved from http://www.dcp2.org/page/main/Data.html - Accessed on 10th March, 2011.

Caupisti, A., C. D'Alessandro, S. Castrogiovanni, A. Barale and E. Morelli, 2010. Nutrition knowledge and dietary composition in Italian Adolescent Female Athletes and non Athletes. Int. J. Sport, Nutr. and Exercise Metabo., Vol. 12, Issued 2, journals.humankinetics.com/.../nutritionknowledg eanddietarycompositioninitalianadolescentfemale. Accessed on 14th March,2011.

Case, A., D. Lubotsky and C. Paxson, 2002. Economic status and health in childhood: The origins of the gradient. Am. Econ. Rev., 92: 1308-13334.

Center for Disease Control and Prevention (CDC), 2000. Growth Charts.

Centers for Disease Control and Prevention, 2004. General Information and National Estimates on Diabetes in the United States. National Diabetes Factsheet, 2003. (Rev. Ed). Department of Health and Human Services. Atlanta, Ga., U.S.

CFNI - Caribbean Food and Nutrition Institute, 2004. Protocol for the Nutritional Management of Obesity, Diabetes and Hypertension in the Caribbean. http://www.paho.org/english/cfni/cfni-protocolnmo dh.pdf Accessed on 17th April, 2011.

Chalapati, R., D.L. Alan and H. Yussif, 2006. Leading causes of death in sub Saharan Africa. The World Bank. Retrieved from www.ncbinlm.nih.gov/books/ NBK2298/. Accessed on 8th April, 2011.

Chen, 1979. Adolescent Nutrition: A Review of the situation in selected South-East AsianCountries. Retrievedfrom www.searo.who.int/.../Nutrition_for_ Health_and_Development_6-Nutritional_Issues_ Among_Adolescents pdf. Accessed on 17th April, 2011.

Christie, D. and R. Viner, 2005. Adolescent development. BMJ, 330: 301-304.

Chris, I., 2010. 10 high cholesterol food to avoid. Retrieved from www.everydayhealth.com/high cholesterol. Accessed on 13th March, 2011.

Dennison, C.M. and R. Shepherd, 1995. Adolescent food choice: An application of the theory of planned behavior. J. Human Nutr. Diet., 8: 9-23.

de Onis, M., M. Blössner, E. Borghi, R. Morris and E.A. Frongillo, 2004. Methodology for Estimating Regional and Global Trends of Child Malnutrition. Int. J. Epidemiol., 33: 1260-1270.

Dudek Susan, G., 2010. Nutrition Essentials for Nursing Practice. Sixth Edition.

Ellen, G. White, 2010. Diet and health http://lifestyle laboratory.com/articles/ellen-white/diet-and-health. html Accessed on 18th April

Erikson, E.H., 1968. Identity: Youth and Crisis. New York: W.W. Norton, 1968, pp: 91-96.

Faruk, A., Z. Momtaz, R.K. Moududur, P.B. Cadi, N.H. Mohammed and A.J. Alan, 2000. Dietary pattern, nutrient intake and growth of adolescent school girls in Urban Bangladesh. Retrieved from http://www. journals.cambridge.org/article_S1368980098000 159. Accessed on 14th April,2011.

George Pamplona-Roger, D., 2006. Healthy foods, Editorial Safeliz, Madrid Spain.

James, H., 2008. A physician's guide to natural health products that work. (2nd Edn.). United States.

Institute of Public Health Nutrition, 2004. Nutritional Status, Dietary Intake, and Relevant Knowledge of Adolescent Girls in Rural Bangladesh. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC297 5850/ Accessed on 18th April.

International Food Information Foundation Council, 2009. Ghana Statistical Service, 2000. Population and housing census special report on urban localities, 2002. Tamale.

Janssen, I., P.T. Katzmarzyk, W.F. Boyce, M.A. King and W. Pickett, 2004. Overweight and obesity in Canadian adolescents and their associations with dietary habits and physical activity patterns. J. Adolescent Health, 35: 360-367.

Li, M., M.J. Diblery, D.W. Sibbritt, H. Yan, 2004. Dietary habits and overweight / obesity in adolescents' in Xi'an city China. J. Adolescent Health, 35: 5.

Lopez, A., D.C. Mathers, M. Ezzati, D.T. Jamison, C.J.L. Murray, 2006. Global Burden of Disease and Risk factors, Oxford University Press, Washington D.C.

Marquis, Robert, E., 2008. Bacteria. Microsoft® Student 2008 [DVD]. Redmond, WA: Microsoft Corporation, 2007.

Michael Latham, C., 1997. Human Nutrition in the developing world, FAO Food and nutrition series-No.29. David Lubn Memorial Library, Rome.

Montgomery, L.E., J.L. Kiely and G. Pappas, 1996. The Effects of Poverty, Race and Family Structure on U.S. Children's Health: Data from the NHIS, 1978 through 1980 and 1989 through 199. Am. J. Public Health, 86: 1401-1405.

MO-NUPA - 01, 2011. Adolescents Nutrition. Available at: http://www.cdph.ca.gov/HealthInfo/healthyliving/ childfamily/Documents/MO-NUPA-01Adolescent Nutrition.pdf.

Meteorological Service Department, 2011. Tamale. 23. Jang Kerry L. , W. John Livesley, Juko Ando, Shinji Yamagata, Atsunobu Suzuki, Alois Angleitner, Fritz Ostendorf, Rainer Riemann , Frank Spinath (2005).

Murray, M. and J. Pizzorno, 2005. Encyclopedia of Natural Medicine, Revised 2nd edition.

National Research Council, 1995. Commission on Behavioral and Social Sciences and Education, Losing Generations: Adolescents in High-Risk settings. Nation Academy Press, Washington D.C.

NCHS, 1990. Health Promotion and Disease Prevention -- United States (1990). Hyattsville, MD: US Department of Health and Human Services, Public Health Service, CDC, National Center for Health Statistics, April 1993; DHHS publication no. (PHS) 93-1513. (Vital and health statistics: data from the National Health Survey; series 10, no. 185).

Neill, K.C., T.E. Dinero and D. Allensworth, 1997. School Cafeteria: A culture for promoting child nutrition education. The Health Education Monograph Series, 15: 40-48.

Netra, T. and F. D'Amico, 1999. Relationship of nutrition Knowledge and obesity in adolescents. Retrieved from www.ncbi.nlm.nih.gov/pudmed/9990502. Accessed on 25th Aril, 2011.

Newacheck, P., Y. Hung, J.M. Park, C.D. Brindis and C. Irwin, 2003. Disparities in Adolescent Health and Health Care: does socio economic status matter? Health Service Res., 38: 1235-1252.

Norman, R., D. Bradshaw, M. Schneider, D. Pieterse and Groenewald, 2011. Ten leading causes of death in South Africa. Burden of disease research unit. Retrieved from www.mrc.ac.za/bod/Revised Burden of Disease Estimates1.pdf. Accessed on 3rd April, 2011.

Norton, A., 2011. Heart disease cases in India. Journal of the American College of of cardiology. Retrieved from Reuters database. Accessed on 14th March, 2011.

Olumaikaiye, M.F., T. Afinmo and M.A. Olubayo-Fatiregun, 2010. Food Consumption Patterns of Nigerian Adolescents and Effect on Body Weight. Retrieved from www.ncbi.nlm.nih.gov/pudmed/ 20083439. Accessed on 25th April, 2011.

Palo Alto Medical Foundation (PAMF), 2001. Teenage Growth & Development: 11-14 Years. Available at: http://www.pamf.org/teen/parents/health/growth-11-14.html.

Pamela, S., 2009. Osteoporosis risk for men and adolescents. Today's Dietician, 11: 8.

Pamplona-Roger, G.D., 2006. Healthy Foods. First edition, Editorial SAFELIZ, Madrid, Spain.

Samms-Vaughan, M., M. Jackson and D. Ashley, 2000. The relationship of prenatal factors to later childhood development and behavior in a cohort of 11-12 years old. Jamaican children. Report. Mona, Jamaican: University of the West Indies.

Samuelson, G., 2000. Dietary habits and nutritional status in adolescents over Europe. An overview of current studies in the Nordic countries. Eur. J. Clin. Nutr., 54 (Suppl 1): S21-28.

Sendrowitz, 1995. Adolescent Nutrition: A Review of the situation in selected South-East AsianCountries. Retrievedfrom www.searo.who.int/.../ Nutrition_for_ Health_and_Development_6-Nutritional_Issues_ Among_Adolescents pdf. Accessed on 17th April, 2011.

Shereen Jegtivig, 2011. Healthy foods instead of bad fats. Retrived from nutrition.about. com/od/ nutrition101/ a/keepitsimple.htm - Accessed on 13th April, 2011.

Spear, B.A., 2002. Adolescent growth and development. J. Am. Diet. Assoc., 102 (3 suppl): S23-9. of adolescent medicine. Philedelphia: W.B. Saunders, 1992: pp: 75-84.

Stabouli, S., V. Kotsis, C. Papamicheal, A. Constantopoulous and N. Zakopoulous, 2005. Adolescent obesity is associated with high ambulatory blood pressure and increased carotid intimalmedial thickness. J. Pediator, 147: 651-656. Accessed on 10th April, 2011.

Swierzewski, S., 2010. Risk factors for stroke. www.healthcommunities.com/corporate/stan.shtml. Accessed on 10th April, 2011.

UNICEF, The Progress of Nations 1997, UNICEF, New York, 1997.

U.S. National Center for Health Statistics (2005, March 7). Leading causes of death in young teens. Retrieved from www.statisticstop10.com. Accessed on 17th April, 2011.

U.S Center for Disease Control, 2007. National Diabetes Fact Sheet, 2007. http://www.cdc.gov/ diabetes/pubs/pdf/ndfs_ 2007.pdf Accessed on 13th April, 2011

Wang, Y., L. Jahns, H.L. Tussing, B. Xie, H. Rockette, H. Liang and L. Johnson, 2010. Dietary intake patterns of low-income urban African-American adolescents. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/ 20800126. Accessed on 17th April, 2011.

World Bank. Adolescent Nutrition. Washington DC, World Bank; at glance 2003a. Available at: http://siteresources.worldbank.org/INTPHAAG/Res ources/AAGAdolNutrEng.pdf.

World Bank, 2003b. Adolescent Nutrition: A Review of the Situation in Selected South-East Asian Countries. World Bank, Washington DC.

WHO, 1948. Constitution of the World Health Organization. Geneva: World Health Organization.

WHO, 2010. Global Status report on noncommunicable diseases. Geneva: WHO.

WHO, 2001. Water related Diseases. Geneva: WHO.

WHO, 2011a. Global Strategy on Diet, Physical Activity and Health: Childhood overweight and obesity.

WHO, 2011b. Report on cancer. Retrieved from www.who. int/mediacenter/factsheets/fs297/en/. Accessed on 18th April, 2011.

WHO, 2006a. Adolescent nutrition: A neglected dimension.

WHO, 2006b, as cited in Phyu phyu A, 2002. Adolescent Nutrition: A Review of the situation in selected South-East Asian Countries. Retrieved from www. searo.who.int/.../Nutrition_for_Health_and_Develo pment_6-Nutritional_IssuesAmong_Adolescents pdf. Accessed on 17th April, 2011.

WHO, 2003. The world health report 2003 - shaping the future. http://www.who.int/whr/2003/en/ Accessed on 18th April

Williams, S.R. and E. Schlenker, 2003. Essentials of Nutrition and Diet Therapy, 8th edition, The C.V. Mosby Co., St. Louis.