UNIVERSITY OF CAPE COAST

ASSESSMENT OF MACRONUTRIENTS AND MINERAL ELEMENT CONTENTS IN LUNCH MEALS OF SOME SELECTED PRESCHOOLS IN THE CAPE COAST METROPOLIS

BY

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2011

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature:…….. Date:……

Candidate's Name: Sophia Acquah

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature:…… Date:……

Supervisor's Name: Dr. Faustina Yaa Amoako-Kwakye

Co-Supervisor's Signature:…….. Date:……..

Name: Mr. Nathan K. Mensah

ABSTRACT

The purpose of the study was to assess macro nutrients and mineral element contents in lunch meals of some selected preschools in the Cape Coast Metropolis. Simple random sampling technique was used to select eight schools from the 21 private preschools that serve lunch meals to the children. The descriptive survey was used for the study and a content validated questionnaire and observation guide were used to seek the needed information from 51 cooks, 8 head teachers in 8 preschools. Food samples were collected on daily basis for five school days of a week and chemically analyzed using the procedures of Association of Official Analytical Chemist and Stewart, Grimshaw, Parkinson and Quarmby. The nutrient contents figures obtained were then compared with WHO Recommended Daily Intake (RDI). Frequencies, percentages and one sample t-test were used to analyze the data and presented in tables.

The main findings of the study indicated that children were not receiving adequate essential nutrients from the meals served at school. The mean intake for Carbohydrates was 45.22, 19.78 below RDI. Proteins mean was 9.10, 2.9 less RDI. Calcium also had a mean intake of 90.10 and this was 309.90 below the RDI. Virtually all the nutrients could not meet the 50% WHO recommendation for lunch. None of the schools studied served fresh fruits. It was also realized that funding of meals was the sole responsibility of parents and cooks did not have adequate knowledge on nutrition.

The important recommendations are that protein sources like meat and fish whose cost per unit weight is high could be supplemented with legumes and pulses that are relatively cheaper in order to improve the protein quality. Finally government should extend the school feeding programme to the preschool level to reduce cost and also relieve parents' of solely funding their children's school meals.

DEDICATION

To my, husband Mr. Emmanuel Ohene - Darko, Glenn and Galia Ohene - Darko.

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CHAPTER ONE

INTRODUCTION

Background to the Study

Early childhood education is receiving global challenges throughout the developed and developing world. Current trends of urbanization and migration, coupled with expanded access to educational service have altered child-care patterns and practices that have for generations provided families with culturally appropriate solution. Scientific evidence accumulated during the past decade by the United Nations High Commissioner for Refugees (UNCHR) has demonstrated the importance of early years of the child's life and developmental cost of inadequate care. It has been found out that the quality of care, interaction and good nutrition provided to a child during the early years enhance his/her psychological, cognitive and social development. In both developed and developing countries, an early childhood development programme increases a child's learning progress and performance in the early years at school.

To ensure sound foundation and secure future of any society, health and nutrition of children need protection. According to Bryant (1970), the roots of school feeding could be traced to 1913 in Germany. An outreach team supplied

free meals to hungry vagrant and needy school children in Munich in Germany. In 1975, needy children were again supplied with free textbooks, clothing and food by other philanthropic school societies in Hamburg. Similar societies sprang up in other cities as well. Later privately funded societies for the special purpose of school feeding were organized, with the Society for Feeding Needy School Children at Dresden in 1880 being the first to be established. Six years later, the society for People's Kitchen in the public schools was established in Angers, France. The objective was to provide meals at school to children who were unable to pay for their feeding. A two cent charge was made to those who could pay (Bryant, 1970). As early as 1867, Victor Duray, the then Minister of Public Instruction, requested school officials to give special attention to the nutrition of children. This request resulted in the establishment of school lunch programmes for needy children in about 464 places in Europe.

The British Parliamentary Papers (1909) revealed that in England the passage of Education Act in 1905 for the provision of meals was the frantic effort of 363 private Charitable Organizations. These Charitable Organizations, in an attempt to provide meals in the schools for needy children, reflected the national concern of the physical condition of the populace. By the early 1900's, School Feeding had spread throughout other European countries such as Holland and Switzerland (Bryant, 1970).

In the United States, School Feeding underwent the same evolution as in Europe, beginning with sporadic food services undertaken by private societies and associations that were interested in child welfare and education. The Children's

Aid Societies of New York initiated a programme in 1853 serving meals to students attending vocational schools. The programmes that started in both countries had gained roots till today.

The School Feeding which started in Europe and United States some years ago did not take place in Africa. According to Ghana Education Service (GES) (2007), the earliest childhood care and education centres established in the post independence era were set up to cater for the children of market women and other working mothers. Currently, this trend has not changed much as most of the children sent to these preschool centres are still those whose mothers are career women of one kind or the other. A lot of these early childhood education centres have sprung up lately all over the country due to the demand for them by most working mothers. These centres are established by the government, Non-Governmental Organizations (NGO), churches and private individuals.

To give this development a legal backing and to ensure the supervision of preschools in Ghana, some policies, laws and acts were promulgated by the Government of Ghana (1951). According to records in 1951, the Government of Ghana made an official policy statement on the need to provide day-care service for preschool children whose mothers predominately engaged in market trading activities in the intense heat and dust. As a follow-up to this statement, the government established six day-care centres in 1954 under the auspices of the Department of Social Welfare and Community Development. These were established in the vicinity of market places at the urban centres such as Cape Coast, Accra, Sekondi and Kumasi (Social Welfare, 2003). Free feeding was not

part of the care given to the children that were kept in these preschool centres. Preceding today's programme is a long history of more than a hundred years of development, testing and evaluating and constant research to provide the best in nutrition education and food service for the nation's million of preschool children.

In Ghana today, there exist three types of child education centres: crèche for children between one and two years, nursery for children aged three and four and kindergarten for five years old children. However, with the implementation of the new educational reform that took off in September, 2007, kindergarten has been officially added to the six years of primary education (GES, 2007).

Ghana and other African countries were selected quite recently to establish the School Feeding Programme on a pilot basis. The establishment of the School Feeding Programme (SFP) has gained the support of other non-governmental organizations (GES, 2007). In July 2003, the Millennium Project Hunger Task Force (MPHTF) proposed that, in collaboration with New Partnership for African Development (NEPAD), World Food Programme (WFP), United Nations Children Fund (UNICEF) and Food and Agriculture Organization (FAO), programmes should be started to link school feeding directly with agricultural development through the purchase of locally or domestically produced food, the cultivation of school gardens and the incorporation of agriculture into school curricula (Ministry of Food and Agriculture (MoFA, 1999).

In Ghana, the SFP is currently running in some selected Metropolitan, Municipal and District Assemblies (MMDA). It is being organized in phases until all the MMDA's are covered. The main goal of the programme is to provide at

least one nutritious meal a day to the poor pupils to enable them to have a sort of sound mind to learn. It was also designed as an innovative response to pervasive problems of poverty, food insecurity and hunger in the eastern corridor of the Northern Region. The programme was furthermore introduced to build the capacity of District Assemblies and Local Communities to plan and manage their food security in the North (World Food Programme, 2006).

In Cape Coast, childhood educational institutes comprise of both private and public (Government owned) schools as it exists everywhere in the country. Currently in Cape Coast Metropolis, it can be observed that some private preschools feed pupils at a fee payable by parents or guardians. This is because the free SFP does not cover preschool pupils in both private and public preschools. Some heads of private preschools, have, therefore, in collaboration with parents negotiated to provide at least one meal a day for their preschoolers at a fee. However there is no evidence of any study that has been carried out to determine whether the lunch meals served to these preschool children in the Cape Coast Metropolis meet the 50% RDI for children.

Statement of the Problem

Many children today spend 8 - 10 hours of their active period within the day at day-care centres or preschools. During this active period, children need to be fed nutritiously in order to help them go through their developmental stages successfully. They are to be fed well because it is believed that good nutrition and good health status influence a child's learning and how well a child performs in school. According to Wardlaw, Gordon and Insel (1996) children who lack

certain nutrients in their diets, particularly iron and iodine, or who suffer from Protein-Energy Malnutrition (PEM), hunger or parasitic infection or other diseases, do not have the same potential for learning as healthy and well nourished children. Nutrition and nutrient intake for the rapid growth is a common characteristic of infants and it slows down in the following few years if proper care is not given to the children.

Taking into consideration the time children spend at day care centres, Landers, Warden, Hunt and Boulton (1994) suggest that whatever children are fed on in the various preschool centres should meet at least 50% of the child's total Recommended Daily Intake (RDI). According to Landers et al. the 50% of the RDI to be met by the preschool centres should include main meal and two snacks. The rest of the 50% should then be met by parents or guardians at home during the child's breakfast and supper. It is therefore important to note that if as much as 50% of the child's total food intake is attributed to lunch alone, then it is imperative to recognize that lunch meals play a vital role in a child's life.

From what experts say about child nutrition and child care, it is clear that out of home child care centres have a remarkable impact on the foods and nutrients provided to young children. Though nutrition standards for day-care programmes have been enacted by the Social Welfare (2003), the question still remains whether preschools provide adequate nourishment for children. Furthermore, do cooks have good nutritional knowledge to provide the children with nutrient dense meals and can the feeding be sustained under the present hike in the cost of food items?

Purpose of the Study

The purpose of the study was to assess the macro nutrients and mineral element contents in lunch meals of some selected preschools in the Cape Coast Metropolis. Specifically, the objectives for the study were to;

1. find out the lunch meal patterns for a week in the selected preschools
2. investigate how the feeding is funded in the selected schools.
3. examine the conditions under which meals are prepared and served in the selected schools.
4. investigate the nutritional knowledge of the cooks who prepare and serve the meals.
5. determine if the nutrient content (macro nutrients and mineral elements) of the meals served in the selected preschools meet the WHO RDI for lunch for preschool children.

Research Questions

The following research questions were used to guide the study.

1. What is the weekly meal pattern in the selected schools?
2. How is the feeding of pre-school children funded?
3. Under what conditions are the meals prepared and served?
4. What is the level of nutritional knowledge of the cooks?
5. Does the nutrient contents (macro nutrients and mineral elements) of the meals served meet the WHO RDI for children's lunch meals?

Hypothesis

H_O There is no significant difference between nutrient contents in meals served in the schools and WHO RDI.

H_1 There is a significant difference between nutrient contents of lunch (protein, carbohydrate, fibre, sodium, phosphorus, calcium, magnesium and potassium) served in the schools and WHO RDI.

Significance of the Study

Generally, the study is expected to provide information on the feeding of preschool children in the Cape Coast Metropolis. Specifically, the study brings to the fore useful information needed by stakeholders such as parents, heads of preschools, Ministry of Education and other interested bodies on the need to provide nutritious meals for children in the schools. Again, if the recommendations made by the study are implemented by the stakeholders such as the government, it will serve as a check or guidelines for the meal providers of the School feeding Programme to combine food stuffs that are rich in essential nutrients. For the heads of schools it will provide insight on the nutritional needs of children and how best they can meet those needs and for parents, it will inform them on the need to meet the nutritional deficit created at school to enable their children stay healthy. It will further serve as a basis for conducting similar studies in other parts of the country and also open other areas for further research.

Delimitation of the Study

The main thrust of the study was to assess some of the macro nutrients and mineral elements of lunch meals provided to preschool children and not all nutrients. Again, ideally, a study such as this should cover a wider scope, this was carried out in the Cape Coast Metropolis with only children in kindergarten (KG).

Limitations of the Study

The results of this study are subject to certain methodological limitations which were beyond the control of the researcher. First, the food samples taken for analyses were selected during a one week period in the first term. It was assumed that the same meals were served throughout the term and the year. Sometimes, however, schools change their menu according to the type of foodstuffs available. Therefore the types of meals that were available at the time of the study may not run through the year but may change as the food seasons and prices also change.

Secondly, the sensitivity of the study might have affected the type of meals served during the period of the study. The administrators might have taken measures to present the best meals they could during the period. Ideally repeated food sampling across the three terms would have improved the validity of the results obtained.

Thirdly, not all food nutrients were analyzed. For example dishes collected were not analyzed for their fats and oils content. An observation of the food samples collected generally indicated excess oil settling on top of most dishes. Since all the dishes collected contained oil of one kind or the other the researcher

assumed that the likelihood of inadequate intake of fats and oils by the children will be very minimal.

Lastly, the sample used was not large enough to allow for findings of this study to be generalized to other schools in the Central Region and Ghana as a whole.

Organization of the Rest of the Study

The report has been organized into five chapters. The first chapter discusses the introduction, which highlights the background to the study, the research problem, and the purpose for the study. The research questions have been stated, with the significance, delimitation and limitation of the study. Chapter Two reviews the literature related to the study which involves empirical studies. The third chapter describes the methodology used for the study. This involves the research design, population and sampling procedures, the research instrument, the pre-testing procedure, the procedure for data collection and the data analysis. In Chapter Four, the results are discussed while the final chapter summarizes the study and provides conclusions. Recommendations are given in the last section of the chapter based upon the findings of the study.

Definition of Terms

Beriberi : A disease that results from insufficient intake of thiamine

Haemoglobin: An iron containing protein attached to red blood cells that transports oxygen from the lungs to the rest of thebody.

Haemolytic anaemia : A rare form of anaemia in which red blood cells are destroyed and removed from the blood stream before their usual life span is up.

Myoglobin: An iron and oxygen binding protein found in the muscle tissue of vertebrates in general and almost all mammals.

Osteocalcin : A protein found in the extracellular matrix of bone and dentin and involved in regulating, mineralization in the bones and teeth.

Psoriasis : A common chronic autoimmune skin condition that causes skin redness and irritation

Ricket : A softening of bones in children due to deficiency or impaired metabolism of vitamin D, phosphorus or calcium potentially leading to fractures and deformities.

Scurvy: A disease resulting from deficiency of vitamin C.

Cholecalciferol: A form of vitamin D.A fat soluble vitamin that prevent ricket.

Calcitriol : A form of vitamin D that is important for the absorption calcium from the stomach and for the functioning of calcium in the body.

Osteocalcin : A noncollagenous protein found in bone and dentin.

Tecopherols : An essential vitamin E which is a powerful anti-oxidant that neutralizes free radical damage caused to the cells.

Tecotrinol : They are potent anti-oxidants that are found primarily in the oil fraction of rice bran, palm fruit, barley and wheat germ.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Review of literature involves the systematic identification, location and analysis of documents containing information related to the research problem. It makes the researcher aware of contributions of other researches that have been done and needs to be done in the area under investigation. In this chapter, therefore, attempt was made to examine related literature on the topic assessing macro nutrients and mineral element contents in lunch meals of some selected preschools in the Cape Coast Metropolis.

It has been noticed that a great deal of work has been documented, but for the purpose of this work, literature was reviewed on the following areas; nutrient needs of preschool children, composition of macro and micro nutrients, diet and improved mental health. The review then continues with group feeding, school meals in Ghana, cost of feeding in Ghanaian schools, funding of school meals, food choices and meal patterns of preschool children, feeding guide for preschool children. Other areas include conditions under which the meals were prepared and served, food service personnel in child care centres, method of nutritional assessment, assessment of under nutrition in children, nutritional anthropometry in infants and children, and nutritional education for parents and caregivers of preschoolers.

Conceptual Framework

Good nutrition is the key to healthy development of individuals, families, societies and the country as a whole. There are growing reasons to believe that improving the nutrition of children can contribute to overcoming some of the greatest health and development challenges that children face.

The concept of good nutritional status of children can be analyzed from three perspectives (World Bank/UNICEF Report, 2002). According to the report, those three perspectives are adequate dietary intake and the absence of infectious diseases; household food security and adequate maternal child-care; and healthy environment. The framework does imply that food, child care and healthy environment define the full range of possibilities and the relative importance of each must be assessed and analyzed in each setting in order to define priorities for action. The parameters set in the report does not pertain only to a normal setting where a child is cared for at home but also applies to situations where a child spends most of his/her active period in places such as the preschool. Preschools that prepare and serve meals to the children are also obliged to meet the goal of providing adequate and nourishing meals, proper child care and healthy and sanitary environment.

According to Landers et al. (1994) children are to receive 50% of the RDI including two snacks as lunch. In achieving the 50% requirement, many factors come to play. Some of the factors include ensuring that meals and snacks provided contain correct proportions of macro nutrients and mineral elements as well as meals being presented in a hygienic environment. In ensuring adequate intake of the essential nutrients in a hygienic environment, other factors also come

to play. Adequate funding for purchasing food items rich in essential nutrients and good nutritional knowledge of care givers as well as hygienic practices are essential. Adequate funding and good nutritional knowledge will inform the quality of meals given to the children. Even though adequate funding and good nutritional knowledge are the core variables that can lead to good nutritional status, hygienic and sanitary environment also become an additional force which can affect the status and invariably, the achievement of the good nutritional status since the absence of good hygiene and sanitation affects the quality of meals served.

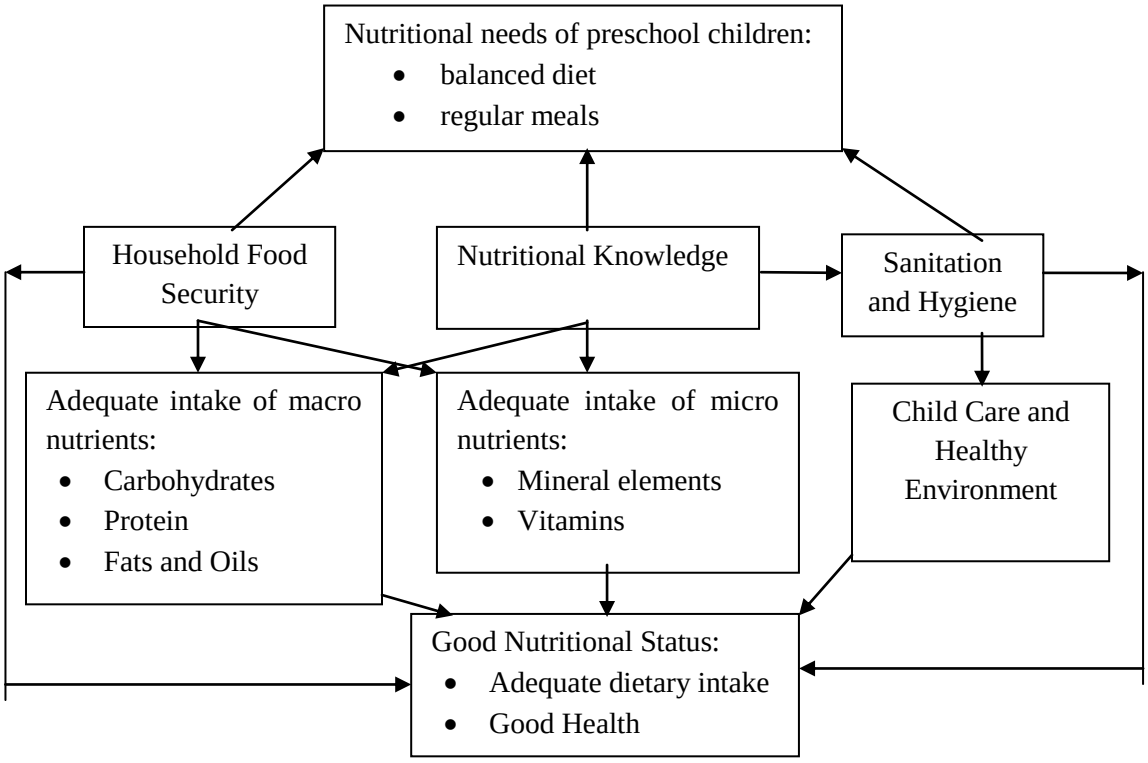

Fig. 1: **Diagrammatic Presentation of the Conceptual Framework**

Source: Author's construct

Nutrient Needs of Preschool Children

"We are what we eat" is a statement frequently used to express the view that the composition of our bodies is dependent to some extent on what is eaten. Latham (1997) states that, "many factors determine an individual's need for nutrient, including body size, rate of growth, physical activity, basal energy and expenditure". Whitner and Rolfes (2002) note that, childhood is the opportune period to shape good nutritional habits. Sound nutrition and eating habits are acquired primarily from parents and other care givers.

No one nutrient, or group of nutrients, is any more important than others; children need dozens of nutrients that function collectively to encourage growth and development. The nutrients needed by children can be grouped under two broad headings: macro and micro nutrients. Macronutrients constitute the majority of an individual's diet, which supplies energy, essential nutrients that are needed for growth, maintenance and activity. Macronutrients such as protein, carbohydrates, fats and oils are used interchangeably as sources of energy with fats and oils yielding nine calories per gram, protein and carbohydrate each yielding four calories per gram. Micronutrients are vitamins and trace minerals. Merch (1999) notes that vitamins and trace minerals are labeled as micronutrients because the body only requires them in very small amounts.

Composition of Macronutrients

Macronutrients are the nutrients that constitute the majority of an individual's diet which supplies energy, and the essential nutrients that are needed

for growth, maintenance and activity. These nutrients include protein, carbohydrate, fats and oils, and water.

Proteins

Protein, as noted by Schucler (1982) is chiefly composed of large combination of amino acids containing the elements carbon, hydrogen, nitrogen and oxygen and is the major source of building materials for muscles, bones, hair, nails and internal organs. Once ingested, protein is broken down into amino acids. Currently there are 22 amino acids that have been identified as vital for growth, development and maintenance of health. Of the 22 amino acids nine are essential, and therefore must be derived from food sources, while the remaining 13 are non-essential and can be synthesized by the body and are therefore referred to as non-essential amino acids.

In Burton and Foster's (2000) submissions, protein can also be further classified as either complete or incomplete. Complete protein sources such as meat, poultry, fish, eggs, milk and cheese contain all of the nine essential amino acids, while sources such as nuts and legumes do not have all the essential amino acids and are therefore considered incomplete. According to Salen and Ore (1990), proteins provide calories but also serve a more important and complex function, therefore an adequate intake of protein is essential if normal growth is to occur. Lack of it results in kwashiorkor. Bonnie and Sue (1996) also add that protein needs of children include those for maintenance of tissue, changes in body composition and synthesis of new tissues. Bonnie and Sue estimate that protein needs for growth range from 1-4g/kg of tissue gained. Toddlers (one and two

years old) still have a lower growth rate, averaging from 1-2kg each year. As a result of this significant slow down in growth, their protein needs for growth decreases as the rate of growth declines. To Burton and Foster (2000), as children grow older and accept table food, they receive additional foods that provide high quality protein. Table 1 presents some of the essential foodstuffs for children and their protein content. Table 2 presents the Recommended Dietary Allowance (RDA) for children between the ages of one and ten.

Table 1: Protein Content of Some Foodstuffs

Food source	Protein content (%)
Eggs	100
Fish	70
Beef	69
Brown rice	57
Soy beans	47
Groundnut	43

Source: Burton and Foster (2000)

Table 2: Recommended Dietary Allowance of Protein for Children

Age (years)	Protein (g/day)
1 – 3	16
4 – 6	24
7 – 10	28

Source: National Academy of Sciences (2006)

Carbohydrates

Carbohydrates are composed of carbon, hydrogen and oxygen and constitute the main source of energy for all body functions, particularly brain functions (Eppright, 1997). In Davies' (1999) opinion, carbohydrates are the easiest form of food for the body to be converted into energy. Once ingested, carbohydrates are turned into glucose in the bloodstream and later into glycogen which is stored in the liver and muscle for later use.

Carbohydrates are chiefly divided into three different chemical classes, monosaccharides, disaccharides and polysaccharides. Monosaccharides are the single sugars, otherwise referred to as simple carbohydrates. Disaccharides are double sugars and are also referred to as simple carbohydrates. Polysaccharides are multiple sugars, otherwise referred to as complex carbohydrates. Simple carbohydrates (monosaccharide and disaccharides), like those found in fruits, break down very rapidly in the body, making them a good sources of quick energy. Complex carbohydrates (polysaccharides) like those found in rice,

potatoes and pasta, take longer to break down in the body, and provide a more even distribution of energy over a longer period of time.

According to Martin and Kern (1992), carbohydrates are the principal sources of dietary energy and act as protein "sparers", so that protein can be used for its primary functions. Pipes and Trahms (1993) also assert that carbohydrates supply between 40 % and 50% of the energy consumed by most infants. Complex carbohydrates are the most important dietary carbohydrate sources.

Davies (2002) argues that foods such as candies, cookies and potato chips, for example, provide primarily calories, whereas cereals and grains are important sources of the B vitamins as well as carbohydrates. Careful attention to the nutrients carried by the carbohydrate containing food is therefore important in planning diets of children. Indiscriminate consumption of candies, cookies, carbonated beverages and other sweetened drinks dulls the appetite for nutrient-rich foods, contributes to overweight, dental caries and general poor nourishment in infants and young children and should be discouraged.

Fats and Oils

Fats and oils, like carbohydrates, are composed of carbon, hydrogen and oxygen. However, in fats, the elements are connected together differently than in carbohydrates. Fats can be found in both plants and animals, and are insoluble in water (Engle & Ricciuti, 1995). Fats provide three primary functions. They are the major source of stored energy for the body, they serve to cushion and protect the major internal organs and they act as an insulator, preserving body heat, and protecting against excessive cold. Wardlaw (2000) explains that once ingested,

fats are broken down into fatty acids and glycerol and are divided into different categories. These are simple fats (triglycerides), compound fats (phosopholipids, glucolipids and lipoproteins) and derived fats (cholesterol).

According to Burton and Foster (2000), fats are used by the liver to manufacture cholesterol. Cholesterol is a member of lipids called sterols and is found only in animal tissues. Cholesterol is important in that it acts as a precursor for the synthesis of various steroid hormones in the body. However, King and Burges (1995) substantiate that polyunsaturated fats can lower both low density lipoprotein cholesterol (LDL, bad cholesterol), as well as lowering high density lipoprotein cholesterol (HDL, good cholesterol). Burton and Foster (2000) further state that polyunsaturated fats can be found in foods like almonds, peanut, sunflower oil, corn oil, fish, mayonnaise, soybean, oil, walnuts and most margarine.

Unsaturated fats, on the other hand, can lower LDL's without affecting ones HDL's making them the healthiest of possible fat sources in the diet. Unsaturated fats can also be found in foods such as pear, cashew, olive oil, and groundnut oil. According to Worthington-Robert and Williams (1996), fats supply between 40 and 50% of the energy consumed in infancy and approximately 40% of the energy consumed after infancy. Fats are calorically concentrated and therefore, may be very important in the diet of children who are lean and physically active and have small appetites, or in the diet of children with oral motor problems who can consume only a limited volume of food. Worthington-Robert and Williams also

state that chunky passive children should limit the quantity of fat consumed to keep away from gaining weight too rapidly.

Water

Even more essential to the body than food is water. Water functions as an essential component of body structure and as a solvent for minerals and other physiologically important compounds. It transports nutrients to and from the cell and helps to regulate body temperature (Barnes, 1992). Wardlaw, Insel and Slyer (1994) state that fluid in liquids and foods consumed are the primary sources of water. In addition, metabolic water is created from the metabolism of proteins, fats and carbohydrates.

Micronutrients (Minerals and Vitamins)

Micronutrients according to UNICEF (2006) are nutrients/minerals that are required by humans and other living organisms through out life in small quantities to orchestrate a whole range of physiological functions, but which the organism itself cannot produce. Although minerals contribute only 3-4 % of the body's weight, they play important roles in the regulation of body fluids, acid-base balance and metabolic processes (Pipes & Trahms, 1993). Williams (1999) states that minerals are grouped into macro (major) and micro (trace) minerals. He explains that minerals are classified as macro minerals if the CDA is greater than 100mg per day. Examples include calcium, phosphorus, magnesium, sodium chloride, potassium and sulphur. On the other hand micro minerals are those needed in quantities less than 100mg per day. Examples are iron, iodine, copper, manganese, fluoride, cobalt, nickle, zinc, chromium and selenium.

Calcium/Phosphorus

Calcium is the most abundant mineral in the body representing about two percent of the body weight whereas phosphorus is the second most abundant mineral element in the body after calcium (Martin & Kern, 1992). Children may need two to four times as much calcium or phosphorus than adults since they are growing; thus 600 mg/day is recommended for the last half of the first year and 800mg/day for one to ten years of age. Davies (1999) and Argon (2006) are of the view that children need calcium and phosphorus for growth of bones and teeth.

Milk and dairy products, cheese, yoghurt, ice cream, egg yolk, dried beans and peas, dark green leafy vegetables and cauliflower are the richest sources of calcium. Other good sources are fish with small bones such as sardines and canned salmon (Williams, 1999). Phosphorus is found in combination with calcium in dairy products but also occur most in protein rich foods such as meat, eggs, nuts, legumes grains. Lack of calcium and phosphorus could result in poor formation of teeth and bones, osteoporosis and rickets in children (Williams, 1999; Tull, 1995).

Magnesium

To Martin and Kern (1992), approximately 50% of the body's magnesium is deposited with calcium and phosphorus in bones, 25% is in muscles, and the remainder is found in soft tissues. Williams (1999) points out that magnesium is generally needed to help in bone metabolism and prevent iron of bone fragility; helps to regulate the synthesis of protein and other compounds which may be essential for optimal oxygen metabolism; and helps to block some of the actions

of calcium in the body, such as contraction in both the skeletal and smooth muscles. Williams listed the food sources of magnesium as nuts, seafood, green leafy vegetables, fruits and vegetables, whole grain-products and human and cow's milk.

Trace Minerals

According to Martin and Kern (1992), trace minerals such as sodium chloride, potassium, iron, copper, zinc, iodine, fluoride, manganese and sulphur are also essential mineral elements needed in the diet of children. Trace minerals are needed for the following functions: haemoglobin and myoglobin formation, building new tissues especially red blood cells, protein synthesis and immune function and sensation of taste and smell. Trace minerals also help in the formation of thyroid hormones, development and functions of the brain and nervous system, bone formation and for fat synthesis. Martin and Kern state the following foods as rich sources of trace elements: liver, meat, fish, shell fish, poultry, eggs, oysters, dried beans and peas, whole grain product, green leafy vegetables, nuts, iodized salt and drinking water.

Vitamins

King and Burges (1995) describe vitamins as chemical compounds that the body needs in small amounts to help it function properly. Because of vitamins' functions in metabolic processes, the amounts required are determined by intakes of energy, proteins and fats. Vitamins are essential for our bodies to function properly, for growth, energy and for general well-being. Vitamins may be

grouped under two broad headings: fat soluble vitamins and water soluble vitamins.

Fat-soluble vitamins**:** According to Taylor (2000), the four fat-soluble vitamins are A, D, E, and K. In his view, because fat-soluble vitamins are soluble in fat and not in water, dietary sources include foods that have some fat content. The body may contain appreciable stores of each fat-soluble vitamin and may also manufacture several of them so deficiencies are relatively rare in industrialized societies. Taylor (2000) also ascertains that excessive intake may be toxic with the exception of vitamin E.

Williams (1999), asserts that the human body is capable of forming retinol (vitamin A) from provitamins known as carotenoids, primarily, beta-carotene. Williams goes on to say that, vitamin A is essential for maintenance of the epithelial cells, those cells covering the outside of the body. It is also essential for proper visual function, such as night vision and peripheral vision. Beta-carotene may function as an antioxidant and has been theorized to confer some health benefits.

Performed retinol is most abundant in fish and fish liver oils, whole and fortified milk and in eggs. Active carotenoids are present in dark leafy green vegetables and yellow-orange as well as fruits such as oranges, limes, pineapples, foods fortified with vitamin A, such as milk and margarine, are also reasonable sources. Williams (1999) notes that inadequate intake of vitamin A could have serious health implications if prolonged. Gradual loss of night vision is one of the first symptoms of mild deficiencies including increases susceptibility to infection

and skin lesions. Vitamin A supplementation may decrease these deficiencies, possibly by strengthening the immune system.

According to Williams (1999), the physiologically active form of vitamin D is calcitriol, which is the hormone of this vitamin. The ultraviolet rays from sunshine converts a compound found in the skin into cholecalciferol (vitamin D_3), a pro-hormone, which is released into the blood and is eventually converted by the liver and kidneys into the active hormone, calcitriol. King and Burges (1995) state that vitamin D plays a central role in bone metabolism through its effects on calcium and phosphorus. It is also involved in the development of the skin and has been used in the treatment of psoriasis, a chronic skin disorder.

Children can meet their vitamin D requirement from skin exposure to sunlight. However, they can obtain some amount from eggs, butter, and fortified margarine, fish liver oils, tuna, and salmon. Deficiencies may occur in individuals who have little exposure to sunshine and may lead to inadequate calcium metabolism and bone deformities known as rickets especially in children (Townsend, 1998).

Vitamin E is a fat-soluble vitamin. Vitamin E physiological activity is derived from a number of different tecopherols and tocotricnols found in the diet, alpha-tocopherol being the most active (Williams, 1999). Though the total function of vitamin E in human nutrition is unclear, its principal role is to serve as an antioxidant. It also helps to prevent the oxidation of unsaturated fatty acids in cell membrane phospholipids and thereby protects the cell from damage.

Vitamin E is found primarily in small fat content in various vegetables, margarine, and fortified ready-to-eat cereals, whole grain products, wheat germ oil and eggs. Moderate to small amounts are found in meat, dairy products, fruits, vegetables and particularly sweet potatoes and dark-green leafy vegetables (Townsend, 1998). If adequate supply is not provided, a deficiency characterized by haemolytic aneamia will occur (Williams, 1999).

According to Williams (1999), vitamin K is a fat-soluble vitamin. It is often called the blood coagulation vitamin or anti-hemorrhage vitamin. Williams adds that, vitamin K is needed for the formation of four compounds that are essential in two steps of the blood-clotting process. In addition, vitamin K appears to enhance the function of osteocalcin, a protein that plays an important role in strengthening bones in children.

Townsend (1998) indicates that vitamin K is found in a variety of plants and animal foods. Good plant sources include green leafy vegetables, such as peas, broccoli, and spinach, while meats and milk contain lower amounts. Vitamin K (menoquinone) is also formed in the intestine by bacteria, so a deficiency is unlikely.

Water-soluble vitamins: Water soluble vitamins are vitamins that are able to dissolve in water and are not stored in the body. Because they are not stored in the body, they must be replenished on daily basis. Once water soluble vitamins are ingested, they are first absorbed by the intestinal tract which promptly passes them directly to the blood, which then takes them to the cellular tissues and other

areas where they are needed. The body rids off any excess through urine everyday.

Pipes and Trahms (1993) and Kings and Burges (1995) are of the view that thiamin requirement of infants are sparse. Thiamin helps the body to burn nutrients to release energy. Thiamin is abundant in whole-grain, pork, lean meat, liver, legumes and nuts. Enriched bread and cereal products are also reasonable source of this nutrient. Inadequate intake of these food sources may result in beriberi.

Although signs of riboflavin deficiency are unusual, very low riboflavin intake may interfere with growth. Like thiamin, riboflavin also helps the body to burn nutrients to release energy and children who lack this may have cracked lips, sores at the corners of their mouth and a rough skin. Riboflavin is found abundantly in dairy products, meats, poultry, fish, enriched green products, green-leafy vegetables and beans (Townsend, 1998).

The fact that tryptophan is converted to niacin makes basic requirement for niacin to be determined. Little is known about the Nutritional Equipment requirement of infants and children. Meat contains both niacin and tryptophan and it is a good source of the nutrient. In general, protein is about one percent tryptophan. Lack of niacin in children will result in pellagra (Townsend, 1998).

For older children, folate needs are extrapolated from those of infants. Folate helps the body to grow and to make healthy red blood cells. The body stores only a little folate in the liver. Unlike iron, folate cannot be reused when a red cell die. So a person needs to eat folates nearly everyday (King & Burges, 1995).

According to Williams (1999), almost all foods contain some folate, but the foods which contain most are liver and kidney, fresh vegetables particularly dark green leaves, fish, beans, groundnuts, maize and other cereals. Much folate is destroyed when foods are stored or cooked for a long time.

According to Williams (1999), an intake of 10mg/day of vitamin C is adequate to prevent and cure scurvy in children. It does not, however, provide for acceptable reserves. In relation to body weight, the vitamin C requirement of older children is higher than that of adults, thus, the recommendation increases over time. King and Burges (1995) contend that vitamin C helps the body to use calcium and other nutrients to build bones and blood vessels. Vitamin C helps the body to absorb non-haem iron and finally helps to destroy free radicals. Fruits and vegetables are the primary sources of vitamin C.

Diet and Improved Mental Health

Denninson (1987) explains that diet may influence how much one learns or can learn. He intimates that diet may affect the stability of ones disposition. It is also known that a good mental and social health require constant level of energy and other nutrients to the brain. When the brain is deprived of energy and nutrients, mental processes are negatively affected. Regular schedule nutrient balance and adequate meals are necessary for one to feel physically well.

Because diet influences the potential of learning as well as good health, an objective of the United States of America Education Programme is that children should receive good nutrition and health care to arrive at school with healthy minds and body. School based nutrition education and meal can improve dietary

practices that affect young people's health intellectual development. Immediate effects of unhealthy eating patterns include under nutrition, iron deficiency anaemia, over weight and obesity.

A study by Latham (1997), showed that even moderate undernutrition can have lasting effect on children's cognitive development and school performance while chronically undernourished children attain lower scores on standardized achievement tests especially on language ability. Andersen (1994) states that when children are under nourished, they become highly susceptible to infection, which in turn affects the performance and attendance in school. If undernutrition is present in children and is carried out further in life, the health of the population might be compromised. Proper nutrition is critical for optimal growth, development and the general well-being and academic performance of children.

A study conducted by Pollite, Libel and Greenfield (1995) also indicates that skipping breakfast could adversely affect children's performance in problem solving tasks. Their study on low income elementary school pupils confirmed that those who participated in school breakfast programmes in America had greater improvement in standardized test scores, were active and had high school attendance rate than their colleagues who did not participate. This finding confirms that good diet actually has an important role to play in improved mental health of children.

Latham (1997) reports that children observed to have increased fatigue, decreased work capacity, reduced intellectual capability and susceptible to diseases were fed with food low in iron content. Ndure (1999) also found out in a

study that childhood malnutrition could delay or irrevocably damage a child's mental development. The merits of investment in school children's nutrition is not only to prevent such effects but also to improve growth and health and contribute to subsequent performance in school and later in the work force. Improving the nutrition of school children will allow more of them to attend school for a longer period and with highest achievement.

Group Feeding

Group feeding is the feeding of selected groups of the population over a specified period of time. MacLaren (1997) reports that group feeding apply when dealing with populations in educational institutions. He suggests that attention should be given to logistics for the various aspects of group feeding which include the ordering of food from local as well as those that must be brought in from outside the area of study which might be influenced by the space available for storage, refrigeration, financial resources, purchasing agreements and the preparation of meals and distribution to the recipients. Various authors have reported on how to organize group feeding schemes. Examples include reports by Brown (1990) and MacLaren (1997).

Brown reports that the involvement of recipients in food selection and preparation has the advantage of introducing new food alongside culturally staple foods. MacLaren report indicates that food and meal times should be chosen so as to enable people eat under quiet undisruptive environments, with comfortable tables and chairs. On food exploration, the reports of Brown (1990) and MacLaren (1997) suggest that individual food preferences based on cultural

performance rotation and cyclic menus which eliminate boredom should be used. Brown concludes that the evaluation of student feeding from objective and subjective viewpoints as well as estimation of plate waste could be used as an index of which foods are most desired. MacLaren finds food available in the locality and financial resources available to organize school meals as the primary determinants of the nutritive value of meals to be provided.

School Meals in Ghana

School meals in Ghana are meals (usually lunch) provided to students at school. It is usually served around noon. For students in the boarding schools, breakfast, lunch and supper are the meals normally served. The purpose is to ensure proper nutrition and health of children, so that they may learn more effectively. In developing countries, Latham (1997) in his study of human nutrition found out that the provision of school meals was done in response to provision of boarding facilities at primary and second cycle institutions. The study of Latham indicates that in boarding schools three meals were provided per day and the menu was based on recommendations made by people with knowledge in human nutrition, including school matrons.

In Ghana, the setting up of missionary schools at localities far away from towns of pupils and students led to the setting up of boarding facilities and associated feeding programmes (GOG Report, 1982). When the country, then Gold Coast attained independence in 1957, Ghana Education Trust, secondary and other tertiary institutions were set up, boarding facilities and feeding programmes were added. This was to enable people from all parts of Ghana to attend

educational institutions of their choice anywhere in the country. The GOG Report indicates that the Ghana Government subsidized secondary school meals from 1975 to relieve parents who paid full feeding fees of their children prior to the introduction of the subsidies. Provision of school meals in other boarding institutions like post-secondary teacher training and nursing colleges, polytechnics and universities, were fully funded by the government of Ghana as part of her human resource development programme, leaving preschools out of this benefit. The GOG report shows that with the deterioration of the country's economy, government subsidy introduced in 1975 was removed. From 1996-97 academic year feeding fees was borne fully by parents.

Adow, Daaku, Daaku and Ofosu (1993) pointed out that the main sources of energy in school meals were cereals, grains, legumes, roots tubers, plantain, and fats and oils used in cooking. The report again indicates that protein sources in Ghanaian school meals were primarily fish and beans. Meat, eggs, milk and milk products were scarcely served in school meals. The reason given in the report was that energy and protein food ingredients are usually based primarily on cost and affordability by the school. The report concludes that when children's meals lack protein and energy, malnutrition sets in and their growth rate and health status is reduced.

Cost of Feeding in Ghanaian Schools

The cost of feeding in Ghanaian schools has been regarded as rather high. The Government of Ghana Report (1995) suggests ways for reducing the cost of feeding. These include effective monitoring of stocks and purchases, efficient

storage, efficient transportation, food production by institutions and the timely release of funds. It was stated in the report that the supervisory system accommodated waste, duplication and corruption and that, aggressive security system should be instituted to check malpractices. The malpractices to be checked included pilfering, over pricing of food items, inflation of prices, short weighting, short delivery and false declaration of spoilage.

There was a section which touched on the need for urgent improvements in the storage facilities to enable them stock the types of food item, which became scarce seasonally. Effort was made to establish central food depots and pooled transportation system to facilitate acquisition and distribution of food items at reduced costs. The report requested the government to adopt a policy of timely release of funds for the purchase of food items to enable institutions to make bulk purchases during the season of abundance. The report (GOG, 1995) further spelt out that educational institution should engage in serious food production to reduce the overall cost of feeding in their schools.

Food Choice and Meal Patterns

Food Choice

While school-food service personnel attempt to provide healthful meals and food choices, children do not always eat the food they receive. Brigges (1994) states that food pattern in United States show distinctive cultural characteristics that change as life style changes. A study carried out by Plum (1994) on the nutritional needs of preschool children revealed that, a child's food choices

arlargely determined by the family environment and other community or external factors.

The dietary patterns of children are determined by social, psychological, and economic factors. Plum (1994) further explained that, toddlers and preschoolers spend more time eating at home than they do in school. Their food choices and food preferences are thus largely dependent on what their parents and caregivers provide. When children are young, their parents and families have greater control over what they eat. As they get older, however, what their friends eat in the school environment and what is available to them in school and elsewhere, will have an impact on what they eat (Brigges, 1994).

To Plum (1994), at the beginning of the twenty-first century, more families were headed by single parents than ever before, and a greater number of two-parent families have both parents in the workforce. As a result, toddlers and preschoolers often have to depend on their schools to feed them. If they are eligible for the School Breakfast Programme (SBP) and National School Lunch Programme (NSLP) at school, they can have free or reduced-priced breakfasts and lunches. Even so, there is no guarantee they will eat what they are given. Burton and Foster (2000) are also of the view that what children eat at school is dependent on many factors, including the dinning environment, peer pressure, administrative support, teacher participation, cafeteria staff and the quality of food choices offered. According to Brigges (1994), children accept simple unmixed dishes more willingly than casseroles and prefer most of their food at room temperature, neither hot nor cold. Food preparation is important as children eat

more easily those foods which they are familiar with. Some portions of new foods can be introduced with familiar foods in feeding them. According to Eppright (1997), dried foods are especially hard for preschool children to eat. Therefore, in planning menu the following must be considered:

1. Always balance dry food with one or two moist foods.
2. Combine sharp rather than acid flavored foods.
3. Include colourful foods such as red tomatoes, green pepper and carrot sticks in their meals.

Meal Pattern

It has been noted that we are raising a generation of nibblers. Anliker, Cowart and Lawless (1991) state that nearly 60% of three to five year old children eat more than three times a day. They go on to say that young children consume food on average of five to seven times a day, although from two to 14 times a day have been noted. Brigges (1994) is also of the view that the frequency of food intake was unrelated to nutrient intakes except when children consumed food less than four or more than six times a day. Children who consumed food less than four times a day consumed fewer calories and less calcium, protein, ascorbic acid, iron, than average intakes of other children. Those who consumed food more than six times a day consumed more energy, calcium and ascorbic acid than average intake of children. He added that, snacks have been noted to provide one-fourth to one-third of the total calories, over one-third of the total sucrose, one-fifth of the total calcium and ascorbic acid and one-fifth of the protein ingested by children. Wardlaw, Insel and Syler (1996) also agree to the fact that proper child nutrition

should usually include eating three meals a day and two nutritious snacks, limiting high-sugar and high-fat foods, eating fruits, vegetables, lean meats and low-fat dairy products, including three servings of milk, cheese or yogurt to meet preschool children's calcium needs. These healthy practices can also prevent many medical problems, including becoming overweight, developing weak bones and developing diabetes. It also ensures that preschool children physically grow to their full potential.

Table 3: Suggested Meal Pattern for Preschool Children

Menu	Children 1 to 3 years	Children 3 to 5 years
Supplement (snacks)		
Milk, fluid	½ cup	½ cup
Juice, fruit/vegetables	½ cup	½ cup
Bread	½ slice	½ slice
Cereals	½ cup	½ cup
Lunch/Supper		
Milk, fluid	½ cup	½ cup
Meat/meat alternate	½ ounce	1 – ½ once
Cheese	½ ounce	1 – ½ ounce
Eggs	½	¾
Cooked dry beans/peas	¼ cup	3/8 cup
Nuts	½ cup	½ cup
Vegetables or fruits	2tbsp	3tbsp

Source: Burton and Foster (2000)

Feeding Guide for Preschool Children

The feeding guide for the preschool child was designed by the United States Department of Agriculture to promote healthy nutrition in children. It is meant to be a general guide to daily food choices. The "guide" provides guidance in planning daily food intakes for children, plan meals and snacks that provide the recommended number of servings each day. The main emphasis of the feeding guide is on the five major food groups, all of which are required for good health. It also emphasizes that foods that include a lot of fats, oils and sweets should be used very sparingly. The feeding guide shows a range of servings for each food group. How much one actually eats depends on age and activity level. Children who are overweight and dieting should at least eat the lowest range of servings. When determining how many servings to eat, it is important to look at the serving size. Larger portions should count as more than one serving, and similar portions will count as only a part of a serving. Meals should consist of at least one third of the fairly recommended portions per the feeding guide.

Funding of School Meals

In the United States, a School Lunch Committee consisting of physicians and Social Workers were organized to find out whether a lunch might be self supported at a three-cent charge to students (Anliker et al., 1991). Shils and Young (1986) Educational Survey in Cleveland shows that two schools were selected on trial basis. Two years later, the board authorized expansion of the programme to other schools and agreed that the board will pay for the cost of

equipment, gas and supply the necessary rooms. The cost of the food and labour was met from the sale of lunch.

Later, clubs and other organizations such as World Health Organisation, United Nation International Children Fund, Food and Agricultural Organisation, World Food Programme and many others came in to support school feeding both in Ghana and abroad. The National School Lunch Programme for instance, has been administered by the National School Lunch Programme for instance, has been administered by the United State Department of Agriculture (USDA) which provides cash reimbursement and supplementary foods to feeding programme. This regulations required that school meals be sold at reduced prices or be given free to children whose families can not afford to buy them. The School Breakfast Programme is also administered by the USDA and supported by consumer groups and low income advocates, whereas the Ghana School Feeding Programme is administered by World Food Programme, United Nation International Children Education Fund, and New Partnership for African Development supported by the Ghana government.

Hygiene and Sanitation of Food, Premises and Personnel

Food hygiene pertains to the hygiene practices that help prevent food contamination and poisoning. Food Sanitation on the other hand within the food industry means adequate treatment of food contact surfaces by a process that is effective in destroying vegetative cells of microorganisms of public health significance without adversely affecting the product or its safety to the consumer. According to King and Burges (1995), good food hygiene is very important in

feeding programmes especially with on-site feeding. They are of the view that, if food is contaminated, children may become sick and malnourished. The Department of Environmental and Natural Resources (DENR) (2007), define food preparation as the handling of foods or utensils in the preparation of meals, including opening and closing of baby bottles, baby food jars and cereal boxes, as well as the opening and closing of any other food items intended for the assembly of ingredients for human consumption. They also defined food service as the distribution of prepared foods for consumption, including those food items prepared at the child care centre; received by the centre from approved food establishments; milk placed in a pitcher or other serving container; ice transport, stored and dispensed; bagged lunches sent from home; and the use of utensils to minimize direct food contact.

Food

Foskett, Caserani and Kinton (2004) observe that in child care centres, the preparation of food shall take place only in hygienic conditions and also food shall be prepared with the least possible manual contact, with utensils, and on surfaces that have been cleaned, rinsed, and sanitized prior to use in order to prevent cross-contamination. They contend that food contact surfaces and utensils shall be cleaned and sanitized after preparing raw foods, prior to preparing ready-to-eat foods and after any interruption of operations in which contamination may have occurred. Also, raw fruits and raw vegetables shall be washed with potable water before being cooked or served. Hobbs and Gilbert (1978) have also posited

that, potentially hazardous foods requiring cooking shall be cooked to heat all parts of the food.

Premises

In the view of Hobbs and Gilbert (1978), each child care centre shall have at least a two-compartment sink, drain boards or countertop space of adequate size, adequate refrigeration equipment and, when needed, adequate cooking equipment, except for child care centres located in a school that receives all food supplies prepared and ready to serve from a food service establishment permitted by a local health department, which is located at the same school and provides food during all hours of child care operations, thus, domestic or commercial kitchen equipment may be used. Moreover, child care centres shall provide a dishwasher and two-compartment sink, a three compartment sink of sufficient size and depth to wash, rinse and sanitized utensils may be used.

According to Brownsell et al. (1989) a separate food preparation sink with drain boards or countertop space of adequate size shall be required when a plan review indicates that separate facilities are needed based on volume and preparation frequency and when domestic refrigeration equipment is used, except in child care centres licensed for fewer than 13 children and located in a residence, the following provisions shall apply:

1. Except for thawing under refrigerated conditions, potentially hazardous foods shall not be prepared prior to the day that such foods are to be served.
2. Potentially hazardous foods that have been heated shall not be reheated or placed in refrigeration to be used in whole or in part on another day.

3. Foods, especially milk, meat, fish and cooked meals in which germ multiplies quickly must be properly stored.
4. Water from a hand wash lavatory shall not be used to prepare formula, mix dry cereals, or other foods.
5. All equipment shall be cleaned at least daily.
6. Counter, shelf or cabinet space, store rooms, refrigerators and freezers shall be provided for food storage.
7. Latrine and waste must be well maintained and properly disposed off.

Personnel

Davies (1999) stated that the following precautions are to be observed by food service personnel:

1. In child care centres, employees and their cooking shall be clean
2. Employees shall keep their fingernails clean
3. Tobacco use in any form is prohibited in any part of child care centres, except in a designated area either outdoors, separate from the outdoor learning environment or indoors in a room with a separate ventilation system approved by the building inspectors. Volunteer personnel shall adhere to the same requirements as employees, as specified in the rules of this condition
4. Water supplies especially drinking water must also be kept under strict hygienic conditions
5. Utensils and equipment for preparing and cooking food must always be washed and kept in a clean place

6. Hands should be free from cracks, roughness and abrasion
7. Wear some form of protective clothing such as an overall
8. Hair should not come in direct contact with food handling
9. Individual suffering from any illness should not be allowed to prepare food.

Method of Nutritional Assessment

Nutritional assessment, according to Baxter (1999) is a structured way to establish nutritional status and energy requirements by objective measurements and completed with objective parameters in relation to specific disease indications where an adequate nutritional treatment can be developed for the patient. Davidson, Passmore, Brocks and Trussewell (1975) observed that nutritional assessment is difficult because there are so many ill defined grades between the obvious well nourished and the ill nourished. In the development of an appropriate design for the Health Nutrition Examination Survey in America, Miller (1973) concludes that the nutritional status is reflected in a complex of interrelationships of clinical observation, biochemical assessment, anthropometric measurement, sociological and psychological evaluations of dietary intake pattern.

All dietary assessment must fulfill the specific purpose of the study. Shils and Young (1986), in his submission states that one should make sure that intakes are representative of typical diet over the time period being investigated, provided a reliable, repeatable and representative data that are capable of validation and conform to the constraints imposed by respondents, interviewer characteristics

and cost. Considering these factors before the beginning of dietary studies saves a great deal of time.

There are two possible ways to assess the adequacy of food and nutrition and to detect the presence of inadequacy in food intake among individuals or population. The first measures nutritional intake and the second assesses nutritional status.

Nutritional Intake Assessment

Measures of nutritional intake estimates the amount of food a person is eating and can be used to assess adequacy of the quantity of dietary supply. In simple terms, one can categorize people as being well-nourished or undernourished based on whether their intake of food matches their food energy needs or nutrient requirements. According to Svedberg (2001), the methodologies that provide such information are those based on national sample surveys or dietary surveys that attempt to measure the food consumption or intake levels of representative individuals within a population. These methods often tend to provide an estimate of the risk of the population or individual to inadequacy of food but do not help to identify actual individuals in the population who are deficient; nor do they help define the degree of severity of the food inadequacy.

Nutritional Status Assessment

The second option assesses the nutritional status of the individual or a representative sample of individuals within a population by measuring anthropometric, biochemical or physiological (functional) characteristics to determine whether the individuals are well nourished or under nourished. This

method makes use of objective, measurable criteria that reflect the changes in anthropometric, biochemical or functional characteristics of the individual as a consequence of inadequate intake food for long period of time or as a result of seasonal fluctuation in intakes of food or poor absorption and utilization of ingested food. Anthropometry is the most frequently used method to assess the nutritional status of individuals or population groups. Measurements of nutritional anthropometry are based on growth in children and body weight changes in adults.

Nutritional Anthropometry

Nutritional anthropometry as defined by Jelliffe (1997), are measurements of the variations of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition. Though, as old as the definition may seem to be, it still has relevance to the subject under consideration. Further to his submissions, he intimates that anthropometric measurements are of two types. They are growth and body composition. They have been widely used for the assessment of the nutritional status of both children and adults. The selection of the ideal single or a combined use of anthropometric indicators depends upon the sensitivity and specificity of the indicator chosen. Sensitivity indices are ideally suited for nutritional status assessment in screening or surveillance activities as they are capable of detecting even small changes that occur in nutritional status during conditions of food inadequacy.

Gibson (1990) posits that nutritional anthropometry has several advantages. These are;

1. Methods are precise, accurate and provide standardization
2. Procedures used are simple, safe and non-invasive
3. Equipment required is inexpensive, portable, durable and can be made or purchased locally
4. Relatively unskilled personnel can perform measurement procedures
5. Information is generated on past nutrition
6. Methods can be used to quantify the degree of undernutrition or over nutrition and provide a continuum of assessment from under to over nutrition
7. Methods are suitable for large sample sizes such as representative population samples
8. Methods can be used to monitor and evaluate changes in nutritional status over time, seasons, generation and
9. Methods can be adopted to develop screening test in situations such as nutrition emergencies to identify those at high risk.

Notwithstanding these advantages, there are also, however, several limitations. Nutritional anthropometric techniques are prone to measurement and other types of errors, both systematic and random. These errors, according to Gibson (1990) arise out of inadequate and improper training of personnel, difficulties in measurement of certain anthropometric characteristics such as skin folds and instrumental or technical errors. Researchers in nutrition explain that

these errors can be minimized by properly training personnel to use standardized, validated techniques and by frequent calibration of instruments, thus improving the accuracy and precision of the measurement.

In infants and children under five years of age, assessment of growth has been the single most important measurement that best defines their nutritional status (De Onis, Monteiro, Akre & Clugston, 2002). Nube (2001) argue that the disturbances in nutrition as a result of inadequacy of food intake, severe and repeated infections or a combination of both, operating very often as a viscious spiral, invariably affect the growth of a child. These adverse conditions Nube (2001) explains are closely linked to the general standard of living and the population's ability to meet its basic needs for nutritious food, safe water, good housing, acceptable levels of environmental sanitation and ready and easy access to health care.

Assessment of the nutritional status of the child by the use of nutritional anthropometric indicators of growth has thus been used not only to provide information on the nutritional and health status of children but also as an indicator of the nutritional status and adequacy of food for all members of that community. Food and Agriculture Organization (1994) report that there are growing doubts whether estimates of undernutrition based on nutritional anthropometry in children alone without any information about the adults in the community necessarily reflect the overall nutritional status and the adequacy of food availability within the entire community.

Height and weight are the most commonly used indicators of the nutritional status of a child. According to a World Health Organization Working Group (1986), appropriate weight-for-age of a child reflects linear growth and can measure long term growth faltering or stunting. On the other hand they also agree that appropriate weight for height is particularly sensitive to acute growth disturbances and is useful to detect the presence of wasting. Kramer (1992) states that weight-for-age represents a convenient synthesis of both linear growth and body proportion and thus can be used for the diagnosis of underweight children. The presence of undernutrition in children is assessed using these three anthropometric parameters (weight-for-age, height-for-age and weight-for-height) and by comparing them with internationally accepted reference standards (WHO, 1983).

World Health Organisation (1995) indicate that if a child has a low height-for-age, that is a z score below two standard deviation of the reference population mean (-2 z – score), such a child is categorized as stunted. Similarly, a low weight-for-age is a diagnostic of an underweight child, while a low weight-for-height is indicative of wasting. They further argue that, the growth retardation prevalence for the under five year old preschool child is estimated by the proportion of weight-for-age, height-for-age and weight-for-height below -2 z score, the accepted cut off for the diagnostic of undernutrition. Hence it is indicative of an increase in risk of morbidity and mortality.

Grantham-McGregor, Powel, Walker and Himes (1991) stress that there is sufficiently good evidence to show that poor growth and smaller size in preschool

children is associated with impaired development. There are a number of studies that have demonstrated a relationship between growth status and school performance or intelligence. However, this cannot be regarded as a simple causal relationship between inadequacy of food, physical growth status and intellectual development. Complex environmental, sociocultural and economic factors also affect both growth and development.

Nutritional Education for Parents and Caregivers of Preschoolers

Feeding and nutrition education programmes in schools when adequately implemented, provide not only important nutrients for children, but also an opportunity for the caregivers to learn to make responsible choices regarding dietary intake. Nutrition education in schools is an important method for developing a nutritionally informed population. This occurs in the various ministries in the country (education, health, agriculture, social and community development) and can also be acquired through various Non-Governmental Organisations.

According to Anliker et al. (as cited by Wardlaw, Gordon and Insel, 1996), the concern that lack of adequate nutrition information was contributing to unwise food choices and food waste in the School Lunch Programmes, Congress enacted, the Nutrition Education Training Programmes (NETP) in 1977, Administered by the USDA, the program offered states grants to develop and implement a state Nutrition Education Plan. Congress identified the following needs for this program in the NETP legislation:

1. The proper nutrition of the nation's children is a matter of highest priority

2. The lack of understanding of the principles of good nutrition and their relationship to health can contribute to a child's rejection of highly nutritious foods and consequent food waste in school food service operation

3. Many school food service personnel have not had adequate training in the fundamentals of nutrition or in how to convey information to motivate children to practice sound eating habits

4. Parents and care givers exert a significant influence on children in the development of nutritional habit and lack of nutrition knowledge on the part of these people can have detrimental effects on children's nutritional development.

However, the general objectives for carrying out a nutrition education programmes in schools in Ghana are: to improve nutrition; to prevent short-term hunger; and increase attendance at school (Martin & Kern, 1992). According to Martin and Kern during the programme, the most active phase was where the state provided nutritional education for School Lunch employees and teachers.

To Davies (1999), nutritional knowledge of parents and other care givers is an important factor to consider in the shaping food preferences of children. The degree to which knowledge of nutrition is incorporated into family and school meal planning appear to be related to positive attitude toward self and problem solving skills. He also presumed that Day-Care teachers also have an impact on the development of food preference in young children. According to him, a survey conducted on day-care teachers concluded that caregivers knew little about nutrition, but they thought it was important, since young children are responsive

to early influences. The role of Day-Care teachers in shaping positive food-related attitudes needs to be strongly supported by the nutrition community. In Davies (1999) report, Day-Care providers readily acknowledged that they needed more information and guidance in developing good food habits and planning meals for preschool children.

Summary

Literature proposes that the degree of every child's nutritional status depends on the degree of stakeholders' commitment and nutritional knowledge. The stakeholders are parents and care givers such as what pertains in preschools. Consequently, the literature review focused on major areas such as nutrient needs of preschool children, composition of macro and micro nutrients, diet and improved health. Other areas included group feeding, funding school meals and conditions under which meals should be prepared and served. From the review there is an indication that there are a number of core factors that come together to help achieve good nutritional status. These core factors focus on aspects such as good nutritional knowledge, hygiene and sanitation practice and adequate source of finance.

Unfortunately, studies from which literature was reviewed were basically studies that had been conducted abroad. Secondly a number of the studies were based on vitamins. Though there were few studies that relates to the constitution of children's meal, not much study have been conducted in Ghana that relates to the assessment of the macro and micro nutrient of children's meal. To this end, this study addresses the macro and mineral content of the lunch meals served to preschool children. The conceptual framework was thus based on the issues and a model was developed for the study.

CHAPTER THREE

METHODOLOGY

This chapter discusses how the study was conducted. It is divided into six sections. The first section covers the study area, the second deals with the research design, and the third deals with the population and sample and sampling procedure. The fourth section covers the research instrument (including pretesting) while the fifth section deals with data collection procedure. The last section covers how data collected was analyzed.

Research Design

The research design for the study was a descriptive survey as it assessed the macronutrients and mineral element contents of lunch meals of pre-school centres. According to Bell (2008), descriptive surveys are concerned with the demographic characteristics, the social environment, the activities, or the opinions and attitudes of some group of people. Since all the characteristics mentioned cannot be measured directly, it involves eliciting responses from respondents to answer the research questions. Denscombe (2007) observes that the notion of a survey suggests that the researcher intends to get information "straight from the horse's own mouth" and is purposeful and structured.

The descriptive survey was employed to help produce a good amount of responses from the heads and cooks in preschools that provide meals to the pupils

during school hours. It also enabled the researcher to gather enough data to determine the nature of the group studied as it existed at the time of the study. The strategy also allowed the use of questionnaire and observation guide which enabled the researcher to analyze the data statistically. The descriptive survey again aided the researcher to describe and document the nutrient content of the lunch meals that were provided by the schools. MacMillan (1996) concurs by stating that the use of the descriptive design is a report of the way things are, what is or what has been.

Thus, this approach is appropriate since not much work has been done to find out the macronutrients and mineral element content of lunch meals served by preschools in the Cape Coast Metropolis. However, Fraenkel and Wallen (2000) indicate that the descriptive research design does have some weaknesses. These include the difficulty of ensuring the questions to be reacted to are explicit; data gathered could produce untrustworthy result because they may delve into private and emotional matters in which respondents might not be completely truthful. They also point out that retrieving a sufficient number of questionnaires administered for meaningful analysis to be made is a problem of the descriptive survey design.

The descriptive survey research design was considered the most appropriate for assessing the quality of lunch meals given to pre-school children in the Cape Coast Metropolis, in view of the reasons listed.

Population

The target population for the study was made up of all private (individually owned) pre-schools in the Cape Coast Metropolis which provide lunch for the children. The private preschools were 21 in number with a total population of 1562. Eight preschools were chosen out of the 21 preschools for the study. The study did not cover the public preschools because government owned preschools do not provide lunch meals for its preschoolers now. The provision of lunch meals for Government owned preschools is yet to be implemented. As depicted in Table 4, the number of head-teachers and cooks involved in the study were eight and 51 respectively.

Table 4: Selected Preschools and Their Population

Name of School	**No of children**	**No of Cooks**
Calvary Day Care	148	5
Calvary school	179	6
Cherish International	216	7
Good Samaritan	264	8
Morning star	204	7
Precious Gift	223	7
St. Anthony	146	5
Sure Start	182	6
Total	**1562**	**51**

The Study Area

The research was conducted in the Cape Coast Metropolis. Cape Coast is the capital of the Central Region of Ghana. It is about 146km away from the capital city (two hours drive west of Accra). The European merchants established the castle schools in the castles along the coast. This establishment marked the introduction of formal education in this country and for that matter in Cape Coast. The schools were essentially set up by the early trading nations, namely, Britain, Holland and Portugal, for the purpose of educating the Africans and the Molattos, as well as Christianizing the Africans. The British, after establishing the Cape Coast castle, started a school in 1694 and this led to the establishment of several schools.

Presently, there are 65 preschools in the Cape Coast Metropolis of which 21 are private, 89 primary schools, including 17 in the private sector, 81 Junior High School (JHS) with 15 being private, 10 Senior High Schools (SHS), one Technical School, one Polytechnic, two Nursing Training Colleges, one Teacher Training College and one University. Kindergarten Education is a two year preschool programme to be run mainly by communities and private organizations with technical support from the government. Children attend kindergarten to learn to communicate, play and interact with others appropriately (Social Welfare Department, 2003). Teachers at the preschool centres provide various materials and activities to motivate the children to learn the language and vocabulary of reading, mathematics and science as well as that of music, art and social behaviours. For children who previously have spent most of their time at home,

kindergarten may serve the purpose of helping them adjust to being apart from their parents without anxiety. It may be their first opportunity to play and interact with a consistent group of children on regular basis. Kindergarten education is therefore meant to predispose the child to school education.

Sample and Sampling Procedure

The sampling technique used was the lottery method. This technique was used to select the eight preschools out of the 21 private preschools that serve lunch meals in the Cape Coast Metropolis. In the lottery method of sampling, names of all the private preschools in the Metropolis were collected and each name was assigned a number on a slip of paper and folded. The slips of paper were then dropped in a bag and shaken vigorously. A slip of paper was removed from the bag without looking into it. The number on each slip of paper was recorded and used to check the corresponding preschool. Thus, the schools that were picked formed part of the study.

The entire 51 cooks and eight head teachers of the selected schools were used because of their small number. Moreover, they were all used so as to get a broader perspective that could really represent the views and opinions of the cooks as well as the head teachers.

Research Instruments

To obtain data pertinent to the research, questionnaires, observation and laboratory tests of food samples were used. There were two sets of questionnaire, one for the head teachers and the other for the cooks (Appendices A and B). The questionnaire for preschool head teachers consisted of three sections. Section A

dealt with the background information of the school while section B was on meal patterns and funding. The questionnaire for the cooks also consisted of two sections. Section A was on background characteristics of the cooks and Section B was on the nutritional knowledge. Both questionnaires consisted of both open and closed ended questions. The questionnaire for head teachers had open ended questions which involved items 1, 2, 3, 8, 9, 14, and 16. This set of questions required the respondents to respond by stating their opinion. Items 4, 5, 6, 7, 10, 11, 12, 13, and 15 were closed ended questions which required the heads to tick the appropriate response.

Questionnaire for the cooks in the selected schools for the study had items 1, 3, 4, 5, 6, and 7 being open ended. Only item 4 was closed ended. The items were mainly open ended for the cooks because the researcher wanted to solicit the views of the respondents without restriction. Again the open ended questions were used to test the extent of their knowledge on nutrition without giving them any clue. The close ended items were also aimed at ensuring uniformity in the responses. Notwithstanding the lapses of the close ended items in restricting the responses of the respondents, its adoption ensured effective editing and analysis of data.

Item five of the questionnaire sought to find out the extent of nutritional knowledge of the cooks with respect to meals served to the children in the pre-schools.

A total number of 14 items grouped into three sections were used to assess the nutritional knowledge level of the cooks. The first section had questions on

the various food nutrients. In all a total of 15 marks representing 33.3% was assigned to the five questions. The second section sought to assess the functions of the various nutrients. There were five questions and each question carried four marks representing 44.4%. The last section was made up of four questions aimed at assessing the cooks' knowledge about the deficiency of the stated nutrients. This section was awarded two and half marks each which represented 22.3%.

In grading the scores of the performance of the cooks, the Basic Education Assessment grading system was adopted and modified. Scores between 80-100% was rated excellent. The score of 70-79% was considered very good, 60-69% good, while 50-59% was satisfactory, 40-49% fair and marks that were 39 or below were considered as poor (Ministry of Education, Science and Sports, 2007).

The use of the observation guide, as an instrument, offered the researcher a distinct way for collecting the data. According to Denscombe (2007), "observation does not rely on what people say they do or what they say they think, it is more direct than what people say they do or think" (pg. 206). To that effect the use of the observation technique gave the researcher first hand information on what went on at the various schools studied. An observation check list (Appendix C) was formulated by the researcher which took into consideration the important activities that were likely to take place at the schools. For example, cleanliness of the kitchen, service area, plates, spoons and cups were captured in the observation guide. The quality of the food served in terms of colour, texture and taste down to the appearance of the cooks were all included in the study. It was anticipated that respondents supplied true, genuine and reliable responses

devoid of extraneous influence. The observation guide also provided answers to what the heads and cooks failed to provide and also served as a cross check on the true situation of affairs.

Pre-testing of Instruments

The aim of pre-testing was to sharpen and fine tune the instruments by correcting possible weakness, inadequacies and ambiguities as well as check the reliability of the instruments. Cooks from four preschools that were not involved in the study were used from August 17 to August 21, 2009 to pre-test the instruments. The sample size for the pre-testing was 22, comprising 18 cooks and four head teachers. The cooks and head teachers were used because the researcher considered them as having similar characteristics with preschools sampled for the actual study in terms of the nutritional needs of children. The questionnaire was personally administered to the 18 cooks and four heads respectively. Extra sheets were attached to the questionnaire for respondents to comment on identified inaccuracies and inadequacies. Based on their comment, the researcher was able to scrutinize and evaluate unclear, biased and deficient items and came out with those that were simple, self explanatory and free of ambiguity. For example, item 13 of the questionnaire for head teachers which required the head teachers to indicate whether the Parent Teacher Association (PTA) was involved in the planning of the meals or not was originally not part of the items that were given to them to respond to. Item 13 was therefore added as a result of the comments made by the respondents.

The pre-testing was necessary because it enhanced the content validity and reliability of the instrument, and improved question format. The Cronbach alpha coefficient was used to check the reliability, because the items were not scored right or wrong i.e. dichotomously. The reliability coefficient was found to be 0.6 which indicates that the items on the questionnaire were reliable enough for the study.

In order to mitigate the effects of the weaknesses associated with the use of descriptive survey on the study, the questions were pre-tested. Further, respondents were assured of their anonymity and confidentiality of responses that they provided. The assurance enabled them to render their responses candidly and dispassionately. On the whole, the pre-testing helped to fine tune the instrument.

Data Collection Procedure

To be able to collect data relevant to the study, an introductory letter from the Department of Vocational and Technical Education was obtained which were sent to the schools. Permission was also obtained from the heads and proprietors of the selected schools to conduct the study. Data was collected personally by the researcher within the study area. To get the cooperation and support of the respondents, the researcher checked the timetables of the various preschools and fixed suitable time that was convenient to the cooks for the interview.

In each school the researcher explained the purpose of the study to the head teachers and the cooks and assured them of anonymity and confidentiality of their participation in the study. Questions were then administered to the cooks and head teachers. There was time for questions during which respondents had the

opportunity to ask questions that were not clear to them before responding to the questionnaire. The administration of the questionnaires to the cooks and head teachers and collection of food samples was done in early October, 2009. The respondents were also well motivated by the questionnaires administered with an explanation that their contribution would not only help to feed the children well but they themselves stood to benefit (in terms of broadening their nutritional knowledge) from such a research. Respondents were given a week each to answer the questions after which the questionnaires were recovered. Heads and cooks cooperated and answered all questions that were put to them willingly after the purpose of the investigation was explained to them.

Collection, Treatment and Analysis of Food Samples

Food samples were randomly collected from tables within the schools studied. Portions of the lunch served to the children were collected while children were at dining for a period of one week in each of the selected schools as recommended by Shils and Young (1986). The lunch meals collected from the various schools were kept in food containers, allowed to cool and covered with tight fitting lids which prevented spilling. All the small bowls used for the collection of the food were labeled and kept in a basket which was pitted with holes to allow fresh air to circulate around the food. The food was carefully transported in a vehicle to the laboratory. The food collected on daily bases was sent to the laboratory on daily bases for five working days of the week. Weights of both main dishes and accompaniments were recorded. Based on the

consistency of dishes, food samples were dried, blended in a laboratory mortar and pestle before the actual chemical analysis.

In this study the reliability of results that were obtained depended a great deal on the accuracy of the chemical analysis performed on the food samples obtained. It was therefore, necessary to locate and use reputable laboratories that had requisite equipment. The Agriculture Technology Village Laboratory of the University of Cape Coast carried out the chemical food analysis.

Sub-samples of respective food samples were taken for dry matter and ash determination following procedures recommended by Association of Official Analytical Chemists (AOAC, 1990). The method generally used for the determination of moisture in the food samples was the measurement of the loss of weight due to drying at temperature of 105^{o}C. (Stewart, Grimshaw, Parkinson & Quarmby, 1974).

Dry Matter

Crucibles were preheated in an oven at 105^{o}C for 24hours. They were then cooled in a desiccater and weighed and the weights were recorded. Amounts (approximately 1gm) of the samples were transferred into the crucibles and weighed and the exact weights were recorded. The samples in the crucibles were dried in an air circulation oven at 105^{o}C till constant weight (i.e. the samples were weighed at 24hour intervals till the last two weights were about the same). The samples were always cooled in a desiccator before weighing (Stewart et al, 1974).

Calculation:

$$\text{Moisture (\%)} = \frac{\text{loss in weight on drying (g)} \times 100}{\text{Initial sample weight (g)}}$$

$$\text{Dry matter (\%)} = \frac{\text{oven dry weight of sample} \times 100}{\text{Initial sample weight}}$$

Ash Content

The ash content which refers to the residue left after the combustion of the oven dry sample followed immediately after the dry matter determination. After the final weight of the dry matter determination had been taken, the crucible together with its dry sample content was transferred into a muffle furnace at a temperature of 500^{o}C for twelve hours. At the end of the period, the crucibles and their contents were transferred into a desiccator for cooling and finally weighed. (Stewart et al. 1974).

Calculation

$$\text{Ash (\%)} = \frac{\text{ash weight (g)}}{\text{Oven dry weight (g)}} \times 100$$

After sampling for the determination of moisture content and ash, the rest of the fresh food sample were homogenized and dried in an air circulation oven at 50^{o}C for about 7 days. The dry samples were then milled into powdery form to be used for the other proximate analysis. The samples were dried at 50^{o}C in order to preserve the integrity of the samples (Stewart et al., 1974).

Determination of Carbohydrate

Soluble carbohydrate was determined using the anthrone method as outlined by Stewart et al. (1974). In the procedure, 50mg of the ground food sample was gently simmered on a hot plate for two hours. The sample was allowed to cool and filtered. Aliquot (part of the filterate) and standard solutions were taken through colour development and the absorbances of the samples and standards were determined using a spectrophotometer. The concentrations and the absorbances of the standard solutions were used to plot a standard curve from which the concentrations (C) of the samples were extrapolated (Stewart et al, 1974).

$$\text{W/w Carbohydrate (\%)} = \frac{\text{C(mg)} \times \text{extract volume (ml)}}{10 \times \text{aliquot} \times \text{sample wt (g)}}$$

Fibre Determination

The standard crude fibre procedure used was the one described in Association of Official Analytical Chemists (1990) handbook. In the procedure an amount of the milled food sample was weighed and extracted with ether for 6 hours to remove oil. An amount of the residue was then weighed and boiled successively with 1.25% sulphuric acid and 1.25% sodium hydroxide to remove all digestible components. The indigestible components were dried in an oven, weighed and ashed in a furnace. The difference between the oven dry weight and the ash constituted the fibre content.

Protein Determination

The determination of protein employed the kjeldahl method which consists of three main processes namely, digestion, distillation and titration. In the process of digestion a known weight of the milled sample was taken and 4.4ml of the digestion mixture added to it and digested for 2 hours at a temperature of 380^{o}C on a kjeldahl digestion bloc. The digestion mixture was prepared by adding 0.42g selenium powder and 14g lithium sulphate to 350ml hydrogen peroxide and mixed well. The mixture was carefully added to 420ml of conc. sulphuric acid. After the digestion, an aliquot (a part) of the diluted digest was taken for distillation. The distillate was titrated against HCL for the nitrogen content of the sample. The percent nitrogen obtained was multiplied by a factor of 6.25 to obtain the percent protein in the food sample (Stewart et al., 1974).

Determination of Some Mineral Elements

According to Stewart et al. (1974) the sulphuric acid – hydrogen peroxide digestion is suitable for the determination of calcium, potassium, phosphorus, magnesium and sodium. Potassium and sodium were determined using the flame photometer whiles calcium and magnesium were determined with atomic absorption spectrophotometer. Phosphorus was determined using the spectrophotometer.

Calcium and Magnesium

Standard solutions of calcium (0, 5, 10, 15, 20, 25ug/ml) were prepared. The standards and the digested sample solutions were aspirated into the atomic

absorption spectrophotometer in turns and their concentrations recorded. A similar procedure was used for the determination of magnesium.

Calculation

If the concentration obtained for a sample is denoted by C then

$$\text{Ca (\%)} = \frac{\text{C}\mu\text{g/ml} \times \text{solution volume (ml)}}{10^4 \times \text{sample weight (g)}}$$

$$\text{Mg (\%)} = \frac{\text{c}\mu\text{g/ml} \times \text{solution volume (ml)}}{10^4 \times \text{sample weight (g)}}$$

Where solution volume is the final volume to which the digested sample was diluted and the factor 10^4 coverts µg/g to percentage (Stewart et al., 1974).

Sodium and Potassium

Sodium and potassium were analyzed using the flame photometer. In the process standard solutions of sodium and potassium were prepared (0, 5, 10, 15, 20, 25µg/ml). The emissions of the standard solutions as well as those of the sample solutions were determined using the flame photometer as described by Rowel (1994). A standard curve was plotted using the concentrations and the emissions of the standard solutions. The concentrations of the sample solutions were extrapolated from the graph using their emissions.

Calculation

If C is the concentration of the sample extrapolated from the graph then

$$\text{Na (\%)} = \frac{\text{C (µg/ml)} \times \text{solution volume (ml)}}{10^4 \times \text{sample weight (g)}}$$

$$\text{K (\%)} = \frac{\text{C (µg/ml)} \times \text{solution volume (ml)}}{10^4 \times \text{sample weight (g)}}$$

Phosphorus

Phosphorus was determined using the spectrophotometer as described by Rowell (1994). In the process ascorbic acid was used as a colour forming reagent. The phosphorus in solution reacted with the ascorbic acid to produce a bluish colour. The colour intensity was proportional to the concentration of phosphorus in solution. Standard solutions (0, 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 µgP/ml) were prepared and the ascorbic acid reagent was added to them. They produced colour intensity which increased with increasing concentration. Aliquots of the digested sample solutions were taken for colour development with the addition of the ascorbic acid solution. With the colours developed, the absorbances of the standard solutions and the sample solutions were determined using the flame photometer at a wavelength of 882nm. A standard curve was plotted and the concentrations of the sample solutions were extrapolated from the standard curve.

Calculation

$$P\ (\%) = \frac{C\ (mg) \times \text{solution volume(ml)}}{10 \times \text{aliquot (ml)} \times \text{sample weight (g)}}$$

Data Analysis

The data collected in this study was checked, coded and statistically analyzed using the Statistical Package for Social Science (SPSS) version 17.0. For the nutrient components, weights of lunch (dry matter basis) were multiplied by their respective nutrient components to obtain quantities of nutrients supplied. The weights of the respective lunches per week was pooled together and divided by five to obtain the mean daily nutrients served at lunch in the schools studied. The data was presented mainly in tables of frequencies and percentages. Hypothesis formulated was tested using the inferential statistic. Specifically, the independent sample t-test statistics was used to determine whether there were any statistical differences between the World Health Organization's RDI for preschool children.

Further, the researcher employed the descriptive statistical tools such as percentages, frequencies and the mean in the analysis of the data collected. MacMillan (1996) agrees that descriptive study simply describes and provides an understanding of a phenomenon usually with simple descriptive statistics and it is particularly valuable when an area is first investigated.

CHAPTER FOUR

RESULTS AND DISCUSSION

The purpose of the study was to assess the macro nutrients and mineral element contents of lunch meals for preschoolers in some selected preschool in the Cape Coast Metropolis. Two main types of data were collected and analyzed to answer the research questions that guided the study. One set of the data dealt with objectives for feeding the children, the types of meals served, how the meals are funded and the nutritional knowledge of the cooks. The other set of data consisted of the actual samples of the food eaten by the children. The observation guide checklist result was also analyzed accordingly based on the objectives.

One Week Lunch Meal Pattern for the Selected Schools

Analysis of the responses given by the head teachers of the various preschools indicated that they all had similar objectives for providing lunch meals to the preschoolers. Their objectives included providing children with, at least, their minimum energy and nutrient needs; encouraging attendance; preventing short term hunger and preventing children from buying unhygienic food from food vendors most of whom did not observe good food hygiene practices. The head teachers common objectives for feeding the preschoolers concurs Bryant's (1970) submission, which states that the objectives for feeding preschool children

should be to provide meals prepared in a clean and healthy environment and also give special attention to the nutrition of the children.

Table 5: One Week Meal Pattern (Lunch) of the Selected Schools

Meals/Dishes	Monday	Tuesday	Wednesday	Thursday	Friday
Tomato sauce and rice	3	2	1	-	1
Jollof rice with beans	2	-	2	-	1
Palava sauce and boiled yam	-	-	-	2	-
Palava sauce and boiled rice	-	3	-	-	2
Beans and gari	-	1	1	-	-
Beans stew and fried plantain	2	-	1	1	1
Palm soup and rice balls	-	-	-	2	2
Beans stew and rice	1	2	3	-	-
Fish stew and spaghetti	-	-	-	3	-
Palm soup and banku	-	-	-	-	1

The answers to the question on the lunch meal patterns for the selected preschools were listed as indicated in Table 5. An examination of Table 5 indicates that three schools out of the eight schools fed the children with tomato sauce and boiled yam, two schools gave jollof rice with beans. Beans stew and fried plantain was served by two other schools with the remaining school serving beans stew and boiled rice as lunch on Mondays.

On Tuesdays, two schools offered tomato sauce with fish and boiled rice while three schools offered palava sauce and boiled rice. A school served beans and gari with the other two schools serving beans stew and boiled rice respectively. Three schools served beans stew and boiled rice on Wednesdays. Three schools served tomato sauce with rice, beans and gari and beans with fried plantain respectively. The two remaining schools served beans stew and boiled rice.

The data presented in Table 5 also show that on Thursdays two schools offered palava sauce and boiled yam, followed by the three schools serving fish stew and spaghetti. Palm soup with rice balls was served by two schools with the remaining school serving beans and fried plantain. On Fridays, palm soup with banku, palm soup with rice balls, jollof rice with fried fish, 'palava' sauce with rice and beans stew with fried plantain were the dishes served in these preschools studied.

Most of the dishes served to the children belonged to the group of cereals, grains, starchy root and plantain. This may attest to the fact that these groups of foods were readily available, relatively cheaper, easy to prepare and did not need

any special equipment and skill. Again, these food groups were given to the preschoolers because they were considered suitable and appropriate, easy to chew and easily digestible. Furthermore, the preschools selected their choice of food from cereals and grains and starchy roots and plantain since they were the staple foods found within the area of study which is Cape Coast Metropolis. Hence these were most familiar foods that had been introduced to the children by their parents. According to Brigges (1994), most children eat foods which they are familiar with more easily. This assertion again is confirmed by the study conducted by Ndure (1999) on the nutritional needs of preschool children which revealed that a child's food choice preference was largely determined by the family environment and other community or external factors. Thus, the food choices seen in the schools conformed to general assertions made by the researchers.

With regards to the combination of meals, the results revealed that all the preschools within the study area served the type of combinations that were acceptable by the preschool children. For instance, "nkontomire" (cocoyam leaves) stew or 'palava' sauce and boiled yam, tomato sauce and kenkey; palm soup and rice balls as identified by the research, indicated a good balance in terms of food texture and colour. This fulfills contribution made by Eppright (1997) that dried foods are especially hard for preschool children to eat therefore one should ensure a balance of dry foods with one or two moist foods.

A critical examination of the weekly meal pattern provided by the preschools showed that, lunch was the only meal given to the children. This indicated that none of them served breakfast, snack or supper. This could be due to the fact that,

money paid by parents was not sufficient to cater for a full day's meal for the children at school. These notwithstanding, preschools that feed the children are responsible for 50% of the nutrient intake for the period they spend at school (Landers et al., 1994). The rest of the 50% is expected to be met at home during breakfast and supper.

Funding of School Meals

Information gathered from all the eight preschools indicated that all the children were fed; implying that at least none of the children went home without lunch. Further investigation on how the feeding was funded revealed that the feeding was solely funded by parents. The reason being that, no fund was provided by the government to support the feeding of the preschool children. The government's non-involvement, however, contradicts how school feeding was organized years ago as reported by the British Parliamentary Papers. For instance, in England, charitable organizations and private individuals were responsible for the funding of meals for preschoolers.

The cost of feeding per child was GH¢ 1.00 within the schools studied. Probing further to ascertain whether the money paid was adequate, seven out of the eight schools, responded that the money paid was not adequate. The respondents argument was that GH¢ 1.00 was not enough to cater for a well balanced and nutritious meal per lunch. This implied that the schools were aware that the children were not receiving adequate nourishment from the meals served.

The seven schools, whose heads stated that money provided was not enough, explained that they supplemented the feeding with school funds which obviously led to adverse increase in children's school levies. On the other hand, the remaining school explained that they reduced the quantity of the food given to the children. This may imply that, the preschoolers were likely to be underfed, which could consequently defeat the intended purpose of feeding the children. This is in line with the assertion by Brigges (1994) that the dietary patterns of children are largely determined by economic factors. Here economic factors seemed to have affected the quantity or size of the meals because if money paid by parents was not enough to cater for the meals given these children, they were likely to be fed on food that was insufficient in quantity.

Conditions under which Meals were Prepared and Served

A question was asked which sought to find out whether the schools had kitchens and dinning rooms for the preparation and service of the meals. The responses are tabulated in Table 6. Responses from respondents indicated that seven schools prepared their meals in the kitchen while only one school prepared its meals in the courtyard. This stands to reason that, seven out of eight selected schools had kitchens where cooking of food was done. Based on this response, a further question was asked to find out where meals were served.

Table 6: Place for Cooking and Serving Meals

Name of School	Cooking Area		Service Area	
	Kitchen	Courtyard	Classroom	Dinning Hall
Calvary Day Care	√	-	√	-
Calvary School	-	√	√	-
Cherish Int. School	√	-	√	-
Good Samaritan Day Care	√	-	√	-
Morning Star Academy	√	-	√	-
Precious Gift	√	-	√	-
St. Anthony's Nursery	√	-	√	-
Sure Start	√	-	√	-
Total	**7**	**1**	**8**	**0**

The responses given indicated that all the schools served children in their classrooms, indicating that it was therefore evident that none of the schools studied had dinning halls for the children to eat their food. The implication of this finding was that from the time meals were served to the time the children finished eating, no teaching and learning could take place. According to the head teachers, lunch meals were most of the time slowly eaten by the children, since asking the children to eat hurriedly could result in choking and prolonged rate of digestion

which could be detrimental to their health. Again the slow pace of eating by the children almost always delayed the next class because the classrooms were normally littered with pieces of food dropped by the children and therefore needed to be swept. This meant extra time was taken to put the classrooms in order before the next class could begin. Putting the classroom in order could take 10-15 minutes.

Storage Facilities for Perishable and Non Perishable Food Items

According to information gathered from the cooks, it was realized that most of their perishable food items were either stored in the refrigerators or deep freezers. On the other hand the non perishable food items were kept in the store room. According to responses given, the store rooms were chosen over other storage facilities because the non perishable food items are relatively stable and therefore do not easily go bad under such storage conditions. Probing further, it was explained to the researcher that meals prepared were consumed on daily basis and rarely did they have left over food. This implied that they knew the quantity of food to prepare for the children on daily basis.

Sanitation of the Kitchen, Equipment and Drinking Water

Cleanliness of surroundings, equipment and utensils have been observed to be significantly correlated with child nutrition status and morbidity (Zeitlin, 1994). Zeitlin (1994) points to a complex set of connections to which the effects of cleanliness may be attributed. These include organizational and management skills of the caregiver and the sanitary environment on child health. Table 8 depicts the observation made on the premises.

The data presented in Table 7 indicates that almost all the schools prepared and served meals under hygienic conditions. It was realized that, almost all the schools used clean plates, cups and cutlery for serving meals to the children. This helps to prevent cross contamination and infection. This is in line with the statement made by Foskett et al. (2004), that in child care centres, preparation and serving of food should take place only under hygienic conditions and food must be prepared with utensils and surfaces which have been cleaned, rinsed and sanitized prior to its use in order to prevent cross contamination and infection. This was supported by Wardlaw et al. (1994) who were also of the view that sanitized utensils and equipment should be provided for use in Day Care Centres. It was also observed that, all the schools within the study area provided potable drinking water for drinking and for meal preparation. With the exception of Cherish International School and Good Samaritan School who stored their pipe borne water in poly tanks, the rest of the schools stored their water in big buckets with lids. This, the researcher found quite unacceptable since the children used their personal cups in fetching the water from these big buckets. It must be noted that allowing children to fetch water from the buckets with their personal cups could result in cross contamination.

Table 7: Sanitation of the Kitchen, Equipment and Drinking Water

Name of School	Kitchen Equipment		Plates and Cups		Cutlery		Drinking Water	
	Good	Fair	Good	Fair	Good	Fair	Good	Fair
Calvary Day Care	-	√	-	√	-	√	-	√
Calvary School	-	√	-	√	-	√	√	-
Cherish Int. School	-	√	-	√	-	√	√	-
Good Samaritan Day Care	√	-	√	-	-	√	√	-
Morning Star Academy	-	√	-	√	-	√	-	√
Precious Gift	-	√	√	-	-	√	√	-
St. Anthony's Nursery	-	√	-	√	-	√	-	√
Sure Start	-	√	-	√	-	√	√	-
Total	**1**	**7**	**2**	**6**	**0**	**8**	**5**	**3**

This contradicts the suggestions made by Davies (1999) that potable and good drinking water must be provided in Day Care Centres. Water supplies especially drinking water must be kept under strict hygienic conditions. However, in their food preparation area, one common big cup was used in fetching water from the big buckets.

Sanitation Facilities

A critical observation of the sanitation facilities for most of the kitchen staff was found to be inadequate. Some of the schools did not have washrooms and changing rooms for the kitchen staff. This made hygiene and cleanliness of staff handling food in these preschools very unsafe.

Finger nails of the cooks were short and generally clean. However the cooks did not have one common uniform they wore. Any one wore anything they deemed fit. On the contrary cooks are generally expected to wear white uniforms with their aprons and caps. The white clothing helps to detect dirt and stains more easily than any other coloured cloth.

Background Characteristics of Cooks

The cooks in the selected schools were requested to indicate the extent of their educational background. Table 8 presents the educational levels of the cooks.

A study of Table 8 shows that 30 cooks had primary/basic education representing 60% of the entire population of the cooks. 19(35%) had junior high/middle school education. Two respondents had senior high school education, leaving none of the respondents with any form of tertiary education.

Table 8: Educational Background of the Cooks

Level of Education	Frequency	Percent (%)
Primary/Basic	30	60.0
Junior High/Middle School	19	34.9
Secondary	2	5.1
Total	**51**	**100**

The result again shows that at least all of the respondents had basic education which was a prerequisite to handle the feeding of preschool children. The low level of education of the cooks was not so surprising. This was because the schools would not like to employ professional cooks whose salaries they could not afford to pay. Experts in nutrition undisputedly agree that the more a person acquire knowledge, the better the person's lifestyle, including his or her nutritional knowledge (Landers et al. 1994). Thus it would have been good if the cooks had better education since education has proved to improve knowledge in nutrition

The cooks were asked to indicate whether they attended or received any kind of further training in Food and Nutrition. Their responses indicated that none of them attended any training outside their premise. Only one school out of the entire eight schools explained that they occasionally received training from experts. They specified that the head teacher and proprietor of the school was a Home Economist and therefore invited other people in her field of knowledge to educate her cooks every quarter of the year. Some of the topics they treated included conservation of nutrients, using the right equipment for the right activity, avoiding accidents in the kitchen, environmental cleanliness and avoidance of contamination in the kitchen.

It can therefore be deduced that the rest of the schools who did not have any form of training depended on other sources for their nutritional information to improve their knowledge on the feeding of preschool children. These sources of obtaining nutritional information included personal experience, books, radio and television programmes. From the data collected, it was realized that 51% of them solely relied on their personal experience gathered over the years of working in the schools. About 28% and 21% of them also received their nutrition information from radio talk shows and television programmes respectively. For this reason it can be concluded that at least all of the cooks from the various schools in one way or the other received some form of information in the area of Food and Nutrition.

Table 9: Sources of Nutrition Information

Source	Frequency	Percentage (%)
Personal Experience	23	51
Radio Talk Show	16	28
T.V Programme	12	21
Total	**51**	**100**

Table 10: Scores on the Nutritional Knowledge of the Cooks

Percentage scores/remarks	Frequency
80 -100 (Excellent)	0
70 – 79 (V. Good)	0
60 – 69 (Good)	11
50 – 59 (Satisfactory)	9
40 – 49 (Fair)	16
≤ 39 (Poor)	15
Total	**51**

This result represents the findings regarding the nutritional knowledge of the cooks. The findings revealed that none of the respondents had excellent knowledge on nutrition of preschool children, 11 had good knowledge, nine had

satisfactory and 16 had fair knowledge. Seven of the respondents had poor knowledge and the remaining eight had very poor knowledge about some foodstuffs and the nutrients they contain. Functions of some nutrients such as protein, vitamin A and calcium were not adequately known by almost all the respondents. On food sources of some of the nutrients, they were able to state a number of them, indicating a fair knowledge on the food sources. It can therefore be concluded that about 60% of the cooks did not have adequate knowledge in nutrition despite their skills in meal preparation. This could be attributed to the fact that the majority of them had low educational background, confirming the statement made by Wardlaw et al. (1996) that many school food service personnel have not had adequate training in the fundamentals of nutrition and on how to convey information to motivate children to practice sound eating habits.

Characteristics of the Food

With regard to the colour, texture, and taste of the food as presented in Table 11 indicates that they were generally good. Two schools served meals that were good in terms of colour and texture. Three served meals that were satisfactory (fair) regarding texture and colour respectively. Just one school served food with good taste and the remaining schools served meals that could be judged satisfactory in taste.

Table 11: Characteristics of the food

Name of School	Colour		Texture		Taste	
	Good	Fair	Good	Fair	Good	Fair
Calvary Day Care	√	-	-	-	-	-
Calvary School	-	√	√	-	-	√
Cherish Int. School	√	-	√	√	-	√
Good Samaritan School	√	-	√	-	√	-
Morning Star Academy	-	√	-	√	-	√
Precious Gift	√	-	√	-	√	-
St. Anthony's Nursery	-	√	-	√	-	√
Sure Start	√	-	√	-	√	-

Nutrient Values of Lunch Served at the Preschools

Preschool children spend eight hours a day, five days a week in their various educational centres. The food eaten by these children during this long period makes an important contribution to their overall nutritional intake at a stage of their growth that is critical for their physical and mental development. According to Landers et al. (1994) the provision of food for children in the various preschools within the eight hour period should meet at least 50% of the RDI of nutrients. Based on this assertion, the quantities of the various nutrients obtained from the analysis of the meals from the selected schools lunch was used to compare 50% of the RDI (see Appendix D) representing half of the

Recommended Daily Intake for children for the eight hour period spent in school. The 50% recommendation has been stated in all the tables that follow.

Table 12: Nutrient Contents of Lunch Served on Monday

Nut.	RDI (50%)	C.D.	C. S.	C. I.	G. S.	M. S.	P. G.	S. A.	S. S.
Protein	12g	15g	8g	5g	7g	13g	4g	11g	6g
CHO	65g	50g	52g	33g	34g	75g	48g	42g	54g
Fibre	9.5g	1.0g	0.9g	0.5g	1.3g	0.5g	0.3g	0.7g	1.2g
Na	0.6g	0.6g	0.8g	0.9g	0.8g	0.9g	0.9g	1.0g	0.7g
P	250g	86mg	49mg	18mg	67mg	94mg	93mg	76mg	68mg
C	400mg	97mg	92mg	101mg	137mg	70mg	53mg	142mg	84mg
Mg	65mg	17mg	32mg	10mg	32mg	45mg	16mg	21mg	19mg
K	150mg	42mg	91mg	83mg	169mg	54mg	94mg	72mg	87mg

KEY: C.D = Calvary Day Care
C.S = Calvary School
C.I. = Cherish International
G.S. = Good Samaritan
M.S. = Morning Star
P.G. = Precious Gift
S.A. = St. Anthony
S.S. = Sure Start

A close look at the data presented in Table 12 indicates that on Mondays, the quantities of proteins served by Calvary Creche, Morning Star and St. Anthony schools were of acceptable quantities as recommended by Landers et al. (1994).

The lunch served by Good Samaritan and Cherish International Schools on the other hand, did not meet the recommended 50%. As compared to the RDI, the quantities of proteins in the meals served in these two schools were 7 and 5 grams respectively. The result meant that children of the two schools were not able to meet their protein intake on Mondays during lunch.

Incidentally the RDI for carbohydrate, the chief and relatively inexpensive nutrient, was not met by most of the schools studied. With the exception of Morning Star school whose meal had 75g of carbohydrates, 10g above the Recommended Intake of 65g for lunch, all the remaining schools had less quantities of the carbohydrate. This contradicts the assertion made by Martin and Kern (1992), which states that carbohydrates should be the principal source of dietary energy and should supply 40 and 50 percent of the energy consumed by most infants and toddlers. The content of dietary fibre, a complex non digestible carbohydrate, known to prevent coronary heart disease, in all the meals served by all the schools studied was very low. The fibre content which ranged from 0.3g to1.3g was very inadequate as compared to 50% RDI of 9.5g. At this stage of their developmental growth, children need enough fibre in their meals to prevent constipation and other related diseases.

The quantities of all the mineral elements presented in Table 13 for Monday meals point to the fact that with the exception of sodium the children did not receive their normal intake. Good Samaritan was the only school whose meal had a quantity of 169mg above the recommended 150mg of potassium. As noted by Williams (1999), food sources such as dried beans and peas, egg yolk, dark green leafy vegetables and cauliflower could have been added to the children's meal to at least boost their intake of calcium and phosphorus. Children deficient in calcium and phosphorus suffer poor formation of teeth and bones.

Nutrient Contents of Lunch Served on Tuesday

Table 13 indicates that meals served to the children in most of the schools studied contained nutrients that were less than the Recommended Daily Intake. For example, while Good Samaritan, Morning Star and St. Anthony schools managed to meet the stated protein content for their preschoolers as indicated by the figures of 14g, 11g, 13g respectively. Calvary Crèche, Cherish International, Precious Gift, Sure Start and Calvary schools served meals that had 9g, 8g, 8g, 10g and 9g of protein content to the children respectively, leaving the children in protein deficit for that period of time.

Table 13: Nutrient Contents of Lunch Served on Tuesday

Nut.	RDI (50%)	C.D.	C.S.	C. I	G. S.	M. S.	P. G.	S. A.	S. S.
Protein	12g	9g	9g	8g	14g	11g	8g	13g	10g
CHO	65g	33g	53g	46g	29g	37g	54g	65g	48g
Fibre	9.5g	0.2g	0.5g	1.2g	0.3g	0.3g	0.8g	0.6g	0.6g
Na	0.6g	0.3g	0.8g	0.5g	0.4g	0.4g	0.7g	0.9g	0.7g
P	250g	79mg	84mg	58mg	81mg	90mg	72mg	87mg	96mg
C	400mg	74mg	109mg	81mg	69mg	65mg	124mg	142mg	89mg
Mg	65mg	11mg	14mg	20mg	23mg	12mg	32mg	44mg	48mg
K	150mg	41mg	48mg	66mg	37mg	57mg	78mg	92mg	63mg

As indicated by Bonnie and Sue (1996), right quantities of protein intake by children leads to proper maintenance of tissue, appropriate changes in body composition and synthesis of new tissues. In effect, the protein deficit could lead to the reverse of the normal function.

Carbohydrate, also known as protein "sparer" had required content (65g) in the meals served by St. Anthony School only while the rest of the schools served food containing low content of carbohydrate in their meals. This finding is contrary to Pipes and Trahms' (1993) postulation that carbohydrate consumed should supply between 40 and 50% of energy to infants and young children.

The mineral elements, calcium and magnesium contained in the meals served were woefully inadequately served by all the schools studied. This low intake could result in diseases such as osteoporosis and ricket in children since the two mineral elements are needed for strong bones and teeth. Phosphorus and potassium were of no exception to the other micro nutrient in the meals served by all the schools studied. With regard to sodium, five of the school met the requirement while the other three schools presented meals that had low quantities of sodium.

Table 14: Nutrient Contents of Lunch Served on Wednesday

Nut.	RDI (50%)	C. D	C. S.	C. I.	G. S.	M. S.	P. G	S. A.	S. S.
Protein	12g	6g	9g	15g	9g	18g	9g	10g	7g
CHO	65g	34g	42g	46g	29g	60g	54g	34g	48g
Fibre	9.5g	0.4g	1.2g	1.1g	0.4g	0.5g	1.3g	0.4g	0.8g
Na	0.6g	0.8g	0.6g	0.7g	1.0g	0.9g	0.6g	1.1g	0.7g
P	250g	53mg	96mg	70mg	65mg	104mg	102mg	75mg	98mg
C	400mg	62mg	48mg	139mg	80mg	131mg	123mg	81mg	64mg
Mg	65mg	23mg	38mg	30mg	12mg	33mg	14mg	12mg	48mg
K	150mg	79mg	64mg	72mg	57mg	83mg	49mg	62mg	58mg

Protein, one of the essential nutrients, was almost always inadequately catered for by two or more schools out of the eight schools studied. Judging from data in Table 14, it appears that apart from Morning Star and Cherish International Schools who had protein content of 18g and 15g respectively served to the children at lunch, the rest of the schools had protein content that were below the RDI 12g that was expected to be given to the children.

This really answers the assertion made by most people that, protein foods such as meat and fish are expensive. It must be noted that meat and fish are not the only sources of protein for consumption. Beans, melon seeds (agushie), soy beans, eggs, milk and groundnuts are some of the foodstuffs that also supply the

human body with protein which are relatively inexpensive as compared to meat and fish. Consequently, beans, melon seeds, eggs and groundnut could have been used as substitute for meat and fish in most of the schools studied to provide the same amount of nutrient.

It is quite surprising to note that carbohydrate, known to be the chunk of every meal served was consistently low in the meals served in almost all the schools studied. None of the schools met the required grams of carbohydrate in their lunch. The question still remains that how do these children meet their energy requirements if the principal nutrient expected to give energy was inadequately served.

Calcium and magnesium were the two major nutrients contained in the meals that were served below the expected intake of 400mg and 65mg respectively during lunch on Wednesday. It was not so surprising to see low quantities of phosphorus and potassium in the meals served because the rich sources of these nutrients such as eggs, nuts and legumes was a luxury to most of the schools studied. Again the only mineral element that met the required standard was sodium.

Table 15: Nutrient Contents of Lunch Served on Thursday

Nut.	RDI (50%)	C. D	C. S.	C. I.	G. S.	M. S.	P. G.	S. A.	S. S.
Protein	12g	5g	8g	9g	12g	9g	10g	11g	9g
CHO	65g	40g	52g	44g	41g	61g	54g	38g	48g
Fibre	9.5g	0.6g	1.0g	0.8g	0.7g	0.6g	1.2g	1.0g	0.9g
Na	0.6g	0.9g	0.7g	1.0g	0.9g	1.1g	0.8g	0.8g	0.6g
P	250g	69mg	93mg	70mg	94mg	53mg	57mg	77mg	83mg
C	400mg	91mg	98mg	97mg	96mg	122mg	84mg	74mg	92mg
Mg	65mg	12mg	16mg	26mg	27mg	41mg	43mg	41mg	38mg
K	150mg	82mg	47mg	54mg	22mg	89mg	98mg	48mg	62mg

Among the schools studied, Good Samaritan was the only school whose meal contained 12g of protein served to its students on Thursday. However, Precious Gift and Sure Start performed a bit better as their intake was somehow close (10g, 11g) to the 50% RDI of 12g, the normal intake for lunch as identified by Landers et al (1994).

Carbohydrate intake for all the schools was below the required quantities in all the schools, just like the three previous days. With regard to the mineral elements, sodium intake had no problem in all the schools, while phosphorus, calcium, magnesium and potassium intake continued to be below the required intakes. In the case of calcium, none of the schools had even 25%of the required 400g. None of the schools met the fibre requirement.

Table 16: Nutrient Contents of Lunch Served on Fridays

Nut.	RDI (50%)	C.D.	C. S.	C. I.	G. S.	M. S.	P. G.	S. A.	S. S.
Protein	12g	12g	8g	9g	6g	13g	8g	10g	11g
CHO	65g	46g	47g	43g	41g	35g	52g	35g	48g
Fibre	9.5g	0.7g	0.9g	0.8g	0.6g	1.0g	1.2g	0.9g	1.4g
Na	0.6g	1.2g	0.7g	1.0g	0.8g	1.2g	0.9g	0.9g	0.6g
P	250g	87mg	78mg	82mg	77mg	33mg	84mg	61mg	72mg
C	400mg	72mg	48mg	112mg	36mg	104mg	32mg	77mg	6mg
Mg	65mg	18mg	32mg	34mg	9mg	16mg	15mg	13mg	21mg
K	150mg	45mg	99mg	51mg	92mg	97mg	35mg	62mg	82mg

A critical examination of the Friday lunch meal analysis also showed that the situation on the four previous days were not different. Only one school, Morning Star School had a protein value of 13g in the lunch served to the children. Carbohydrate and fibre, as usual, did not meet the RDI standards. The mineral elements were as usual not adequate except sodium. Magnesium content (9mg) consumed by children of Good Samaritan School was extremely low compared with the 65mg RDI.

A summary of the results of the analysis of the nutrient contents of the meals provided for the children for the whole week showed that the nutrient contents in the meals for Friday were not different from the other days of the week. As depicted in Tables 12, 13, 14, 15 and 16, the nutrient sodium was most of the time

served in high quantities by most of the schools studied. This could possibly be attributed to the addition of high quantities of food enhancers such as ‘maggi cube’ which contain mono sodium. Mono sodium is a chemical compound found in food enhancers that contributes to the flavour and taste of a dish. The relatively high quantities of sodium in the meals of the children did not match the assertion made by Hildreth (1985) that the amount of sodium in the body be accurately maintained for good health. In this study the amount of sodium was rather higher than the Recommended Intake. Low quantity of magnesium content was served compared to the 50% Recommended Daily Intake of 65mg in all the schools studied. This contradicts Stearns (1971) report that, correct amount of magnesium in the body work as an activator of many enzymes. This includes the system utilizing ATP, a compound that provides energy in the cells for muscle contraction, nerve impulse and synthesis of vital cell constituent. Magnesium deficit could lead to pronounced personality change, muscle spam, nausea, apathy and decreased tendon reflexes. Dietary fibre was also not served in their right proportion throughout the week. This could be attributed to the fact that most of the foodstuffs used in the preparation of the children’s lunch were mainly refined and therefore lacked fibre. Though there is no evidence to show that children who attend child care centres are at a greater nutritional risk than children who are cared for at home, studies in child care centres have revealed that their intakes at lunch and the two snacks (which were not served in all the schools studied) did not meet the 50% of RDI for some of the nutrients. Approximately all centres failed to provide 50% of RDI.

Statistical Result of Nutrient Contents of Meals Served

The data as presented in Table 17 indicates that the mean value of the protein content served in all the schools was (M=9.10, SD=1.36) whereas the test value was 12, t(7) = -6.05, p = .001(5% level of significance). A comparison of the mean protein value of 9.1 with the World Health Organization (WHO) standard value of 12 indicates that there is a mean difference of -2.9. This shows that the protein content in the lunch meals served to the children fell below the recommended levels as established by WHO.

Table 17: Results on Nutrient Content

Nutrient	N	Mean	Std. Dev.	Mean Diff.	Sig. Value
Protein	8	9.10	1.36	-2.90	.001
CHO	8	45.22	6.47	-19.78	.000
Fibre	8	0.78	0.17	-8.72	.000
P	8	76.05	7.40	-173.95	.000
Na	8	0.80	0.09	0.20	.001
C	8	90.10	11.72	-309.90	.000
Mg	8	25.20	5.57	-39.80	.000
K	8	69.07	5.84	-80.93	.000

Again the use of the t values presents a p value of .001 which falls below the 5% significance level. It can therefore be asserted that there is a significant difference between the World Health Organization's recommended protein level and the level of protein served to the children in the schools. Unfortunately however, the difference falls far below the recommended level. This therefore,

implies that the children in the schools studied may have a protein deficit for that period of time, and if these are not provided in the other meals taken at home, then the children may stand the risk of stunted growth, poor development and health maintenance (Schucler, 1982).

For Carbohydrate, the average mean served for the week was (M = 45.22, SD = 6.47) while the test value was 65, t (7) = -8.65, p =.000 (5% level of significance). Comparing the mean carbohydrate value of 45.21 with the WHO recommended value of 65 shows a mean difference of -19.78. This demonstrates that the carbohydrate content served to the children was again below the recommended intake by WHO. As indicated earlier by Eppright (1997), carbohydrate constitutes the main source of energy for all body functions, particularly brain functions. Therefore, the inadequate levels of carbohydrates served to the children could in effect bring about less energy for all body activities and also hinder the proper functioning of the brain of the children.

Fibre provided for the children during the week in the schools (M = .78, SD = .17) was statistically significant compared with the recommended WHO fibre value of 9.5. The hypothesis at t(7) = 147.83, p = 000 was therefore rejected indicating that the fibre content of the meals provided for the children in the various schools studied was below the WHO fibre value. The low levels of fibre intake could result in other related illness such as colon cancer and constipation.

Judging from Table 17, one can confidently say that with the exception of sodium, all the other mineral elements provided for the children were woefully inadequate compared with the WHO standard. For instance, calcium known to promote strong teeth and bones in children (Davies, 1999; Argon, 2006) had an average mean of (M = 90.10, SD = 11.72) whereas the test value was 400 t(7) =

-74.78, p = .000 (5% level of significance). Weighing the mean calcium value of 90.10 with the WHO standard value of 400 shows a mean difference of -309.90. The mean difference therefore, illustrates that the children were seriously being underfed with the essential mineral elements needed for proper growth.

It can therefore be concluded that with the exception of sodium, the rest of the nutrients provided in the lunch meals for the preschoolers did not meet the 50% recommended intake, therefore measures would have to be put in place to check these inadequacies.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The purpose of the study was to assess the macro nutrients and mineral element contents of lunch meals in selected preschools within the Cape Coast Metropolis of the Central Region of Ghana. This chapter provides summary of the study, conclusions drawn from the findings, recommendations made, and suggestions for future research.

Summary

The purpose of the study was to assess macro nutrients and mineral element contents in lunch meals of some selected preschools in Cape Coast Metropolis. The specific areas covered include:

1. objectives for feeding preschool children
2. funding of school meals
3. conditions under which meals were prepared and served
4. background characteristics and nutritional knowledge of cooks and
5. nutritional value of the lunch meal served at the preschools.

The descriptive survey was used for the study. Simple random sampling technique was used to select eight preschools out of the 21 private preschools that serve lunch meals. All the 51 cooks and eight head teachers were involved in the

study. Two sets of questionnaire were used for data collection (i.e. separate questionnaire for cooks and heads of the preschools). Data were collected in the various schools during school hours. In addition, observations were carried out to cross validate the data collected. Chemical analysis of carefully collected and transported food samples were also carried out using the procedures recommended by Association of Official Analytical Chemist (AOAC, 1990) and Steward et al (1974). The data collected in this study were checked, coded and statistically analyzed using the Statistical Package for Social Science (SPSS) version 17.0. The data was presented mainly in tables of frequencies and percentages. The independent sample t-test statistics was used to determine whether there were any statistical differences between the World Health Organization's Recommended Daily Intake for preschool children and that of the nutrient contents served to the preschool children. For the nutrient components, weights of lunch (dry matter basis) were multiplied by their respective nutrient components to obtain quantities of nutrients supplied.

A summary of the findings are as follows:

1. The school meals in all the selected preschools were mostly cereals, grains and plantain. Dishes such as jollof rice, plain boiled rice, banku and fried plantain with their accompaniments were commonly served among the schools.
2. The moisture content was high in almost all the meals served.
3. The lunch dishes were average in dry matter content.
4. No snacks or fresh fruits were served to the preschool children.

5. Parents were solely responsible for the funding of school meals provided to the children by the various preschools studied.
6. The school meal service charge of (GH¢1.00) was not adequate and there were no subsidies provided by the Government of Ghana, Local District Assemblies or Non-Governmental Organizations. The meals served were therefore inadequate in terms of size.
7. There were kitchens for food preparation but there were no dinning rooms in any of the schools so the children were served in the classrooms.
8. Conditions under which meals were prepared and served were generally hygienic, including articles for service such as plates and cutleries.
9. All the schools provided portable drinking water for both meal preparation and drinking. Six out of the eight schools had big buckets from which children fetched water using their cups. This practice was not acceptable as there could be a possible source of contamination from the different cups.
10. The majority of the cooks (96%) had education up to junior secondary/middle school level but this did not actually reflect on their knowledge in nutrition. Most of them (60%) were not able to answer a good number of nutrition questions put to them.
11. Only one school provided some form of training for the cooks on nutrient needs of preschool children and nutrient conservation.

12. The sources of nutrition information were through radio or television programmes on nutrition, personal experience or from simple nutrition books.
13. With the exception of one or two schools which occasionally met the protein content of the RDA for lunch, the rest of the schools failed to meet the 50% protein content.
14. Carbohydrate content was also generally not adequate.
15. None of the schools met the 50% fibre content.
16. With the exception of sodium that was adequately catered for, the rest of the mineral elements contained in the meals served failed to meet the recommended intake for children.

Conclusions

The conclusions drawn from the findings about the assessment of macro nutrients and mineral elements content in lunch meals of children in some selected preschools in the Cape Coast Metropolis are that

1. The meals of the children were generally cereal based. Fresh fruits and snacks which could have increased the macro nutrients and mineral element contents of the meals were not served as part of their meals.
2. Conditions under which meals were prepared and served were generally clean but meals were served in classrooms.
3. Nutrition knowledge of the cooks was not the best one would have wished for taking into consideration the developmental stage of the children they are catering for.

4. The nutrient contents of meals served did not meet the 50% of the RDI for lunch; this can partly be attributed to the supposedly inadequate funding which did not make it possible to include meat, liver and fish in the lunch meals for the children.

Recommendations

Based on the results obtained, it is recommended that;

1. Protein sources like meat and fish whose cost per unit weight is high could be supplemented with legumes and pulses that are relatively cheaper in order to increase quantity of protein served to the children.
2. Fresh fruit should be served as part of their meals to make their intake balanced.
3. Government should extend the school feeding programme to the preschool level to reduce cost and also relieve parents of solely funding their children's meals.
4. Schools should also employ trained and competent personnel who are equipped with knowledge in nutrition and skills in the preparation of school meals
5. Regular in-service training should be organized by heads of preschools for their cooks to improve their nutritional knowledge on the feeding of the children.
6. Food based recommendations must be developed, promoted and supported through policy initiatives, state licensing and / or national accreditation standards and resources and training for child-care centre staff and parents.

Suggestions for Future Research

1. It will be of interest if researchers could carry out similar research work in other districts and regions of Ghana to find out if similar situations pertain.
2. Chemically analyze the other nutrients such as fats and oils and vitamins which this work did not cover.
3. It is also recommended that further studies should include measurement of weight and height of children in relation to their food intake.

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APPENDICES

APPENDIX A

QUESTIONNAIRE FOR THE PRESCHOOL HEADTEACHERS

Introduction

The aim of this research is to assess the nutrient content of lunch meals served to preschool children in the Cape Coast Metropolis. This study is for educational purposes therefore any information given will be treated strictly confidential.

Instruction

Please read through the following questions and answer all questions as best as you can. Tick [√] where appropriate and supply the needed information where applicable.

A. BACKGROUND INFORMATION

1. What is the name of your school?

   ……

   ……

   ……

2. How old is your school?

   ……

   ……

3. What is the population of your school?

   ……

4. Is the school run by the government [ ] or private [

5. Is the school a boarding [ ] or a day [ ] school

Others, please specify:……...

B. MEAL PATTERNS AND FUNDING

1. Do you feed all the children in your school?

   Yes [ ] No [ ]

   If yes, how many do you feed in a day?

   ……..

   If no, state how the children get their meals

   ……

2. What is/are the main objectives for feeding the children at school?

   [ ] to prevent short time hunger

   [ ] improve their nutrition

   [ ] encourage attendance at school [ ] to increase children's food intake

   [ ] to provide children with at least their minimum energy and nutrient needs

   Others, please specify:……...

3. Who pays for the feeding of the children?.....

4. How much do they pay for the meals?.....

5. Is the money provided adequate for the meals served?

   Yes [ ] No [ ]

If no, how do you cope?.....

6. Who cook for the children?

   Cooks from special training institution [ ]

   Teachers [ ]

   Attendants [ ]

   Some selected parents [ ]

7. Are the children given any assistance during feeding?

   Yes [ ] No [ ]

   If yes, who offers the assistance?

   Attendants [ ] Teacher [ ] Older pupils [ ]

8. Did you include the P.T.A in the meal planning?

   Yes [ ] No [ ]

   If yes, how do you involve them?

   As Organizers [ ]

   As Supervisors [ ]

   Assist in evaluation of the program [ ]

   Others, please specify:……

9. What problem(s) do you encounter when feeding the children?

……

……

10. What means do your cooks acquire nutritional information?

Seminars [ ] in-service training [ ]

Others, please specify:……

11. **WEEKLY MEAL PATTERN FOR THE CHILDREN**

Days	**Breakfast**	**Snack**	**Lunch**	**Others**
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				

APPENDIX B

QUESTIONNIARE FOR THE PRESCHOOL COOKS

Introduction

The aim of this research is to assess the content of meals to preschool children in the Cape Coast Metropolis. This study is for educational purposes therefore any information given will be treated strictly confidential.

Instruction

Please read through the following questions and answer all questions as best as you can. Tick [√] where appropriate and supply the needed information where applicable.

Background Characteristics

A. What is your age?.....

B. What is your educational background?

i. Primary/Basic [ ]

ii. Middle/Junior High School [ ]

iii. Senior High/Vocational/Technical [ ]

iv. Teacher Training College/Nursing [ ]

v. Polytechnic/University [ ]

C. What is your professional qualification?

……

D. Do you attend nutritional programs?

Yes [ ] No [ ]

If yes, how often:……

If no, what other means do you obtain nutritional information?

……

…….

Nutritional Knowledge

1. What are the food sources of the following nutrient? (Give at least three)

Protein foods:…….

Carbohydrates:……...

Fats and Oils:…….

Vitamins:……

Mineral elements:……...

2. What are the functions of the following nutrients to children?

Protein:……...

Carbohydrates:……...

Fats and Oils:…….

Vitamins:……

Mineral elements:…….

3. State one deficiency disease of the following food nutrients.

Carbohydrates:…… Vitamin A:……

Protein:……Calcium:……..

APPENDIX C

OBSERVATION CHECK LIST

1. Cleanliness of the service area

   Very good [ ] Good [ ]

   Satisfactory [ ] Poor [ ]

2. Cleanliness of serving plates spoons and cups

   Very good [ ] Good [ ]

   Satisfactory [ ] Poor [ ]

3. The quality of food served in terms of:

   Colour:……...

   Texture:……..

   Taste:…….

4. Provision of adequate and clean water for drinking

   Very good [ ] Good [ ]

   Satisfactory [ ] Poor [ ]

5. Availability of detergents, napkins, and clean water for washing of hands and cleaning of plates before and after eating.

   Very good [ ] Good [ ]

   Satisfactory [ ] Poor [ ]

6. Where children are served

   Classroom [ ] Kitchen [ ]

   Courtyard [ ] Dinning [ ]

7. The temperature of food

   Hot [ ] Warm [ ] Cold [ ]

8. How children are served

   Group [ ] Individual [ ]

9. Assistance giving to children when eating

   ……

10. Appearance of the servers in terms of:

    Attire:……

    Finger nails:……...

    Hair:……..……

11. Washroom for the cooks

    Yes[ ] No[ ]

APPENDIX D

Recommended Daily Intake and 50% Requirement Values for Lunch Meals

Nutrient	RDI (100%)For the day	RDI (50%)For lunch
Protein	24g	12g
Carbohydrate	130g	65g
Fibre	19g	9.5g
Sodium	1.2g	0.6g
Phosphorus	500mg	250mg
Calcium	800mg	400mg
Magnesium	130mg	65mg
Potassium	300mg	150mg

Source: World Health Organization, 2007