# DIETARY AND PHYSICAL ACTIVITY GUIDELINES FOR GHANA

## MINISTRY OF HEALTH

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# Foreword

# Acronyms

| | |
|---|---|
| BCC | Behaviour Change Communication |
| BMI | Body Mass Index |
| BMR | Basal Metabolic Rate |
| CHD | Coronary Heart Disease |
| CVD | Cardiovascular Disease |
| GDHS | Ghana Demographic Health Survey |
| DHA | Decosahexaenoic Acid |
| DNA | Deoxyribonucleic Acid |
| EPA | Eicosapentaenoic Acid |
| FAO | Food and Agricultural Organization |
| HDL | High Density Lipoprotein |
| IMR | Infant Mortality Rate |
| LDL | Low Density Lipoprotein |
| MOH | Ministry of Health |
| NCDs | Non-communicable Diseases |
| NIH | National Institutes of Health |
| RDAs | Recommended Dietary Allowances |
| RNA | Ribonucleic acid |
| PAL | Physical Activity Level |
| U5MR | Under-five Mortality Rate |
| UNICEF | United Nations Children’s Fund |
| WHA | World Health Assembly |
| WHO | World Health Organization |

# 1. INTRODUCTION

In recognition of the public health importance of physical activity, the 57th World Health Assembly (WHA) endorsed the World Health Organization (WHO) Global Strategy on Diet, Physical Activity and Health in May 2004.(1) The Strategy was developed in response to a request from Member States at World Health Assembly 2002 (Resolution WHA55.23). According to the World Health Report 2002, and the WHO Investing in Chronic Diseases report, mortality, morbidity and disability attributed to the major non-communicable diseases (NCDs) currently account for about 35 million (60%) of the estimated 58 million global deaths and 47% of the global burden of disease.(2, 3) These figures are expected to rise to 73% and 60% respectively, by 2020. It is not often appreciated that the total number of deaths from chronic diseases is double the number of deaths from all infectious diseases (including HIV/AIDS, tuberculosis and malaria), maternal and perinatal conditions, and nutritional deficiencies combined.

Besides the global burden of NCDs, it has to be realized that, developing countries, bear the brunt of the diseases and deaths. Currently, 66% of the deaths from chronic NCDs are estimated to occur in developing countries. The rates are expected to rise due to the rapid changes in our diet and increasing physical inactivity accompanying rapid urbanization. Moreover, people from developing countries are experiencing these chronic NCDs at a younger age than those in the developed world.

The Global Strategy has four main objectives:

1. to reduce the risk factors for NCDs that stem from unhealthy diets and physical inactivity by means of essential public health action and health-promoting and disease preventing measures;
2. to increase the overall awareness and understanding of the influences of diet and physical activity on health and of the positive impact of preventive interventions;
3. to encourage the development, strengthening and implementation of global, regional, national and community policies and action plans to improve diets and increase physical activity that are sustainable, comprehensive, and actively engage all sectors, including civil society, the private sector and the media;
4. to monitor scientific data and key influences on diet and physical activity; to support research in a broad spectrum of relevant areas, including evaluation of interventions; and to strengthen the human resources needed in this domain to enhance and sustain health.

A few major risk factors account for much of the morbidity and mortality from chronic NCDs. The most important risk factors are high blood pressure, high levels of cholesterol in the blood, inadequate intake of fruit and vegetables, overweight or obesity, physical inactivity and tobacco use. Five of these risk factors are closely related to diet and physical activity. In one study among Africans, only 5 risk factors (current/former tobacco smoking, self-reported hypertension and diabetes, abdominal obesity, and lipoprotein ApoB/ApoA-1 ratio) accounted for 89% of the risk for an initial heart attack.(4)

The main message of the guidelines is that intake of nutritionally adequate diet and engagement in adequate physical activity will promote good health, and prevent sickness, in particular, fruits and vegetables should be promoted and that requires behaviour change communication (BCC).

Nutritional needs differ at different stages of life and these are reflected in the Dietary Guidelines. For the newborn, there is no better food than breast milk only for the first six months of life. Older children need adequate amounts of variety of foods to ensure good growth and development. Whilst adults often need to balance maintaining a healthy diet and physical activity in order to prevent weight gain.

In general, children, adolescents and adults need to enjoy a wide variety of nutritious foods and ensure that food is handled well and safe to eat. Nonetheless, children, adolescents, pregnant and lactating women as well as the aged do have some special needs.

## 1. Aims and Objectives

The aim of these guidelines is to provide relevant, practical and scientifically valid information about how to promote and maintain health and wellbeing through healthy, enjoyable eating and physical activity. The objectives are;

1. to have a uniform policy guidelines on diet, physical activity and health
2. to guide the development of learning materials and health and diet education messages for the public and as well teaching

# 2. ENERGY REQUIREMENTS

## 2.1 Introduction

Nutrients are the essential source of energy for the body to function effectively. When foods are broken down, they yield energy to the body. In food, the energy is locked inside three nutrients: Carbohydrate, Fat and Protein. The energy from these nutrients are released from food during digestion, then absorbed into the bloodstream and converted to glucose or blood sugar. The unit of energy that foods provide to the body is known as the calorie.

Foods containing carbohydrate; protein and fat contribute to the total calories in a food product, but to different degrees. Carbohydrate and proteins both contribute 4kcal/g, whereas fat contributes 9kcal/g. Therefore fat contains the highest calories per unit weight. Though alcohol (ethanol) is not considered part of the food system, it contributes to the total energy intake (7kcal/g) and therefore its contribution towards total energy intake cannot be overlooked among persons who regularly consume alcoholic beverages.

## 2.2 Importance of energy and its benefits to human activity and health

The energy obtained from food is used to fuel the body to perform its daily functions. Energy requirements vary from person to person, from one age group to another and also on the type of physical activity one engages in. When energy intake exceeds energy expenditure, the excess is stored in the form of fat for later use resulting in weight gain. All nutrients, including alcohol (a non-nutrient), can be converted to fat and stored in the body.

The body uses energy for the following purposes:

- to keep a resting, awake body alive and functioning properly in a warm and comfortable environment. This is referred to as basal metabolism. This amount of energy is dependent on the lean body mass. This means that the basal metabolism is higher in lean individuals than fat ones
- to move around during the day which includes; walking, working and exercising
- to digest food that are eaten, absorb and further process nutrients;
- to regulate body temperature.

## 2.3 Current situation in Ghana

The energy intakes of vulnerable people in the Ghanaian society is usually influenced by factors such as lack of food availability or food insecurity, inequality of distribution within the family, and the use of low energy dense traditional foods. This is particularly true for pregnant and lactating women and children who have already relatively high needs for energy.

Traditional Ghanaian foods tend to be lower energy dense than those eaten in the high income countries because of the following: a high water content; a low fat content; and being largely cereal and vegetable based, and therefore have relatively high dietary fibre content. However, with changes in the dietary patterns of Ghanaians towards a more westernized diet, the average energy intake is increasing.

It has also been observed that the caloric intake increases with income. This means that the affluent in society are consuming more than the required daily energy intake and are more likely to suffer from weight gain.

### 2.4 Effect on the general health of the population

The right amount of energy is required daily for optimal health. This is determined by the energy balance. This balance depends not only on how much energy is consumed in foods, but also how much of it is expended. An individual is in energy balance when energy intake equals energy output. When energy intake is greater than the output, a positive energy balance occurs which would result in weight gain, especially in non pregnant, non-lactating adults. This increases the risk of obesity, diabetes, hypertension, heart attacks, stroke, some cancers and mortality in adults. The only situation where a positive energy balance is necessary is during pregnancy and lactation, where increased energy is needed to support the developing foetus as well as the production of milk to feed the baby. Infants and children also need a positive energy balance to grow.

A negative energy balance results when energy consumed is less than energy expended which leads to weight loss. Chronic negative energy balance in the individual leads to wasting (too thin-for-height), failure to thrive and makes one more susceptible to infections. The wasted person has little or no fat stores, muscle mass and poor strength. If unchecked the outcome is death.

***Table 1*** **Estimated calorie requirement (in Kilocalories) for each gender and age group at three levels of physical activity**

| | | Activity Level | | |
|---|---|---|---|---|
| **Gender** | **Age (years)** | **Sedentary[a]** | **Moderately Active[b]** | **Active[c]** |
| **Child** | 2–3 | 1,000 | 1,000–1,400 | 1,000–1,400 |
| **Female** | 4–8 | 1,200 | 1,400–1,600 | 1,400–1,800 |
| | 9–13 | 1,600 | 1,600–2,000 | 1,800–2,200 |
| | 14–18 | 1,800 | 2,000 | 2,400 |
| | 19–30 | 2,000 | 2,000–2,200 | 2,400 |
| | 31–50 | 1,800 | 2,000 | 2,200 |
| | 51+ | 1,600 | 1,800 | 2,000–2,200 |
| **Male** | 4–8 | 1,400 | 1,400–1,600 | 1,600–2,000 |
| | 9–13 | 1,800 | 1,800–2,200 | 2,000–2,600 |
| | 14–18 | 2,200 | 2,400–2,800 | 2,800–3,200 |
| | 19–30 | 2,400 | 2,600–2,800 | 3,000 |
| | 31–50 | 2,200 | 2,400–2,600 | 2,800–3,000 |
| | 51+ | 2,000 | 2,200–2,400 | 2,400–2,800 |

Source: USDA Dietary Guidelines for Americans, 2005

a. **Sedentary** means a lifestyle that includes only the light physical activity associated with typical day-to-day life.
b. **Moderately active** means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to miles per hour, in addition to the light physical activity associated with typical day-to-day life.
c. **Active** means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.

Example of an 1800kcal diet for a healthy sedentary male between the ages of 9-13

Carbohydrate (CHO) content of approx 270gms

Morning meal: 80gms CHO
Akasa 6 soup laddlefuls
Plus 2 sardine tin sizes whole wheat bread
Plus 2 dessertspoonfuls evaporated milk
Plus 1 stewing spoon of cut vegetables

Mid-morning snack: 10gms CHO
1 medium orange

Afternoon meal: 80gms CHO
Yam 2 sardine tin sizes or 4 thin slice
Plus 2 stewing spoonfuls kontomire stew
Plus 1medium whole fish or ½ palm size fish

Mid-afternoon snack: 19gms CHO
1 sardine tin size pineapple or 1 cup diced pineapple

Evening meal: 80gms CHO
Rice 5 stewing spoons
Plus 2 stewing spoons garden egg stew
Plus 2 small match box size meat

**2.5 Recommendations for energy intake**

Recommendation for dietary energy intake from food must satisfy the requirements for attainment and maintenance of optimal health, physiological function and well-being (which depends on health plus ability to satisfy demands imposed by society and the environment as well as all the other energy-demanding activities that fulfil individual needs).

1. Choose foods with the right amounts of energy and nutrients (i.e. high nutrient-dense food such as vegetable and fruits). Details will be discussed in the section on food guides
2. Increase physical activity by exercising regularly
3. Limit snacking between meal and avoid overeating
4. Do not skip meals as hunger would increase intake of food at the next meal

**Energy Needs by Population Groups**

**Infants and Children of all ages and adolescents (0 - 19)**
Infants, children and adolescent need more energy per kilogram body weight for growth, development and physical activity.

**Adults (20 – 59)**
Physical growth is no longer a factor in adulthood, and basal metabolic rate (BMR) is relatively constant among population groups of a given age and gender. Habitual activity and body weight are the main determinants of energy requirements.

**Older adults and the Elderly (60 +)**
There is decline in BMR with age and habitual activity, therefore, the aged do not need too much energy.

**Pregnancy**
Dietary intake must provide the energy that will ensure the full-term delivery of a healthy baby of adequate size and appropriate body composition by a woman whose weight and body composition and Physical Activity Level (PAL) are consistent with long-term good health and well-being.

**Lactation**
The energy requirement of a lactating woman is defined as the level of energy intake from food that will balance the energy expenditure needed to maintain a body weight and body composition, a level of physical activity and breast milk production that are consistent with good health for the woman and child, that will allow economically necessary and socially desirable activities to be performed.

Macronutrients in diets provide the bulk of energy requirements for the body. The next section focuses on macronutrients.

# 3. MACRONUTRIENTS

Nutrients are those elements from food and drink that perform a sustaining or metabolic function when taken into the body. Our bodies need nutrients in order to grow, develop and function properly.

A nutritionally adequate diet (originally referred to as balanced diet) is a diet that provides all essential nutrients in their right proportions.

Macronutrients are nutrients the body needs in large amounts and these consist of proteins, carbohydrates and fats.

## 3.1 Carbohydrate

3.1.1 Introduction

Carbohydrates are one of three basic macronutrients needed to sustain life (the other two are proteins and fats).. They play an important role in metabolism as the body's main source of energy.

There are two basic types of carbohydrates; simple and complex carbohydrates. The simpler forms are sugars of various types found in fruits and milk as well as table sugar, and the more complex forms are starches and dietary fiber which is a component of plant-based foods and occurs in the cell walls and the outer coverings of leaves, seeds and fruits.

Carbohydrates can be polished(refined) or unpolished.

Examples of unpolished carbohydrates are,

a. Whole meal cereals and their products such as corn, *ga* or *fanti kenkey*, brown rice, millet, *fula*, sorghum
b. Tubers and their products such as yam, cassava, *gari*, cocoyam, water yam and potatoes
c. Starchy fruit such as plantain

Examples of polished carbohydrates are: polished white rice, polished breakfast cereals such as *oblayoo*, *ekuegbemin*, and white flour, white *kenkey* (*nsiho*), *abodoo*, osino *kenkey*

Examples of refined starches are custard powder and tapioca

### 3.1.2 Importance and benefits of Carbohydrates

Carbohydrates are metabolized in several stages by the digestive system and the liver and converted into a simple sugar called glucose. Some glucose remains stored in the liver and muscles as glycogen, ready for release into the bloodstream if blood glucose levels fall too low. The remainder of the glucose goes right into the bloodstream and is used directly by all the cells in the body for energy. It is key to note that, glucose is the preferred energy source for the brain and central nervous system as well as the placenta and fetus during pregnancy.

Sugars can enter the bloodstream rapidly, providing a quick burst of energy. Starches, by contrast take longer to convert to usable energy, as a result, energy is released over a longer period of time

Besides providing energy directly, carbohydrates play an important role in the metabolism of fat stores. To utilize fat stores efficiently the body needs at least some dietary carbohydrates. Carbohydrate-containing foods are also vehicles for important micronutrients and phytochemicals which are non-nutritive plant chemicals (e.g. flavanoids in fruits) that have protective or disease preventive properties.

Dietary fibre[1] is important for gastrointestinal health and function and it also beneficial for decreasing the risk of coronary heart disease. Consumption of dietary fibre also helps one to feel full for longer periods, thus, preventing eating in-between meals and thus reduces the risk of obesity thus reducing the occurrence of certain diseases such as diabetes.

### 3.1.3 Current situation in Ghana

There is a dearth of information on the eating habits of Ghanaians. The available studies, however, show that there is a gradual shift from eating local dishes with abundant unrefined carbohydrate and high fibre foods to highly-refined foods such as polished white rice. Additionally, the consumption of sugar based drinks has increased. This all adds up to make a high consumption of carbohydrates in Ghana.

### 3.1.4 Effects on the health

Carbohydrates are important for maintenance of health and prevention of diseases as described in previous sections, however if consumed in large amounts, intake of fat, protein and some micronutrients will be compromised. High consumption of carbohydrate in the absence of regular exercise leads to excess energy intake resulting in overweight and obesity. There is a concern that obesity is on the increase in Ghana. In a study conducted in seven African countries comprising Nigeria, Congo Brazzaville, Liberia, Senegal, Sierra Leone, Niger and Ghana, Ghana was cited as leading in the obesity league. The Ghana study was conducted among a sample of 5000 adults aged (16 years and above). The results points to obesity as more of an urban than rural problem. The prevalence was highest in Greater Accra, 16.1% whereas in Upper East and West Region it was almost non-existent. The prevalence of obesity was found to be 5.5% the prevalence is higher among females 7.4% compared to males 2.8%. It was more common among the married than unmarried. Obesity was highest among the employed compared to self-employed or the not working for pay. By ethnicity, obesity was highest among Ga Adangbes, Ewes and Akans 14.6%, 6.6% and 6.0% respectively (5). In a recent study among 1015 civil servants, the prevalence of obesity was found to be 10% in men and 36% in women (6). According to the GDHS 2008 the proportion of overweight or obese women is 30%, with 9% of women considered to be obese (BMI≥30.0) (7).

Obesity is excessive body fat which further impairs the health of the individual. It is a major risk factor linked to type 2 diabetes, hypertension, stroke and other heart diseases sleep disorders, gall bladder diseases, and certain cancer and ultimately death.

[1] Dietary fibre not digested but remains in the intestines where it forms part of the faeces and helps the faecal matter to retain water, increasing the faecal volume and moving it normally through the bowels. This helps in the removal of toxic waste through the colon in shorter time, i.e. it makes you have regular bowels.

### 3.1.5 Recommendations for Carbohydrate Intake

Like all other types of macronutrients, carbohydrates should be taken in moderation. About 50% of total energy intake should be provided by a variety of carbohydrate sources to protect against chronic diseases (leaving about 15% for fat and 30% for protein) Carbohydrates consumption should be containing polished, non-polished, soluble and insoluble food items. Children and adults need a minimum of 130 grams of carbohydrates for proper brain function. Eating foods containing more carbohydrate than one requires could result in weight gain, obesity and could further lead to diabetes mellitus and heart disease.

A good daily carbohydrate diet would require you to eat foods containing whole grains. Whole grains can be found in whole cereals, oats, millet and their products (e.g. brown bread, Ga/Fanti kenkey, banku, koko, etc). Beans are also an excellent source of slowly digested carbohydrates as well as a great source of protein.

Diets in which unrefined / unpolished carbohydrates foods are the primary source of energy as well as fibre should be encouraged. Examples of rich sources of fibre are okro, garden eggs, carrots, dried beans and peas, leafy vegetables, cereals such as oat bran, corn bran, and fruits such as oranges, pineapple and apples, nuts and seeds. Consumption of fibre (at least 25g daily for adults - 5 servings of fruit and vegetables and 6 servings of grain products of which at least 3 should be whole grains) contributes to the prevention of constipation, diverticular diseases, colon cancer, breast cancer, excess cholesterol and diabetes. It also helps to clear LDL-cholesterol. Dietary fibre promotes optimal pH in the intestines to prevent microbes from producing cancerous substances and thereby preventing colon cancer.

## 3.2. Protein

### 3.2.1 Introduction

Proteins are made up of long chains of 20 different amino acids; chemicals that are the building blocks of the body. The body can make 12 of the amino acids out of others, but there are 8 of them it cannot make. Those the body can make are called non essential amino acids while the 8 it cannot make are called essential amino acids. The essential amino acids must be present in the protein consumed. They are essential requirements for human body's growth and development.

The body assembles the forms of protein it needs by chemically linking amino acids in a specific order. For this to occur, however, all the amino acids must be available at the same time, since one must keep supplying the nine essential amino acids through one's food choices including them in one's diet at least twice a day.

Proteins are essential for the growth and repair of body tissues. The body uses proteins in muscle, hemoglobin, hair, teeth, nails, bones and many other important components.

Special proteins known as nucleic acids are found in ribonucleic acid (RNA) and deoxyribonucleic (DNA) is to transmit hereditary characteristics.

Another type of proteins, known as enzymes – play an important role in chemical reactions that build up and break down cellular material in the body. Each human cell contains several thousand kinds of enzymes.

The sources of protein are;

i. Animal proteins e.g. meats of all kinds, poultry, eggs, milk, cheese, yoghurt, snails, fish and sea-food.
ii. Plant proteins e.g. beans (soya, bambara, cow pea), melon seeds (*agushie*), groundnuts.

Animal protein is the only source that contains all the essential amino acids required by human body. Single plant source proteins are deficient in some amino acids but in combination with other plant sources all the essential amino acids may be provided in a meal. Thus, when eating the plant-based diet one should use mixed plant proteins in order to get the recommended daily amount especially all the essential amino acids.

### 3.2.2 Importance and benefits of proteins

Protein is essential to human health. It is an important component of the cells and tissues of the body and they make up the greater portion of the substance of the muscles and organs (apart from water). Hair and nails are mostly made of protein. Special proteins known as nucleic acids found in ribonucleic acid (RNA) and deoxyribonucleic acid (DNA) transmit hereditary characteristics. Another type of proteins, known as enzymes – play an important role in chemical reactions that build up and break down cellular material in the body. Each human cell contains several thousand kinds of enzymes.

Proteins are necessary for the following:

- Growth and development of the body
- Maintenance and the repair and replacement of worn out damaged tissues
- Production of metablic and digestive enzymes
- An essential constituent of certain hormones, such as insulin

Proteins can provide energy to the body, however their main importance is as an essential constituent of all cells. Only about10 percent (animal based diet) of total calories consumed by the average human being needs to be protein.

### 3.2.3 Current situation in Ghana

Animal protein is very expensive in Ghana, so the amount of protein consumed by the average person is relatively small compared to other countries. Plant protein is relatively cheaper than animal protein. However, many people do not know how to mix the various types of plant proteins to get the required amount necessary for the individuals. In general, the consumption of protein is lower in rural areas compared to the urban areas. Notwithstanding, in both urban and rural areas certain, Ghanaian men eat more protein than their women counterparts.

### 3.2.4 What is the effect on the general health of the population?

Deficiency of protein is a serious problem in developing countries including Ghana. It leads to kwashiorkor in young children (under five years) who do not have enough protein added to their diet. Children whose diet is deficient in protein show an array of symptoms that include: retarded growth, loss of and changes in hair colour, slow healing of wounds, poor digestibility, anaemia,

oedema (draining of fluid from blood into the tissues), liver damage and poor immunity. The pregnant woman who does not consume adequate amounts of protein will develop anaemia which can affect her and the unborn baby. The baby can be born prematurely or underweight and may be stunted early in life.

It is vital to consume adequate amount of proteins every day. Even minor protein deficiencies will eventually cause fatigue and irritability and reduces the body's production of antibodies resulting in greater susceptibility to infection and slower recovery from disease. Wounds and burns will heal more slowly as well. A continued protein deficiency may lead eventually to anaemia and liver diseases.

It is desirable not to eat too much protein. If necessary the body can convert protein to glucose, a fuel vital energy but excess proteins usually are converted to substances known as fatty acids which are then stored in fat tissues.

### 3.2.5 Recommendations for Protein Intake

It is recommended to exclusively breastfeed babies from birth to six month of age, followed by timely introduction of appropriate and nutritionally adequate complementary foods.

Breast milk provides the protein babies need to be healthy and strong for the first six months. Young children should be provided with adequate amounts of protein in their diets to prevent iron deficiency anaemia. Adults should take adequate amounts necessary to repair worn out tissues. Pregnant women should have enough protein in their diet to prevent anaemia, premature delivery, bleeding during child birth and low birth babies.

People who cannot afford the animal proteins should be taught how to mix plant proteins to get a mix of amino acids as they will get from animal proteins.

Individuals can supplement their protein intake from animals, (goats/sheep/rabbit), snail and legumes reared and grown from their own back yard.

**How much protein to eat daily**

One quick way to get a rough estimate of ones protein need is to divide ones weight in pound by three. Thus, if one weighs 150 pounds, dividing by three the approximate daily protein needed is 50 grams.

This is roughly the amount of protein found in 2 to 3 ounces servings of lean cooked meat, poultry or fish.

The recommended dietary daily allowance for both adult men and women is 0.8 gram of protein/kilogram (2.2 lbs) of body weight. People with special needs like children, pregnant and lactating women would need a slightly higher intake. (See table 2).

***Table 2.*** **Recommended Dietary Allowances (RDAs) for protein at a variety of age categories**

| **Category of Persons** | Age group | Daily allowance |
|---|---|---|
| **Infants** | Up to 5 months<br>5 months–1 year | 13 grams<br>14 grams |
| **Children** | 1–3 years<br>4–6 years<br>7–10 years | 16 grams<br>24 grams<br>28 grams |
| **Males** | 11–14 years<br>15–18 years<br>19–24 years<br>25+ years | 45 grams<br>59 grams<br>58 grams<br>63 grams |
| **Females** | 11–14 years<br>15–18 years<br>19–24 years<br>25+ years | 46 grams<br>44 grams<br>46 grams<br>50 grams |
| **Pregnant** | | 60 grams |
| **Lactating** | first 6 months<br>second 6 months | 65 grams<br>62 grams |
| **However, this chart does not take into account your size—and larger people tend to have greater protein requirements. The following calculation is a more popular method for calculating daily protein amongst most health professionals:*<br>*Your weight in pounds multiplied by 0.36 to 0.50 = Daily protein requirement (in grams)*<br>**Avid exercisers and athletes require even more. Check out Food Before, During, and After Exercise for more information.* | | |

**Source: Your Personal Protein Requirements - Family Education.com**

## 3.3 **Fats**

### 3.3.1 Introduction

Lipids are the chemical group name for organic substances of a fatty nature, which are not soluble in water. Lipids that are solid at room temperature are known as fats and those that are liquid at room temperature are called oils.

Fat is a macronutrient with the highest energy value of 9.0 kcals per unit weight. This is 2.25 times that of carbohydrates and proteins. Fats are the storage form of concentrated fuel in the body. They are the chemical form in which most of the energy reserve of animals and some seeds are stored.

Dietary fat is found in foods derived from both plants and animals. It is divided into saturated, unsaturated (mono- and poly-unsaturated), trans-fats and cholesterol. Saturated fats are heavier, denser and usually solid at room temperature. They are mostly of animal origin, e.g. fat in dairy products (milk, cream, ice-cream, butter and cheese), in red meat (veal, beef, pork, lamb), in poultry, eggs, and in some plants such as palm, palm kernel and coconut oils.

Unsaturated fats are less heavy and tend to be liquid, oils. The monounsaturated fat is oleic acid which is found in olive, canola and groundnut oils. The most common polyunsaturated fatty acid is linoleic acid. This is also known as an omega-6 fatty acid and occurs in seed oils such as sunflower oil, safflower oil and corn oil. Another type of polyunsaturated fatty acid is omega-3 fatty acids present in smaller quantities in dark leafy vegetables, canola oil and flaxseed oil, Eicosapentaenoic acid EPA and Decosahexaenoic acid DHA both found predominantly in fish oils.

**Trans-fats**

Trans fats occur in natural products such as meat and dairy foods. They are also formed during some manufacturing processes, such as when edible oils are hydrogenated to make hard margarines used for making crispy cookies, pie crust flaky and vegetable oils to be spreadable. The process of hydrogenation makes polyunsaturated fatty acids lose their health benefits and acts like saturated fats.

**Dietary cholesterol**

Technically, this is not a fat, but from a different chemical group of lipids called sterols. Cholesterol is vital in human metabolism. It is part of the cell membrane of all cells, part of the myelin in the brain and nervous system, and the starting material for synthesis of bile acids and sex hormones in the body. It is present in all animal tissue particularly egg yolk, organ meat such as liver and kidneys and meat. Cholesterol does not occur in plant foods.

The body does not need cholesterol from outside, so there is no biological requirement for it. Eating cholesterol does not necessarily increase cholesterol in human blood plasma because when it is absorbed the body tends to reduce its own endogenous cholesterol synthesis. Cholesterol can, however, accumulate in blood and in the inner walls of arteries, leading to the occurrence of coronary heart diseases.

**Plant sterols**

These are also known as phytosterols. Plant sterols are chemically very similar to cholesterol but with a small difference in their chemical structure. They occur in oils from plants sources- for example, in nuts and seeds, although they may be taken out by the refining process. When eaten, plant sterols interfere competitively with absorption of cholesterol from the intestine.

**Composition of some common edible Fats in Ghana**

Most of the common edible fats and oils in the Ghanaian market are very high in saturated fatty acid content, with the exception of groundnut oil (Table 3). Coconut oil is very high in saturated fats, (about 90%) followed by palm kernel oil, 83%. The predominant monounsaturated and polyunsaturated fatty acids in all these oils are oleic and linoleic acid, respectively. Shea butter has been found to have a fat composition similar to cocoa butter, and is used as a substitute for lard or margarine in diets because it makes a highly, pliable dough. Soyabean (soybean) oil, which is also readily available on the Ghanaian market, is a rich in the unsaturated fatty acids, especially polyunsaturated fatty acids (59%).

***Table 3*. Fatty acid composition of some common Ghanaian edible Fats**

| Fat or Oil | Saturated (%) | Monounsaturated (%) | Polyunsaturated (%) |
|---|---|---|---|
| Coconut oil | 90 | 8 | 2 |
| Palm oil | 50 | 40 | 10 |
| Palm kernel oil | 83 | 15 | 2 |
| Groundnut oil | 20 | 48 | 32 |
| Shea nut | 47 | 46 | 7 |
| Soyabean oil | 14 | 27 | 59 |

*Adapted from: Gurr, M.I. (1992) Role of fats in food and nutrition. Second Edition, Elsevier Applied Science.*

### 3.3.2 Importance and Benefits of Fats

Fats are essential for life. Some fats are produced by the body while some must be eaten as part of our diet. Dietary fats (oils) provide energy and are a source of other necessary fatty acids not produced by the body which are important in the synthesis of many cells structures and several biologically important compounds. As a source of energy it yields about 9 kcal/g which is more than twice the energy yielded by carbohydrates and proteins (about 4 4 kcal/g). Fats aid absorption of fat-soluble vitamins A, D, E, and K and carotenoids. They are stored in the adipose tissue which supports and protects vital organs, regulates body heat, and found in myelin sheaths of nerves (relay nerve impulse) and regulates the cell membrane transport. Fat is also desirable to make food more palatable.

### 3.3.2. Current Situation in Ghana

Traditional foods eaten by Ghanaians invariably had low fat content, mainly because fat and high fat-containing foods are much more expensive than high carbohydrate-containing ones. That is Fats were mostly from plant based sources rather than animal source foods.

Currently, overweight and obesity which were considered problems only in high income countries are now increasing in Ghana, particularly in urban towns and cities. A major contributor to this alarming trend is the changing dietary patterns. This includes the increasing consumption of westernized diets, high in fats as well as sugars and salt.

Diabetes rates in Ghana are also increasing. The common form of diabetes is type 2, or non–insulin dependent, diabetes mellitus. Overweight and obesity are the strongest diet-related risk factors for type 2 diabetes. Since dietary (total) fat is energy dense and high fat intakes can be associated with overweight and obesity, the policy of moderation in fat intake aims to reduce the incidence of diabetes as well as obesity. There is evidence that high-fat diets increase insulin resistance. The risk of diabetes is positively related to saturated trans-fat intakes and negatively related to polyunsaturated fat intake. Also, there is some evidence suggesting that total fat intake is associated with certain cancers.

### 3.3.3 Effects on Health

The body requires fats for essential functions and therefore some fat needs to be consumed. However the different types of fats consumed may have varied health effects. When saturated fats predominate in the diet, they tend to raise plasma cholesterol especially Low density lipoprotein (LDL) cholesterol which is major risk factor for coronary heart disease CHD. On the contrary the

replacing saturated dietary fats which are mostly monounsaturated has been associated with a decrease in LDL cholesterol levels. However, monosaturated fatty acids do not lower cholesterol levels as much as polyunsaturated fatty acids. Oils rich in polyunsaturated fatty acids specifically the omega-6 fatty acid linoleic acid, and the omega-3 fatty acids has been consistently shown to lower plasma total and LDL cholesterol. In addition, fish oils have a greater lowering effect on plasma triglycerides and have been found to be protective against coronary heart disease (CHD). On the other hand, Trans-fatty acids have a cholesterol-raising effect and therefore associated with coronary heart disease.

### 3.3.4 Recommendations for Fat

The recommended total fat intake is not more than 10 – 15 % of the total caloric requirements for adults with most of the fats coming from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts, and vegetable oils. For children 2-3 years, the recommended fat intake is 30 – 35% and 25 – 35% for children and adolescents 4-18 years of age respectively. Diseased individuals should stick to 15 – 25 % to provide the needed fatty acids.

Less than 10% of total calories should come from saturated fatty acids with trans-fatty acid consumption being kept as low as possible. Total daily cholesterol intakes should be less than 300 mg/day of cholesterol.

**Recommendations for reducing dietary fat/oil intake**

A number of practices can be incorporated in everyday life to optimize the fat profile of the diet.

1. Some saturated fats/oils such as palm oil, coconut oil, shea butter, should be used in moderation
2. Choose predominantly unsaturated vegetable oils such as sunflower, canola, corn, soya, olive and flaxseed rather than animal fats, or hydrogenated vegetable oils.
3. Include fish high in poly unsaturated fatty acids, for example, sardines, tuna, salmon and herring in your diet.
4. Select fat-free, low or reduced fat milks instead of full-cream milk.
5. Choose low-fat yoghurts instead of full-cream yoghurt.
6. Buy lean cuts of meat and trim away the obvious fat before cooking or eating. Discard the skin of cooked chicken.
7. Limit consumption of high fat meat products such as sausages, bacon and processed meats.

In addition,

1. Discard fat drippings from cooked meat. Another way of reducing saturated fat is to replace some of the meat with plant-based protein-rich foods such as legumes and nuts.
2. Limit consumption of biscuits and pastry products, which are high in saturated fat.
3. Limit consumption of high fat fast foods, street foods and away from home foods.
4. Bake or grill foods instead of frying.
5. Skim or remove excess oil from soups and stews.

***Table 4*** **Recommended Proportion of Macronutrient in Diet**

| **NUTRIENT** | **CONTRIBUTION TO DIET** |
|---|---|
| CARBOHYDRATES<br>• Unrefined starchy foods<br>• Vegetables and fruits | <br>30 - 50 %<br>10 – 15% |
| FAT | 10 – 15% |
| PROTEIN<br>• If Animal-based diet<br>• If Plant-based diet | <br>5 - 10 %<br>20 – 30% |

**Source: Adapted from MOH, 2008 Regenerative Health and Nutrition : Healthy Lifestyle Training Manual**

# 4. MICRONUTRIENTS

Micronutrients are vitamins, minerals, antioxidants, and phytochemicals. As a group, they are called micronutrients because, in comparison with protein, carbohydrates, fats, and water, they are needed by the body in relatively small amounts.

All micronutrients are needed to some degree in the body to perform various functions for the physical and physiological well-being of the body. It is therefore important to consume foods rich in vitamins and minerals in order to prevent a deficiency state. Micronutrients are needed in the body to aid in the release of the energy from carbohydrates and fats, or transform the protein into the lean body mass.

Not everyone is equally vulnerable and need the same amount of micronutrients. Infants, pregnant women, lactating mothers and the sick may require a higher level of micronutrients to meet growth and other physiological changes taking place in the body. The requirements differ on the basis of body size, rate of growth, and special physiological situations (pregnancy, lactation and certain acute and chronic diseases). Hence men and women of different ages have distinct requirements.

Vitamins and minerals, and their importance in disease prevention, were discovered in the early years of this century. Much recognition is now being given to antioxidants and phytochemicals because of the role they are known to play in fighting against cancer and in the nutritional management of HIV and other chronic diseases. No further discussion will be made on the antioxidant and phytochemicals as they are still being studied.

### 4.1 Vitamins

Vitamins are substances found in food; they are needed in only small quantities but are essential for growth and development and triggering vital body functions. Vitamins are not made in the body and so must be obtained through the diet. Hence, we need a daily supply from our daily meals

Vitamins can either be fat soluble or water soluble. Fat soluble vitamins means they dissolve in fats and excess can be stored in the body, while Water soluble vitamins dissolve in water and excess cannot be stored in the body. The vitamins of importance are Vitamin A, Vitamin D, Vitamin E, and Vitamin K (fat-soluble vitamins), Vitamin $B_1$ (Thiamine), Vitamin $B_2$ (Riboflavin), Vitamin $B_3$ (Niacin), Vitamin $B_6$, Folate, Vitamin $B_{12}$, Pantothenic acid, Biotin, and Vitamin C (water-soluble vitamins)

Some benefits of adequate dietary supply of Vitamins are as follows;

- Adequate production and supply of body energy needs
- Building and repairing of body tissues
- Increased resistance to diseases
- Anti-oxidant effect that keeps organs in good shape and slows down aging
- Promotes proper nervous function

Details of the beneficial effects for each of the vitamins mentioned above and the daily recommended energy and nutrients intakes for groups of people are found in appendix I and III respectively.

Though vitamins in general are beneficial for the body's activity, they will not all be discussed in detail in this document with the exception of Vitamin A due to its public health significance among the Ghanaian population.

### 4.1.1 Vitamin A

#### 4.1.1.1 Importance and Benefits of Vitamin A

Vitamin A is a fat soluble vitamin but insoluble in water. It is an important component of the visual purple of the retina of the eye and therefore ensures good vision. It is required for maintenance of epithelial cells, mucous membranes, and skin. It is also needed for immune system function and resistance to infections.

#### 4.1.1.2 Current Situation in Ghana

The prevalence of vitamin A deficiency is high amongst children and pregnant women. Vitamin A deficiency affects 72% of the country's under five populations and contributes to one out of three of all child deaths between the ages of 6 to 59 months (8). The number of childhood deaths attributed to Vitamin A deficiency will be 104,300 between 2005 and 2014 (9). Vitamin A deficiency accounts for close to 12% of all clinical attendance of pre-school children and 38% of their hospital admissions (10). Additionally lactating women were reported to have low breast milk retinol levels (11).

In Ghana the dietary deficiency of Vitamin A is common among pregnant women and infants. It may also be common among people who abuse alcohol or those who have medical conditions that affect the ability of the body to absorb fats, this is because Vitamin A is soluble in fats.

Most Ghanaian diets are made of staples such as cereals, starchy roots and tubers with little fruits and vegetables that is supposed to provide the requisite micronutrients in their diets, resulting in micronutrient deficiencies including Vitamin A. Vitamin A deficiency slows down growth in children and increases the susceptibility of women, children, pregnant and lactating women to disease and infection. It is also the cause of night blindness and a worse deficiency state can result in death through other conditions.

Some of the rich sources of Vitamin A include; carrots, red palm oil, mangoes, pawpaw, dark green leafy vegetables, liver, eggs, orange fleshed sweet potatoes and some other yellow/orange coloured foods.

#### 4.1.1.3 Effects on Health

Adequate vitamin A status has been shown to reduce infant and child mortality in certain populations. Vitamin supplementation reduces case fatality rates from measles (12).
Vitamin A deficiency causes reduction of the ability to see in dim light which is called night blindness. More severe forms of deficiency causes Xeropthalmia. Vitamin A deficiencies also increase the risk of disease and infection particularly among vulnerable groups such as pregnant women and infants.

#### 4.1.1.4 Recommendations

**Children:** for children 0-6 months, exclusive breast feeding is recommended; however, breast feeding mothers should ensure a postpartum dose of Vitamin A and also consume diets rich in vitamin A rich foods.

Children from 6 months up to 2 years should be given appropriate and nutritionally adequate complementary food in addition to breast milk; Vitamin A rich foods such as red palm oil, dark green leafy vegetable, orange fleshed sweet potatoes, yam, plantain, fish, liver, fruits and vegetables, etc. can be used to plan meals for children within this age group as well as children above 2 years of age. Children 6-59 months should receive dose of Vitamin A capsules every 6 months.

**Pregnant and Lactating women;** pregnant and lactating women should eat a variety of foods rich in Vitamin A in order to increase their body stores to meet their demand and that of the developing foetus or the breastfeeding baby in the case of lactating mothers. (Examples of Vitamin A rich foods are stated in appendix I)

**Sick children and adults;** malnourished, sick and children at risk, should be given oral supplementation of vitamin A and also consume a variety of foods rich in Vitamin A. Adults who are sick are also recommended to eat foods rich in Vitamin A and other micronutrients for recovery, this is because Vitamin A plays an important role in immune function.

### 4.2 Minerals

Minerals are inorganic elements that the body needs daily to help form tissues and various chemical substances. They cannot be synthesised by the body. They assist in nerve transmission and muscle contraction and help regulate fluid levels and the acid – base balance of the body. Since minerals are absorbed, used and excreted by the body, they must be replaced continuously.

Minerals can either be macro or micro. Macrominerals are needed in larger amounts (i.e. in milligram to gram quantities) while microminerals on the other hand are needed in the body in smaller quantities (i.e. in microgram to milligram quantities).

**Macrominerals**
- Calcium, Phosphorous, Magnesium, Sodium, Chloride, Potassium, Sulphur

**Microminerals**
- Iodine, Iron, Zinc, Copper, Fluoride, Selenium, Chromium, Cobalt, Molybdenum, Manganese

Mineral such as calcium, iron, potassium and sodium are contained in almost every food and most people can obtain sufficient quantities of essential minerals by eating a variety of foods, particularly fruits and vegetables

The major microminerals of public health importance in Ghana are iron and iodine. The deficiency states are associated with morbidity and mortality of children and women especially pregnant and lactation women. Details of the beneficial effects of all the minerals can be found in appendix II.

### 4.2.1 Iron

#### 4.2.1.1 Importance and Benefits

Iron (Fe) is a component of red blood cells that assist in the transportation of oxygen throughout the body. It is essential for:

- the formation of haemoglobin and certain enzymes,
- many proteins and enzymes that maintain good health,
- transporting oxygen in the blood to all parts of the body,
- many metabolic reactions and the regulation of cell growth and differentiation,
- immune activity,
- proper functioning of the liver, and
- protection against the actions of free radicals.

#### 4.2.1.2 Current Situation in Ghana

Iron deficiency is the root cause of anaemia in children, pregnant women and lactating women in Ghana. It is estimated that 78% of pre-school children are anaemic (7). The incidence of severe anaemia among pre-school children is a public health concern since it is above 10% of WHO cut-off point. Anaemia was also found among 65% of pregnant women and this has implications for maternal mortality. Ghana has an unacceptably high maternal mortality rate of 214-740/100,000 and 20% of this figure is attributed to anaemia (9).

Pregnant women, breast feeding and new mothers, infant and children, menstruating females especially adolescents and older adults are at greatest risk because of the changes in their metabolic rate. Babies who are not exclusively breast fed and are not given iron fortified formula or cereals may develop iron deficiency anaemia.

This deficiency is most frequently caused by poor dietary intake of iron. It can also occur as a result of malaria and excessive bleeding.

#### 4.2.1.3 Effects of Iron on Health

Iron is vital to health. It is essential for a child's brain development during pregnancy and early childhood. Iron deficiency on the other hand may lead to slow cognitive and social- development during childhood. During pregnancy it could result in premature deliveries and low birth weight babies. It could result in the increase risked of maternal mortality due to the reduced ability to survive bleeding during and after birth. Iron deficiency anaemia also decrease immune function, which increases susceptibility to infection. The most common symptoms of iron-deficiency anaemia are fatigue (tiredness) and weakness.

#### 4.2.1.4. Recommendations for Iron Intake

Iron is essential for blood formation which is the main carrier of oxygen and other nutrients to organs in the body for proper functioning; a deficiency state could therefore pose severe health consequences. Hence for a healthy and productive life it is important foods rich or fortified with iron are consumed with fruits or foods rich in Vitamin C by both men and women including the aged.

**Children;** Children 0-6 months should be exclusively breast fed and those on formula should be given iron fortified formula.

Children from 6 months to 2 years in addition to breast milk should be fed with iron rich complementary foods or foods fortified with iron. Examples of such foods are soy beans and other forms of beans, liver, kidney, fish, groundnuts, fortified flour, green leafy vegetables, etc. These can be used to prepare recipe/meals such as weanimix porridge, groundnut cake, (*kulikuli*) fried bean cake (*koose*), soy bean milk, grilled liver etc.

**Pregnant and Lactating women;** Pregnant women should ensure sufficient dietary intake of iron by consuming iron rich / fortified foods in order to meet their demand and that of the growing foetus. Pregnant women should attend antenatal clinics regularly and also take their iron folate supplements given them.

Lactating women on the other hand may be anaemic, as a result of excessive loss of blood during delivery. Hence, the need to take vitamin supplements and adequate dietary supply of iron. Two additional meals rich in energy, minerals and vitamins are recommended. (Refer to Appendix I) for some rich source of iron)

**Women of reproductive age;** Women until menopause loose blood every month which make them vulnerable to iron deficiency anaemia. It is important that adolescents and women during this reproductive period ensure the consumption of foods rich in iron as well as fruits rich in Vitamin C because it aids in the absorption of iron during digestion. Heavy bleeders and women that cannot ensure adequate dietary intake of iron can take vitamin supplements prescribed by their doctors.

### 4.2.2 Iodine

Iodine is essential for the production of thyroxin. Thyroxin is one of the hormones produced by the thyroid gland and used for a number of vital body functions, such as maintaining body temperature, brain development / maturation and functioning, growth and reproduction.

The thyroid gland is a butterfly shaped body at the front part of the neck just below the voice box.
Iodine deficiency disorders (IDD)- the world single greatest cause of preventable brain damage, causes a range of nervous system disorders. Iodine deficiency also contributes to increased number of child deaths: it is associated with neonatal deaths, stillbirths, and miscarriages. A deficiency of iodine during early foetal life can adversely affect foetal brain development, causing impaired cognitive function of varying degrees in children. The most severe form is cretinism. The commonest sign of iodine deficiency is goitre.

Iodine deficiency occurs in areas where the soil is deficient in iodine (due to soil nature / flooding/ leaching etc) resulting in low levels of iodine in locally grown foods and the vegetation)

#### 4.2.2.1 Importance and Benefits

Iodine forms part of the hormones of the thyroid gland, an endocrine gland situated in the lower neck. Thyroid hormones are important for regulating metabolism. In children they help to regulate growth and development, including mental development. Iodine is also important in reproduction and the regulation of body temperature.

#### 4.2.2.2 Current Situation in Ghana

Iodine deficiency is also another issue of serious public health concern in Ghana. Ghana has a goitre rate of 9.5%. The most severe iodine deficiency is found in the Upper East and Upper West regions of the country with about 56.4% and 56.5% goitre prevalence

# 9. PHYSICAL ACTIVITY

## 9.1 Introduction

Every year, more than 2 million deaths (from NCDs) are attributable to physical inactivity worldwide(17). Globally, 60% to 85% of persons from both developed and developing countries are not physically active enough to gain health benefits, particularly girls and women (due to myth and misconception about exercise and females). Nearly two thirds of children are also insufficiently active for their health.

In Ghana, evidence of physical inactivity is obtained from the growing problem of overweight and obesity. The Demographic and Health Surveys (GDHS) in Ghana show an increase of overweight or obesity from 12.7% to 25.3% in non-pregnant women aged 15-49 years.(7) In an Accra study, it was observed that overweight or obese persons were less likely to self-report job-related moderate or heavy physical activity than persons with normal weight (26%-39% vs. 55%-63%).(18) On the other hand, persons of normal weight were also more likely to report sedentary job-related physical activity than those who were overweight or obese. It has to be noted that, in cross-sectional studies, it is generally not possible to determine the cause-effect sequence of overweight and physical inactivity.

Data on levels of physical activity of children and students at all levels in Ghana are scarce (the need for nationally developed physical fitness test for students at all levels). In the Multiple Indicator Cluster Survey of 2006, 0.7% of children under five years were estimated to be overweight or obese.(13) Two years later, the GDHS 2008 suggested that about 5% of children under five years of age were overweight or obese.(7). There is ample evidence that childhood obesity carries over into adulthood. As many as 80% of obese children become obese adults. (19) Persistent obesity over 7 years of age is an important predictor of obesity in adulthood. Disturbingly, the harmful effects of overweight on cardiovascular function can be present as early as 9 years of age.(20)

Among students in Junior High School in Ghana aged 13-15 years surveyed as part of a global school health survey in 2007, only 13.1% reported that they were physically active for a total of at least 60 minutes per day on all 7 days during the past 7 days were unfortunately found to be physically inactive (boys – 13.8%, girls – 12.6%).(21) In contrast, 27.4% of the students reported spending three or more hours per day during a typical or usual day sitting and watching television, playing computer games, talking with friends, or doing other sitting activities. The survey found that 0.5% of the students were overweight and 4.4% were at risk of becoming overweight. If the apparent neglect of programmes tackling the nutritional and health needs of this group of students continues, Ghana risks stoking up NCD-related diseases in young adults in future.

## 9.2 Health Benefits of Physical Activity

The death rates from any cause are lower among physically active than among sedentary people. In a recent review of several studies, it was noted that highly active men had a 22% lower risk of all-cause mortality compared to mildly active men.(22) The corresponding figure in women was 31% lower all-cause mortality. Regular physical activity over longer time is strongly associated with a reduction in all-cause mortality in active subjects compared to sedentary persons.

Numerous randomized clinical trials support that accumulating at least 30 min/day of moderate-intensity physical activity on at least 5 days of the week has a beneficial effect on numerous physiological and clinical variables.(23) Moderate activity, such as brisk walking for 30 to 60

minutes a day most days of the week, is associated with significant reductions in the incidence and mortality of cardiovascular disease. A detailed description of the health benefits of physical activity is available from several publications including the 1996 Report of the US Surgeon General on Physical Activity and the World Heart Federation (23).

Regular moderate physical activity results in many health benefits for adults including reduced risk of dying prematurely, particularly from heart diseases, and slows the risk of developing diabetes, high blood pressure, colon and other cancers etc. Physically active lifestyle may also help reduce blood pressure in people who already have the disease or may reduce risk factors of CVD, increase HDL cholesterol, and lower triglycerides and the tendency to developing thrombosis.

Regular moderate physical activity may also help control weight, build and maintain healthy bones, muscles, and joints. It also helps older adults become stronger and better able to move about without falling; help control or manage respiratory disorders like asthma, bronchitis etc; promotes psychological well-being and reduces stress, anxiety and feeling of depression

Whereas the National Institutes of Health (NIH) Consensus Development Panel and the WHO recommend at least 30 minutes of moderate-intensity physical activity on most days of the week, recent reports suggest that 60 minutes of exercise each day may be necessary to prevent weight gain(24).

Even small amounts of physical activity — approximately 75 minutes per week — can improve cardio-respiratory fitness levels of sedentary overweight individuals.(24) While this level of exercise is lower than that currently recommended to produce weight loss, this finding should encourage those people who do not exercise at present to start doing some form of physical activity.

The beneficial effects of regular exercise on some of the body systems are as follow:

1. The number of capillaries increases to facilitate the transport of oxygen and food nutrients to muscle cells while at the same time eliminating carbon dioxide and other waste products from the cells.
2. Exercise increases the number of erythrocytes or red blood cells. The greater the number of erythrocytes the more oxygen the blood can carry to other body cells. This delays fatigue.
3. It increases in the number and size of the air sacks of the lungs and through whose walls the exchange of oxygen and carbon dioxide occurs.
4. Strengthens the heart muscle making it more efficient so that it can pump out a greater volume of blood with each stroke. This is why people who exercise regularly are less likely to suffer cardiac malfunction.

In summary, physical activities have its health related components: cardiorespiratory endurance, muscular strength and endurance, flexibility and body composition. The other benefits bother on skilled related fitness: agility, balance, agility, coordination, reaction time and speed.

For older adults participation in regular physical activity reduces the functional declines associated with ageing and to achieve other benefits of physical activity identified for all adults.

Individuals with different forms of sickness/ disability should be considered along side the guidelines. They should take into consideration the type and severity of sickness/disabilities and seek medical advice from their health care professionals before engaging in physical activity.

**Examples:**

**Physical Activity – Effect on Health of Pregnant Women**

- Pregnant women should seek regular medical advice.
- Pregnant women in the absence of medical or obstetrics complication should incorporate 30 minutes of more moderate – intensity physical activity on most if not all days of the week.

**Physical Activity – Effects on Sickle Cell Patients**

- Sickle cell patients have a problem of insufficient supply of oxygen due to their red blood cells sickle shaped nature. Less oxygen is therefore absorbed by the red blood cells leading to insufficient availability of oxygen in the system
- Physical activity of moderate intensity to vigorous may cause the breakdown of the red blood cells with consequent release of the oxygen and other components of the haemoglobin e.g. bilirubin. Otherwise is a clog of such breakdown products which takes time to flow in the circulatory system. This causes an accumulation in the joints which gives rise to inflammatory condition in the joints – sickle cell crisis.
- The type of physical activity suitable for such group of patients is; low intensity, regular walking, to improve circulation and respiration. Moderate and vigorous intensity of regular physical activity is not advisable to sickle cell patients.

**Physical Activity – Effects on Tuberculosis Patients**

- Active tuberculosis of the lungs leads to shallow breathing, there is reduced rate of inspiration and expiration and general body weakness.
- Physical activity is not recommended for active tuberculosis patients.
- The sub acute and fully treated TB of lungs patients can benefit from low to moderate intensity physical activity which will improve the rate of respiration. (25)

### 9.3 Guidelines for Starting Physical Activity

There are a number of important points to note about physical activity:

1. Contact a physician to ascertain your health status
2. Get the appropriate attire or kit and footwear
3. Use safe environment/ and arena or sports ground for activities
4. Exercise under conducive climatic conditions (i.e. avoid extremely hot or cold temperatures)

5. You should always warm up when beginning your exercise programme and warm and cool down after each exercise session. There should be warm-up, main work out and cool down.
6. Restore lost fluid approximately 30minutes after intense workouts ( with water, or any sports drink)
7. Involve in safe exercises as recommended below
8. Start with low exercise intensive exercises of between 20% to 30% of your heart rate or below
9. Exercise between 20-45 minutes per session
10. Exercise between 2 to 4 times a week
11. Start with leisurely walking, then brisk walking and/or bicycling for the first two to four of initial exercise then move into slow jogging after three to four weeks of exercise. After five to six weeks of low intensity exercise , gradually increase(at your own pace):
    - Intensity, from 30% - 60% of your heart rate
    - Duration, from 30-60 minutes per session
    - Frequency, from 3-5 days per week
    - Aerobic activities such as jogging, running, average bicycling, swimming etc.
    - Engage in flexibility exercise 2-4 days a week (stretching exercise)
12. Jog slowly to cool-down after every activity for the session and stretch

**Precautions before Starting Exercise**

- To avoid soreness and injury, individuals wishing to increase their physical activity level should start out slowly and gradually build up to the desired amount to give the body time to adjust.
- People with chronic health problems, such as heart disease, diabetes, or obesity, or who are at high risk for these problems should first consult a physician before starting a new programme of physical activity.
- Men over age 35 years and women over age 30 years who plan to begin a new **vigorous** physical activity program should consult a doctor first to exclude any heart disease or other health problems.

### 9.4 Recommended levels of physical activity

Adults should strive to meet either of the following physical activity recommendations:

1. Adults should engage in moderately-intensity physical activity for at least 30 minutes on 5 or more days of the week; OR
2. Adults should engage in vigorous-intensity physical activity 3 or more days per week for 20 or more minutes exercise session.
3. Those who are trying to keep weight off should aim a bit higher: Try to get 60–90 minutes of moderate-intensity activity daily, without taking in extra calories.

4. It is never too late to start an active lifestyle. Regardless of how old you are, how unfit you feel, or how long you have been inactive, starting a more active lifestyle now through regular, moderate-intensity activity can make you healthier and improve your quality of life.

**Children and Adolescents** –

- One hour or more of moderate or vigorous aerobic physical activity a day, including vigorous intensity physical activity at least three days a week. Examples of moderate intensity aerobic activities include hiking, bicycle riding and brisk walking.
- Vigorous intensity aerobic activities include bicycle riding, jumping rope, running and sports such as soccer, basketball and field hockey. Children and adolescents should incorporate muscle-strengthening activities, such as rope climbing, sit-ups, and tug-of war, three days a week. Bone-strengthening activities, such as jumping rope, running and skipping, are recommended three days a week.

Children and adolescents of school going age should be held accountable on fitnesss standards. Thus compulsory physical education should be added in the school curriculum for at least 120 minutes a week.

**Youth and Young Adults** –

- Adults gain substantial health benefits from two and one half hours a week of moderate intensity aerobic physical activity, or one hour and 15 minutes of vigorous physical activity. Walking briskly, water aerobics, ballroom dancing and general gardening are examples of moderate intensity aerobic activities. Vigorous intensity aerobic activities include race walking, jogging or running, swimming laps, jumping rope and hiking uphill or with a heavy backpack. Aerobic activity should be performed in episodes of at least 10 minutes. For more extensive health benefits, adults should increase their aerobic physical activity to five hours a week moderate-intensity or two and one half hours a week of vigorous-intensity aerobic physical activity. Adults should incorporate muscle strengthening activities, such as weight training and push-ups, stretching such as sit-and-reach and regular gardening, at least two days a week ( to improve joint flexibility).

**Older Adults and The Aged** –

- Older adults should follow the stated guidelines, but should always exercise within their physical capacity. If a chronic condition prohibits their ability to follow those guidelines, they should be as physically active as their abilities and conditions allow. If they are at risk of falling, they should also do exercises that maintain or improve balance and flexibility. Put older people into age categories (group)

**Women during pregnancy** –

- Healthy women should get at least two and a half hours of moderately-intensive aerobic exercise per a week during pregnancy and after delivery, preferably spread throughout the week. Pregnant women who habitually engage in vigorous aerobic exercise or who are highly active, can continue during pregnancy and after delivery, provided they remain in a

healthy state and discuss with their health care provider how and when physical activity should be adjusted over time.

- Women after 40years are prone to having osteoporosis. Therefore, their exercise selection is important and hence should seek medical advice

**Adults with disabilities** –

- Those who are able bodied should get at least two and a half hours of moderate aerobic activity a week, or one hour and 15 minutes of vigorous aerobic activity a week. They should incorporate muscle-strengthening activities involving all major muscle groups two or more days a week. When they are not able to meet the guidelines, they should engage in regular physical activity according to their abilities, and should avoid inactivity.

# 10. DIET, PHYSICAL ACTIVITY AND WEIGHT MANAGEMENT

Body weight supports the functioning of the body. To maintain a healthy state and well being one must maintain a healthy weight for his/her age, height and gender. There are standard body weights considered normal for each age and sex. Thus, to maintain good health there must be a balance between body weight and height.

Weight is determined by how well balanced one's diet is and the extent to which dietary energy is expended. Energy is expended through physical activity among others. An unbalanced diet and lack of physical activity may lead to either overweight or underweight. The problems associated with overweight are obesity, diabetes, hypertension, heart disease, stroke, heart failure and menstrual disorders. Underweight results in reduced stamina, mental depletion, vitamin deficiencies and associated diseases, impaired immunity leading to frequent sicknesses.

A healthy body weight is measured as the body mass index (BMI), a measure of thickness or fatness. It is calculated by dividing one's weight in kilograms by height squared in metres. It is important to note that men have more muscle mass and larger bone structure than women

The formula is

$$\text{BMI} = \frac{\text{weight in kg}}{(\text{height in m})^2}$$

Example;

Weight = 90kg
Height = 1.83

$$\text{BMI} = 90/(1.83 \times 1.83)$$
$$= 26.9 \text{ kg/m}^2$$

| **Weight/height (kg/m²)** | **Classification** |
|---|---|
| Below 18.5 | Underweight |
| 19 – 24.5 | Healthy |
| 25 – 30 | Overweight |
| 30 plus | Obese |

Preventing Weight gain is a matter of finding the balance between food intake and physical activity. Weight management should always be looked at from four perspectives, namely: increasing/gaining weight (under weights: BMI < 18.5), maintaining weight (Ideal Weight BMI= 18.5 to 24.5), decreasing/losing weight (overweight: BMI>25<30) and managing or treating obesity and its co-morbidities (obese: BMI>30).

1. When you want to gain weight:

a. reduce the intensity and duration of physical activity throughout the day

b. engage in 10 to 20 minutes especially strengthening and weight training exercise for 2 to 3 times in the week

2. When you want to maintain your weight:
a. do physically active work for a longer duration about 3 to 5 days in the week
b. engage in approximately 30 minutes of moderate to vigorous intensive activity on most days of the week to prevent gradual, unhealthy body weight gain.

3. When you want to lose weight:
a. engage in at least 30 minutes of moderate intensity physical activity for 5 days in the week
b. engage in vigorous activities morning and evening for at least 20 to 30 minutes
c. engage in more vigorous activities for a longer duration.
d. be careful not to lose more than 1kg a week or more than 6kg in a month

4. when you want to manage obesity and its co morbidities:
a. consult a health care provider or medical doctor about weight loss strategies prior to starting a weight reduction programme to ensure appropriated management of other health conditions.
b. engage in less vigorous activities for at least 20 to 30 minutes, 3 times in a week

**Recommendations**

To maintain, increase or lose body weight, one must try and observe the following;

1. It is essential for overweight adults and overweight children with certain chronic diseases and or on medication to consult a health care provider or medical doctor about weight loss strategies prior to starting a weight reduction programme to ensure appropriate management of other health conditions.
2. It is wise to be well informed enough about your health conditions
3. Be concerned (discipline) enough to try to change your diet and physical activity lifestyle
4. Be patient enough for the results
5. Be consistent enough to reach the goal of a healthy lifestyle.
6. Eat a nutritionally adequate diet and exercise regularly
7. Eat more nutrient-dense foods like fruits and vegetables
8. Limit energy-dense foods like fats.
9. Maintain an energy balance supported by a regular programme of physical exercise
10. Take adequate amounts of water
11. Reduce alcohol intake
12. Avoid smoking if possible

These are examples of physical activities that can keep you fit and healthy.

- Exercise with other people at it keeps you accountable because you know somebody is waiting for you, i.e. walking groups or cycling bunch rides.
- Walking to a beat by listening to music helps to keep you exercising longer than expected. Try something new aside from the walking routine, like dancing, swimming and aerobics. Schedule it – make sure your physical activity is part of the “things to do” list.
- Exercise early since other tasks and household chores could prevent you from exercising. Stay focused.

- Get your clothes and shoes ready the night before, if not make sure you have a bag of exercise clothes with you at work or in the car.
- Keep track by monitoring your incidental exercise in a diary.

Up to approximately 60 minutes of moderate to vigorous intensity, physical activity on most days of the week may be needed to prevent unhealthy weight gain.

- To sustain weight loss for previously overweight/obese people, about 60 to 90 minutes of moderate intensity, physical activity per day is recommended for already physically active persons.
- Reduction of sedentary activities (i.e. jobs with limited physical activity) appears to be helpful in treating and preventing overweight among children and adolescents (26, 27).

# 11. APPENDICES

## APPENDIX I **VITAMINS, IMPORTANCE AND SOURCES**

| Nutrients | Importance /Role | Deficiency | Source |
|---|---|---|---|
| Vitamin A | Required for maintenance of epithelial cells, mucous membranes, and skin. Needed for immune system function and resistance to infections. Ensures good vision. Needed for bone growth. | Xeropthalmia and night blindness. Increased risk of disease and infection. Common with pregnant women and infants being the most often affected. | Full-cream milk (when fortified), cheese, butter, red palm oil, fish oil, eggs, liver, carrots, mangoes, pumpkin, green leafy vegetables, yellow sweet potatoes. |
| Vitamin B1/Thiamine | Used in energy metabolism, supports appetite, and central nervous system functions. | Beriberi, nervous damage. Other symptoms include loss of appetite, weakness etc. | Whole-grain cereals, meat, poultry, fish, liver, milk, eggs, oil, seeds, and legumes. |
| Vitamin B2/ Riboflavin | Used in energy metabolism, supports normal vision, health and integrity of skin. | Dry and scaling skin. Eyes may become bloodshot, itchy, watery and sensitive to light. | Milk, eggs, liver, meat, fish, yogurt, green leaves, whole-grained cereals, and legumes. |
| Vitamin B3/Niacin | Essential for energy metabolism, supports health and integrity of skin, nervous and digestive systems. | Pellagra. Other symptoms include irritability, mild diarrhoea, skin rashes, loss of appetite, weakness etc. | Milk, eggs, meat, poultry, fish, peanuts, whole-grained cereals, unpolished rice. |
| Vitamin B6 | Facilitates metabolism and absorption of fats and proteins, converts tryptophan to niacin. Helps to make red blood cells. | Oily, flaky skin, cracked lips, nausea, diarrhoea. Can usually occur babies fed with infant formula. Also, some TB drugs cause B6 deficiency. | Legumes (white beans), potatoes, meats, fish, poultry, shellfish, watermelon, oil seeds, maize, avocado, broccoli, green leafy vegetables. |
| Folate | Required for synthesis of new cells, especially red blood cells and gastrointestinal cells. Helps in the development of the neural tube of the foetus in pregnancy. | Megaloblastic anaemia. Some symptoms include, shortness of breath, heartburns, pale skin, etc. | Liver, green leafy vegetables, fish, legumes, groundnuts, oil seeds. |
| Vitamin B12 | Required for synthesis of new cells, helps to maintain nerve cells. Works together with folate. | Penicious anaemia, Nervous damage, inflammation of tongue and mouth. | Meat, fish, poultry, shellfish, cheese, eggs, milk. |
| Pantothenic acid | Forms part of Coenzyme A, used in energy metabolism | Deficiency is rare because the vitamin is made by the body. | Widespread in foods |
| Biotin | Forms part of a coenzyme used in energy metabolism, fat synthesis, amino acid metabolism, and glycogen synthesis | Inflammation and increased sensitivity. Hair loss, muscle pain, nausea, etc. | Widespread in foods |
| Vitamin C | Helps the body to use calcium and other nutrients to build bones and blood vessel walls. Increases non-heme iron absorption. Increases resistance to infection and | Scurvy, leading to muscle weakness, joint pains, poor healing of wounds, bleeding and swollen gums. | Citrus fruits such as orange, tangerine, lemon, grape fruits, and also in baobob, guava, , pineapple, , pawpaw, mangoes; Vegetable; cabbage, green |

| | | | |
|---|---|---|---|
| | acts as an antioxidant. Important for protein metabolism. | | leaves, tomatoes, peppers, |
| Vitamin D | Required for mineralization of bones and teeth. | Softening of the bones, a condition called osteomalacia in adults and rickets in children. | Produced by skin on exposure to sunshine, milk, butter, cheese, fatty fish, eggs, liver. |
| Vitamin E | Acts as an antioxidant. Protects cell membranes and metabolism, especially red and white blood cells. Protects Vitamin A and other fats from oxidation. Facilitates resistance against diseases, particularly in lungs. | Very rare, but deficiency may cause nervous problems. | Green and leafy vegetables, vegetable oils, wheat germ, whole-grain products, butter, liver, egg yolk, peanuts, milk fat, nuts, seeds. |
| Vitamin K | Essential in blood clotting. | Bleeding from mouth, genital and urinary tract, intestines and skin | Cabbage, carrot, avocado pear, spinach, peas. |

## APPENDIX II **MINERALS, IMPORTANCE AND SOURCES**

| **Nutrient** | **Importance / Role** | **Source** |
|---|---|---|
| Calcium | Helps: -<br>ƒ to build strong bones and teeth<br>ƒ with bone formation and for bone density<br>ƒ the heart to beat<br>Keeps the muscles healthy and helps them contract | Milk, Dairy products, Sardines, Spinach, Fortified, cereals, Fortified margarine. |
| Phosphorus | Helps to build strong bones and teeth<br>Forms part of every cell<br>Important in genetic material<br>Forms part of phospholipids (phosphorous-containing lipids)<br>Is used in the transfer of energy<br>Is important in pH regulation | Meat, Poultry, Fish, Eggs, milk and legumes |
| Magnesium | Is vital to many basic metabolic functions as an activator of enzymes<br>Aids in bone growth and the function of nerves and muscles | Dark green leafy vegetables , Legumes (dried beans), Nuts and seeds, Whole grains, Milk, Wheat bran |
| Sodium | Is an electrolyte that helps control fluid balance in cells<br>Aids in muscle flexing and the flow of nerve impulses | Table salt, Soy sauce, Cheese, Smoked and cured meats, Processed and canned foods |
| Chloride | An electrolyte that helps control fluid balance in cells<br>Helps maintain pH balance<br>Forms part of the acid found in the stomach which is necessary for digestion | Table salt, Sea foods, Milk, Meat, Eggs |
| Potassium | Is an electrolyte that aids in the control of blood pressure and water balance in cells<br>It helps maintain pH balance<br>Vital for muscle contraction and nerve impulses<br>Helps with proper function of heart and kidneys | Fruits, Vegetables, Milk, Meat, Poultry, Cereals, Legumes, plantain, banana. |

| | | |
|---|---|---|
| | Is necessary for carbohydrate and protein metabolism | |
| Sulphur | Forms part of proteins (it has a stabilising function)<br><br>Forms part of the vitamins biotin and thiamine, and the hormone insulin<br><br>Is involved in body's detoxification processes | All protein-containing foods , Meats, Fish, Poultry, Eggs, Milk, Cheese, Legumes, Nuts |
| Iron | Healthy blood - helps red blood cells carry oxygen<br><br>Iron plays a role in maintaining a healthy immune system<br><br>Helps with brain development and function<br><br>Iron forms part of enzyme reactions that carry messages from one nerve cell to another | Fortified cereal, Dried beans, Meat, Chicken, Liver, Kidney, Egg yolks, Sea foods |
| Zinc | Involved in the synthesis or degradation of major metabolites such as carbohydrates, lipids and proteins<br><br>Involved in enzyme activity<br><br>Helps in the stabilization of the protein and genetic structure in cells<br><br>Involved in communication and division of cells<br><br>Helps with maintenance of a healthy immune function | Meat, Fish, Poultry, Milk products, Whole grain cereals, Dried beans |
| Selenium | Its antioxidant properties protect against damage to cells and help maintain their health<br><br>Involved in enzyme activities | Grains, Onion, Sea foods, Kidney, Liver, Meats, Vegetable |
| Copper | Needed for the absorption and use of iron in the formation of red blood cells<br><br>Helps to form the protective covering of nerves<br><br>Forms part of many enzymes | Liver, Shellfish, Whole grains, Legumes, Kidney, Poultry, Oysters, Chocolate, Nuts. |
| Iodine | Forms part of thyroid hormones that helps to regulate growth, development, and metabolic rate | Iodised salt, Seafood, Plants grown in iodine-rich soil |
| Manganese | Component of essential enzyme system | Beet greens, Whole grains, Nuts, Legumes, Fruit. |
| Fluoride | Present in bone and teeth | Fluoridated water, Food grown or cooked in fluoridated water, Tea, |

| | | |
|---|---|---|
| | Helps make teeth resistant to decay<br><br>May help to minimize bone loss | Seafood. |
| Molybdenum | Constituent of essential enzymes | Legumes, Cereals, Organ meats. |
| Cobalt | Part of Vitamin $B_{12}$ and is therefore involved in nerve function and blood formation | Foods of animal origin, Meats, Milk, Dairy products. |
| Chromium | Associated the functioning of insulin and glucose metabolism | Whole grain cereals, Vegetable, Meat, Brewer's yeast |

## APPENDIX III DAILY RECOMMENDED INTAKES FOR ENERGY AND NUTRIENTS FOR GROUPS OF PEOPLE

| **Sex and Age group** | **Body weight** | **Energy** | **Protein** | **Iron** | **Zinc** | **Vitamin A** | **Vitamin C** | **Folate** |
|---|---|---|---|---|---|---|---|---|
| Years | kg | kcal | g | mg | mg | mcg **RE** | mg | mcg DFE |
| Both sexes | | | | | | | | |
| 0-6 months | 6.0 | 524 | 11.6 | 0[a] | **1.1** | 375 | **25** | 80 |
| 6 months-1 | 8.9 | 708 | 14.1 | 9 | **0.8** | 400 | **30** | 80 |
| 1-3 | 12.1 | 1022 | 14.0 | 6 | **8.4** | 400 | **30** | 160 |
| 4-6 | 18.2 | 1352 | 52 2 | 6 | 10.3 | 450 | **30** | 200 |
| 7-9 | 25.2 | 1698 | 25.2 | 9 | 11.3 | 500 | **35** | 300 |
| Girls | | | | | | | | |
| 10-17 | 46.7 | 2326 | 42.6 | 14/32[b] | 15.5 | 600 | **40** | 400 |
| Boys | | | | | | | | |
| 10-17 | 49.7 | 2824 | 47.8 | 17 | 19.2 | 600 | **40** | 400 |
| Women | 55.0 | | | | | | | |
| 18-59 | | 2408 | 41.0 | 29/1 1[c] | **9.8** | 500 | **45** | 400 |
| Pregnant 3rd semester | | **+300** | +6.0 | High[d] | 15.0 | 800 | **55** | 600 |
| breastfeeding | | +505 | +17.5 | 15 | 16.3 | 850 | **70** | 500 |
| 60 and over | | 2142 | 41.0 | 11 | **9.8** | 600 | **45** | 400 |
| Men | 65.0 | | | | | | | |
| 18-59 | | 3091 | 49.0 | 14 | 149.0 | 600 | **45** | 400 |
| 60 and over | | 2496 | 49.0 | 14 | 14.0 | 600 | **45** | 400 |

Adapted from FAO 2005 *Family nutrition guide* using the following sources: Energy - FAO. 2004. *Human energy requirements.* Rome; Protein - WHO. 1985. *Energy and protein requirements.* Technical Report Series 724. Geneva; Micronutrients - FAO/WHO. 2002. *Human vitamin and mineral requirements.* Rome.

[a]: Full-term babies are born with sufficient iron stores for six months.

[b]: Amount needed when menstruation starts.

[c]: Amount needed after menopause.

[d]: Needs are so high that iron supplements are usually recommended for pregnant women and pregnant adolescent girls.

Notes

Kcal = kilocalorie; RE = retinol equivalents; DFE = dietary folate equivalents.

These values assume that:

- children are breastfed for at least the first year;
- older children and adults eat small amounts of iron-rich foods (e.g. meat), other animal proteins and vitamin C-rich foods, and large amounts of staple foods such as maize.
- the bio-availability values used for iron are ' 10% bio-availability', and those used for zinc are 'low bio-availability';
- adults have moderate physical activity.

APPENDIX IV **RECOMMENDED DAILY INTAKE OF WATER**

**7 months-Adulthood Males and Female**

| **Ages** | **Water Intake mls** | **No of Glass equivalent (230 – 250 size)*** |
|---|---|---|
| 7 months | 236.6 | 1 |
| 8 months | 266.2 | 1 |
| 9 months | 266.2 | 1 |
| 10 months | 295.7- | 1 - 1½ |
| 11 months | 295.7- | 1 - 1½ |
| 1 year | 325.3 | 1½ |
| 13 months | 325.3 | 1½ |
| 14 months | 325.3 | 1½ |
| 15 months | 325.3 | 1½ |
| 16 months | 325.3 | 1½ |
| 17 months | 354.9 | 1½ |
| 18 months | 354.9 | 1½ |
| 19 months | 354.9 | 1½ |
| 20 months | 354.9 | 1½ |
| 21 months | 354.9 | 1½ |
| 22 months | 384.5 | 1½ – 2 |
| 23 months | 384.5 | 1½ – 2 |
| 2 years old | 414.0 | 1½ – 2 |
| 3 years old | 473.2 | 1½ – 2 |
| 4 years old | 507.8 | 2 |
| 5 years old | 591.5 | 2 – 2½ |
| 6 years old | 680.2 | 3 |
| 7 years old | 739.3 | 3 – 3½ |
| 8 years old | 828.1 | 3 – 3½ |
| 9 years old | 887.2 | 3½ – 4 |
| 10 years old | 1035.1 | 4 |
| 11 years old | 1123.8 | 4½ |
| 12-13 years old | 1301.2 | 5 |
| 14 - adulthood | 1537.8 | 6 – 6½ |

***Approximation**

APPENDIX V **Quantified Daily Menus for Children of Different Age Groups**

**Suggested Meal Plan for 6-9 months**

| MEAL PLAN | |
|---|---|
| 5 a.m. | Breast milk |
| 7 a. m. | Fortified Porridge |
| 10 a.m. | Fresh fruit |
| 12 noon | Lunch (Semi - solid) |
| 3 p.m. | Breast milk |
| 5 p.m. | As at 12 noon |
| 7 p.m. | Plain porridge |

**Suggested Meal Plan for 9-12 months**

| MEAL PLAN | |
|---|---|
| 5 a.m. | Breast feed |
| 7 a.m. | Soya rice water |
| 10 a.m. | Peeled pawpaw |
| 12 noon | Lunch - beans stew & Ripe plantain |
| 3 p.m. | Plain koko |
| 6 p.m. | Light soup + soft mashed yam |

**Suggested Meal Plan for a Toddler 1-2 years**

| MEAL PLAN | |
|---|---|
| 7 a.m. | Breast feed |
| 8 a. m. | Fortified Porridge + Bread |
| 10 a.m | Mashed banana |
| 12 noon | Lunch |
| 3 p.m. | Plain porridge |
| 5 p.m. | Light soup + kenkey |
| 7 p.m. | Plain porridge |

**Suggested Meal Plan for 24-36 months (2-3 years)**

| MEAL PLAN | |
|---|---|
| 7 a. m. | Breakfast |
| 10 a.m. | mid-morning snack |
| 12 noon | Lunch beans stew + Rice |
| 3 p.m. | Mid-afternoon snack |
| 5 p.m. | Super - Light Soup + yam |
| 8 p.m. | Bedtime snack |

**Suggested Meal Plan for 36-60 months (3-5 years)**

| MEAL PLAN | |
|---|---|
| 7 a. m. | Breakfast Weanimix |
| 10 a.m. | Mid-morning Banana |
| 12 noon | Lunch - groundnut soup + rice |
| 3 p.m. | Snack doughnut |
| 5 p.m. | Supper - garden egg stew + banku |
| 8 p.m. | Bedtime |

Note: brush teeth or use local chewing stick or sponge, then wash mouth with water before bed.

**Suggested Meal Plan for 60-72 months (5-6 years)**

| MEAL PLAN | |
|---|---|
| 7 a. m. | Breakfast Rice porridge + bread |
| 10 a.m. | Mid-morning Banana+ roasted Groundnuts |
| 12 noon | Lunch Palm soup + rice |
| 3 p.m. | Mid-afternoon Snack |
| 5 p.m. | Supper Kontomire stew + boiled Plantain |
| 8 p.m. | Bedtime |

Note: brush teeth or use local chewing stick or sponge, then wash mouth with water before bed.

## APPENDIX VI Charcoal Filtration of Water

***How to Assemble the Items for Your Filter***

1. ***Two containers***: The one at the top has the filtering materials. It also should have enough openings through the bottom to allow filtered water to flow easily down into the second container at the base with a tap for use in fetching the filtered water.
2. ***A suitable suitably porous cloth or membrane***: The white cotton fabric used for towels or napkins would do. It could be folded into two or more times and used as the first in the set of filters. It should be porous enough to allow water flow but be able to trap dust and other solid impurities. As soon as this fabric gets stained or discoloured, it should be replaced, washed and kept for later use.
3. ***The filters***: Use the following guidelines for producing 100% pure water:

(a) ***The charcoal***: Must be 100% charcoal or what remains, after cooking with firewood or after firing any other charcoals and no more smoke is produced from them. Put off the fire and wash off the ash. Thoroughly dry the coals and pound or somehow them to roughly about 1 cm or small but unable to be washed through the thin fabric described in (b) immediately below. Larger pieces cannot be compact enough within the “cushions” described below and unfiltered water would rush through them and render the filter ineffective.

(b) ***Suitably thin and porous fabric***: For the top and bottom of the bags or "cushions" to be created, use fabric similar to sieves for flour, porous enough to allow water to flow through but charcoal pieces to remain behind, The fabric for the four sides of these "cushions" should be thick enough to prevent water from easily flowing through the sides where these “cushions” touch the inner wall of the container holding the unfiltered water.

(c) ***Size of cushions***: Each “cushion” should be about 2 ins or 10 cm thick. When properly loaded flat with the charcoal, each of them should fit firmly and tightly against the wall of the container and not allow unfiltered water to pass down the edges.

(d) ***The number of charcoal-filled “cushions”***: Depends on how deep the top container is but would allow enough space for unfiltered water. The sketch in Figure 10.1 has 6 cushions but more can be used. Stacked flat, one on top of the other, the cotton fabric mentioned in item 2 above to be at the very top.

4. The top "cushion," the dirtiest of the set should be taken out at the end of between 3 to 6 months or at shorter intervals, depending on the quality of water being filtered. A fresh replacement “cushion” should always be used at the very bottom of the entire set and the previous No. 2 “cushion” now comes to the very top. The contents of the tired “cushion” can then be emptied, the fabric washed and refilled with fresh coarsely-ground charcoal and stored for future use. This system of rotation can be maintained indefinitely.

5. Whenever the top “cushion” is replaced, use pure water, soap and a suitable sponge for thoroughly washing the insides of each of the two containers.

## 12. References


1. World Health Organization (2004) Global strategy on diet, physical activity and health. Geneva.
2. WHO (2002). Reducing risks, promoting healthy life. The World Health Report 2 Geneva:
3. WHO (2005) Preventing chronic diseases: a vital investment. WHO Global Report. Geneva.
4. Steyn K, Sliwa K, Hawken S, Commerford P, Onen C, Damasceno A, et al. (2005) Risk factors associated with myocardial infarction in Africa: the INTERHEART Africa study. Circulation.112:3554-61.
5 Biritum, R B et al (2005) The Epidemiology of Obesity in Ghana, Ghana Medical Journal, Sept., 2005, 39(3), 82 – 85
6 Addo, J et at (2009) Obesity in Urban Civil Servants in Ghana Association with pre-adult wealth and adult socio-economic status, Public Health, 123(5), 365 - 370
7. Ghana Statistical Service, and Macro International Inc. (2009) Ghana Demographic and Health Survey 2008: Preliminary Results. Claverton, Maryland.
8. MOH Survey 1997, Description of the Magnitude and distribution of Vitamin A Deficiency in Southern Ghana
9. Ghana Health Services, Ghana Profiles 2005
10. Navrongo Health Reserach Unit, Vitamin A Supplementation (VAS) Trial 1993, MOH, Ghana
11. MOH, Ghana Survey, 2005
12. FAO, Food and Nutrition Series, No. 29. Human Nutrition in the developing world by Michael C. Latham Professor of International Nutrition, Cornell University, Ithaca, New York, USA 1997
13. Ghana Statistical Service, UNICEF and USAID (2007) Monitoring the situation of children, women and men: findings from the Ghana Multiple Indicator Cluster Survey 2006. Accra:
14. WHO Data base on World Health Survey on Fruits and Vegetables Consumption, 2003
15. Aggrey-Fynn E (2001) The contribution of the fisheries sector to Ghana's economy. Sustainable Fisheries Livelihoods Programme (SFLP). DFID/FAO
16. WHO, (2003) Diet, Nutrition and The Prevention Of Chronic Diseases, WHO Technical Report Series 916.
17. World Heart Federation. Physical Activity & CVD. Geneva; September 2002.
18.. Amoah AGB (2003) Sociodemographic variations in obesity among Ghanaian adults. Public Health Nutrition, 6:751-75.
19. Wyllie R. (2005) Obesity in childhood: an overview. Current Opinion in Paediatrics. 17:632-35.
20. Thompson DR, Obarzanek E, Franko DL, Barton BA, Morrison J, Biro FM, et al (2007) Childhood overweight and cardiovascular disease risk factors: the National Heart, Lung, and Blood Institute Growth and Health Study. J Pediatrics. 150(1):18-25.
21. Owusu A. (2007) Global School-based Student Health Survey: Ghana 2007 Fact Sheet: CDC.
22. Löllgen H, Böckenhoff A, Knapp G, (2009) Physical activity and all-cause mortality: an updated meta-analysis with different intensity categories. Int J Sports Med. 30:213-24.
23. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

Physical Activity and Health (1996) A Report of the Surgeon General. Executive Summary. Atlanta, GA;

24. Church TS, Earnest CP, Skinner JS, Blair SN, (2007) Effects of different doses of physical activity on cardiorespiratory fitness among sedentary, overweight or obese postmenopausal women with elevated blood pressure: A Randomized Controlled trial. JAMA. 2297:2081-91.
25. Survey from BSc Nursing Staff, Quality Assurance Unit/Institutional Care Division/GHS),
26, Morbidity and Mortality Weekly Report, (1997) March vol. 46 / No. Rr6.
27. Wuest, D and Bucher, C (2006) Foundations of Physical Education, Exercise Science and Sports, 15th Edition New York: McGraw Hill,
28. Living Well With Diabetes (Page 14), Developed by a multidisciplinary group of diabetes patient educators and health care providers from Ghana and the US. © 2000, University of Virginia School of Medicine, Diabetes Outreach Programme, Charlottesville, Virginia, USA. © 2006, Revised By A.G.B. Amoah, A.A. Owusu, S.K. Owusu on behalf of the Authors