DIETARY AND PHYSICAL ACTIVITY GUIDELINES FOR GHANA

MINISTRY OF HEALTH

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Preface

In 2004, the World Health Assembly (WHA) adopted a resolution to deal with the threat of non-communicable diseases (NCDs) which currently account for 60% of deaths globally. The resolution launched the Global Strategy on Diet, Physical Activity and Health, of which the focus was on the two major risk factors of NCDs, unhealthy diet and physical inactivity. Subsequently, the WHO has developed the Global Strategy on Diet, Physical Activity and Health as a guide for member nations.

The disease pattern in Ghana shows an epidemiologic transition with the rise in non-communicable diseases (NCDs). Currently, most of the NCD burden on the ascendance is diet related and is due to malnutrition leading to underweight or overweight and obesity. Growing evidence in the literature points to an association between a reduction of morbidity and mortality from NCDs and a healthy diet and physical activity. The rising trend of NCDs in Ghana can be halted by the promotion of a healthy diet and physical activity. Thus, the need for Dietary and Physical Activity Guidelines for Ghana is long overdue.

This Dietary and Physical Activity Guidelines is the first of its kind in Ghana, though one can cite numerous protocols and manuals that have been developed to guide the provision of nutrition and diet counselling, advice and education to clients, and patients who come in contact with health personnel. The guidelines are designed for use primarily by policy makers, health service providers, dieticians, nutritionists, health trainers and educators. The Dietary and Physical Activity Guidelines are a standard guide to the development of learning materials and health education messages for the general public as well as for teaching.
# Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>BCC</td>
<td>Behaviour Change Communication</td>
</tr>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>BMR</td>
<td>Basal Metabolic Rate</td>
</tr>
<tr>
<td>CHD</td>
<td>Coronary Heart Disease</td>
</tr>
<tr>
<td>CVD</td>
<td>Cardiovascular Disease</td>
</tr>
<tr>
<td>GDHS</td>
<td>Ghana Demographic Health Survey</td>
</tr>
<tr>
<td>DHA</td>
<td>Decosahexaenoic Acid</td>
</tr>
<tr>
<td>DNA</td>
<td>Deoxyribonucleic Acid</td>
</tr>
<tr>
<td>EPA</td>
<td>Eicosapentaenoic Acid</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>HDL</td>
<td>High Density Lipoprotein</td>
</tr>
<tr>
<td>IMR</td>
<td>Infant Mortality Rate</td>
</tr>
<tr>
<td>LDL</td>
<td>Low Density Lipoprotein</td>
</tr>
<tr>
<td>MOH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>NCDs</td>
<td>Non-communicable Diseases</td>
</tr>
<tr>
<td>NIH</td>
<td>National Institutes of Health</td>
</tr>
<tr>
<td>RDAs</td>
<td>Recommended Dietary Allowances</td>
</tr>
<tr>
<td>RNA</td>
<td>Ribonucleic acid</td>
</tr>
<tr>
<td>PAL</td>
<td>Physical Activity Level</td>
</tr>
<tr>
<td>U5MR</td>
<td>Under-five Mortality Rate</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
</tr>
<tr>
<td>WHA</td>
<td>World Health Assembly</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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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 must be emphasized that developing countries bear the brunt of these 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 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 a nutritionally adequate diet and engagement in adequate physical activity will promote good health and prevent sickness. In particular, fruits and vegetables in a daily diet 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 only breast milk for the first six months of life. Older children need adequate amounts of a variety of foods to ensure good growth and development. 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 is safe to eat. Nonetheless, children, adolescents, pregnant and lactating women, as well as the aged, do have special nutritional 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 uniform policy guidelines on diet, physical activity and health
2. To guide the development of learning materials, health and diet education messages for the public, and 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 is 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 4 kcal/g, whereas fat contributes 9 kcal/g. Therefore, fat contains the highest calories per unit weight. Though alcohol (ethanol) is not considered part of the food system, it contributes 7 kcal/g to the total energy intake and therefore, its contribution 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 in which one engages. 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 body 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 individuals
• to move around during the day, which includes walking, working and exercising
• to digest food that is eaten, absorbed and further processed into nutrients
• to regulate body temperature

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

Traditional Ghanaian foods tend to be lower in energy density than those eaten in high income countries because of the following: a high water content; a low fat content; and a relatively high fibre content being largely cereal and vegetable based. 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

Appropriate energy intake 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) or 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

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age (years)</th>
<th>Sedentary a</th>
<th>Moderately Active b</th>
<th>Active c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>2–3</td>
<td>1,000</td>
<td>1,000–1,400</td>
<td>1,000–1,400</td>
</tr>
<tr>
<td>Female</td>
<td>4–8</td>
<td>1,200</td>
<td>1,400–1,600</td>
<td>1,400–1,800</td>
</tr>
<tr>
<td></td>
<td>9–13</td>
<td>1,600</td>
<td>1,600–2,000</td>
<td>1,800–2,200</td>
</tr>
<tr>
<td></td>
<td>14–18</td>
<td>1,800</td>
<td>2,000</td>
<td>2,400</td>
</tr>
<tr>
<td></td>
<td>19–30</td>
<td>2,000</td>
<td>2,000–2,200</td>
<td>2,400</td>
</tr>
<tr>
<td></td>
<td>31–50</td>
<td>1,800</td>
<td>2,000</td>
<td>2,200</td>
</tr>
<tr>
<td></td>
<td>51+</td>
<td>1,600</td>
<td>1,800</td>
<td>2,000–2,200</td>
</tr>
<tr>
<td>Male</td>
<td>4–8</td>
<td>1,400</td>
<td>1,400–1,600</td>
<td>1,600–2,000</td>
</tr>
<tr>
<td></td>
<td>9–13</td>
<td>1,800</td>
<td>1,800–2,200</td>
<td>2,000–2,600</td>
</tr>
<tr>
<td></td>
<td>14–18</td>
<td>2,200</td>
<td>2,400–2,800</td>
<td>2,800–3,200</td>
</tr>
<tr>
<td></td>
<td>19–30</td>
<td>2,400</td>
<td>2,600–2,800</td>
<td>3,000</td>
</tr>
<tr>
<td></td>
<td>31–50</td>
<td>2,200</td>
<td>2,400–2,600</td>
<td>2,800–3,000</td>
</tr>
<tr>
<td></td>
<td>51+</td>
<td>2,000</td>
<td>2,200–2,400</td>
<td>2,400–2,800</td>
</tr>
</tbody>
</table>

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

Carbohydrate (CHO) content of approx. 270gms
Dietary and Physical Activity Guidelines for Ghana

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

Mid-morning snack: 10 gms CHO
    1 medium orange

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

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

Evening meal: 80 gms 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

Recommendations 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 the 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 vegetables and fruits). Details will be discussed in the section on food guides.
2. Increase physical activity by exercising regularly
3. Limit snacking between meals and avoid overeating
4. Do not skip meals as hunger would increase the intake of food at the next meal

Energy Needs by Population Groups

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

Adults (20 – 59)
Habitual activity and body weight are the main determinants of energy requirements at this age range.

Older adults and the Elderly (60 + yrs)
There is a reduction in habitual activity and BMR with age therefore, the elderly do not need as 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, and 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 simple forms are sugars of various types found in fruits and milk as well as table sugar. The more complex forms are starches and dietary fiber, which is a component of plant-based foods. Dietary fiber occurs in the cell walls and 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, garri, cocoyam, water yam and potatoes
   c. Starchy fruit such as plantain

Examples of polished carbohydrates are: polished white rice, polished breakfast cereals such as olayoo, 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. flavonoids in fruits). Phytochemicals have protective or disease preventive properties. Dietary fibre is important for gastrointestinal health and function and it is 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. In turn, this reduces the risk of obesity and reduces 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 Upper West Region it was almost non-existent. The prevalence of obesity was found to be 5.5%; 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 those 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 the Ghana Demographic and Health Survey of 2008 by the Ghana Statistical Service among 1015 civil servants, the prevalence of obesity was found to be 10% in men and 36% in women. Proportion of overweight or obese women is 30%, with 9% of women considered to be obese (BMI $\geq 30.0$).

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, heart disease, sleep disorders, gall bladder diseases, certain cancers and ultimately death.

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% of intake for fat and 30% for protein). Carbohydrate consumption should contain polished, non-polished, soluble and insoluble food items. Children and adults need a minimum of 130 grams/day 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 one to eat foods containing whole grains. Whole grains can be found in whole cereals, like 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, peas, leafy vegetables, cereals such as oats, bran, or corn, and fruits such as oranges, pineapple, apples, nuts and seeds. Consumption of fibre 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 prevents colon cancer. Adequate fibre consumption is at least 25g daily for adults, which is 5 servings of fruit and vegetables and 6 servings of grain products of which at least 3 should be whole grains.

3.2. Protein

3.2.1 Introduction

Proteins are made up of long chains of 20 different amino acids, which 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 proteins consumed in the diet. They are essential requirements for the 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. Therefore, one must continue supplying the eight essential amino acids through 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 acid (DNA) which function to transmit hereditary characteristics.

Other protein, 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), and groundnuts.

Animal protein is the only source that contains all the essential amino acids required by the 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 a plant-based diet, one should use mixed plant proteins in order to get the recommended daily amount of 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. Proteins make up the greater portion of muscles and organs (apart from water).

Proteins are necessary for the following:

- Growth and development of the body
- Maintenance, repair and replacement of worn out or damaged tissue
- Production of metabolic 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 about 10 percent of total calories consumed in an animal-based diet 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 individuals. In general, the consumption of protein is lower in rural areas compared to the urban areas. Notwithstanding, in both urban and rural areas, 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 an adequate amount of protein every day. Even minor protein deficiencies will eventually cause fatigue and irritability and reduce 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 disease.

It is desirable not to eat too much protein. If necessary the body can convert protein to glucose, a vital energy source. However, 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 of protein 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 weight 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 would get from animal proteins.

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

**How much protein to eat daily**

One quick way to get a rough estimate of one’s protein need is to divide one’s weight in pounds by three. Thus, if one weighs 150 pounds, dividing by three results in approximately 50 grams of daily protein needed.

This is roughly the amount of protein found in a 2 to 3 ounce serving 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

<table>
<thead>
<tr>
<th>Category of Persons</th>
<th>Age group</th>
<th>Daily allowance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants</td>
<td>Up to 5 months</td>
<td>13 grams</td>
</tr>
</tbody>
</table>
### 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, flaky pie crust and spreadable vegetable oil. 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 disease.

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 rich in the unsaturated fatty acids, especially polyunsaturated fatty acids (59%).
Table 3. Fatty acid composition of some common Ghanaian edible Fats

<table>
<thead>
<tr>
<th>Fat or Oil</th>
<th>Saturated (%)</th>
<th>Monounsaturated (%)</th>
<th>Polyunsaturated (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut oil</td>
<td>90</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Palm oil</td>
<td>50</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Palm kernel oil</td>
<td>83</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>Groundnut oil</td>
<td>20</td>
<td>48</td>
<td>32</td>
</tr>
<tr>
<td>Shea nut</td>
<td>47</td>
<td>46</td>
<td>7</td>
</tr>
<tr>
<td>Soyabean oil</td>
<td>14</td>
<td>27</td>
<td>59</td>
</tr>
</tbody>
</table>


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 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, is 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 were much more expensive than high carbohydrate-containing foods. Thus, 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 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 replacement of saturated dietary fats with mostly monounsaturated fats 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, have 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, are 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 fat intake should be 15 – 25 % of total calories.

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.

<table>
<thead>
<tr>
<th>Recommendations for reducing dietary fat/oil intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>A number of practices can be incorporated in everyday life to optimize the fat profile of the diet.</td>
</tr>
<tr>
<td>1. Some saturated fats/oils such as palm oil, coconut oil, and shea butter should be used in moderation.</td>
</tr>
<tr>
<td>2. Choose predominantly unsaturated vegetable oils such as sunflower, canola, corn, soya, olive and flaxseed rather than animal fats, or hydrogenated vegetable oils.</td>
</tr>
<tr>
<td>3. Include fish high in poly unsaturated fatty acids, for example, sardines, tuna, salmon and herring in your diet.</td>
</tr>
<tr>
<td>4. Select fat-free, low or reduced fat milks instead of full-cream milk.</td>
</tr>
<tr>
<td>6. Buy lean cuts of meat and trim away the obvious fat before cooking or eating. Discard the skin of cooked chicken.</td>
</tr>
<tr>
<td>7. Limit consumption of high fat meat products such as sausages, bacon and processed meats.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>CONTRIBUTION TO DIET</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARBOHYDRATES</td>
<td></td>
</tr>
<tr>
<td>• Unrefined starchy foods</td>
<td>30 - 50 %</td>
</tr>
<tr>
<td>• Vegetables and fruits</td>
<td>10 – 15%</td>
</tr>
<tr>
<td>FAT</td>
<td>10 – 15%</td>
</tr>
<tr>
<td>PROTEIN</td>
<td></td>
</tr>
<tr>
<td>• If Animal-based diet</td>
<td>5 - 10 %</td>
</tr>
<tr>
<td>• If Plant-based diet</td>
<td>20 – 30%</td>
</tr>
</tbody>
</table>

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 energy from carbohydrates and fats, or transform the protein into lean body mass.

Not everyone is equally vulnerable and needs 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 the 20th 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 antioxidants 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 dissolve in fat and excess amounts can be stored in the body. Water soluble vitamins dissolve in water and excess amounts cannot be stored in the body. The fat soluble vitamins of importance are Vitamin A, Vitamin D, Vitamin E, and Vitamin K. Vitamin B₁ (Thiamine), Vitamin B₂ (Riboflavin), Vitamin B₃ (Niacin), Vitamin B₆, Vitamin B₉ (Folic acid), Vitamin B₁₂, Vitamin B₅ (Pantothenic acid), Vitamin B₇ (Biotin), and Vitamin C (Ascorbic acid) are important water-soluble vitamins.

Some benefits of an 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 ensure proper functioning of organs 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 nutrient 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. It is an important component of the visual function of the retina of the eye and therefore ensures good vision. It is required for the maintenance of epithelial cells, mucous membranes, and skin. It is also needed for immune system function and preventing resistance to infections.

4.1.1.2 Current Situation in Ghana

The prevalence of vitamin A deficiency is high among children and pregnant women. Vitamin A deficiency affects 72% of the country’s under five population 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 between 2005 and 2014 will be 104,300 (9). Vitamin A deficiency accounts for close to 12% of all clinical attendance by 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 because Vitamin A is fat soluble.

Most Ghanaian diets are made of staple foods such as cereals, starchy roots and tubers with little fruits and vegetables. Fruits and vegetables provide the requisite micronutrients in the diet. Insufficient intake of fruits and vegetables results in micronutrient deficiencies including Vitamin A. Vitamin A deficiency slows down growth in children and increases the susceptibility of women, children, and pregnant and lactating women to disease and infection. It also causes night blindness. A severe deficiency state can result in death through other conditions.

Some 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 reduces infant and child mortality in certain populations. Vitamin A supplementation reduces case fatality rates from measles (12). Vitamin A deficiency reduces the ability to see in dim light, which is called night blindness. More severe forms of deficiency causes xerophthalmia. Vitamin A deficiency also increases 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 intake of 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 older children. Children 6-59 months should receive an appropriate 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 at risk children 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 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. Minerals cannot be synthesised by the body. They assist in nerve transmission, 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 large amounts (i.e. in milligram to gram quantities). 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

Minerals such as calcium, iron, potassium and sodium are contained in almost every food. 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 are iron, zinc and iodine. The deficiency states are associated with morbidity and mortality of children and women especially pregnant and lactating 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 assists 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
- 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 the WHO cut-off point. Anaemia was also found among 65% of pregnant women, which has implications for maternal mortality. Ghana has an unacceptably high maternal mortality rate of 214-740/100,000 live births and 20% of this figure is attributed to anaemia (9).

Pregnant women, breast feeding and new mothers, infants 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.

Iron deficiency is most frequently caused by poor dietary intake of iron. It can also occur as a result of malaria, helminth infection 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 increased risk of maternal mortality due to 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 or 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. An iron deficiency state could therefore pose severe health consequences. Hence, for a healthy and productive life, it is important that 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 of age should be exclusively breast fed. 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 recipes/meals such as weanimix porridge, groundnut cake, (kulikuli) fried bean cake (koose), soy bean milk, grilled liver and others.

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 to them.

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

Women of reproductive age: Women up to the age of menopause lose blood every month which makes them vulnerable to iron deficiency anaemia. It is important that adolescents and women during this reproductive period ensure their 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 structure at the front part of the neck just below the voice box.

Iodine deficiency disorders (IDD) are the world’s single greatest cause of preventable brain damage and they cause a range of nervous system disorders. Iodine deficiency also contributes to an increased number of child deaths, including 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. This may be due to soil nature, flooding, leaching, etc., resulting in low levels of iodine in locally grown foods and 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 rates, respectively. Results from various studies worldwide show that 3% of all children born to iodine deficient mothers will be cretins, 10% will be severely mentally retarded and 87% will present some degree of intellectual deficit. With the appropriate intervention of salt iodization and universal consumption, productivity losses due to iodine deficiency of USD 1.1 billion could be prevented between 2005 and 2014 (9). Over 296,000 children in Ghana can be saved from various forms of mental retardation over the next ten years (9).

4.2.2.3 Effects on Health

Insufficient iodine in the body causes the thyroid to work hard to trap more, resulting in an enlarged gland, known as goitre. Other symptoms of iodine deficiency are chronic fatigue, reduced immune function, dry skin and sometimes puffiness of the face. In moderate forms, iodine deficiency causes mental retardation and in severe forms results in cretins. The damage caused during pregnancy may be permanent in the child. Therefore, preventing iodine deficiency is important. It is vital to ensure that all women of child bearing age are not iodine deficient.

4.2.2.4 Recommendations

All segments of the population, especially children and women, are affected by iodine deficiency disorders and for that matter need to consume foods rich in iodine. Sea foods are the richest sources of dietary iodine.

It is also recommended that all households should use salt that is fortified with potassium iodate, i.e. iodated salt.

Micronutrients and the Aged

In Ghana, many policies and strategies in fighting malnutrition are focused on women, children, people living with HIV/AIDS and people of reproductive age. The aged are often left out. Unlike the developed countries where homes for the aged exist, there are no such facilities in Ghana. The management of the aged is therefore left in the hands of those in the household, who may not have the requisite knowledge of their nutritional needs.

As people age their taste buds deteriorate. To compensate they may prefer very sugary or salty foods. They also tend to eat less and therefore take in fewer calories and smaller amounts of important nutrients. In addition, it becomes very difficult for the body to digest and absorb certain vital nutrients.

4.3 General Recommendations for Micronutrients

Eat plenty of fruits and vegetables that are rich in anti-oxidants. Anti-oxidants neutralize the effect of free radicals. Examples include foods rich in Vitamin A, Vitamin C, Vitamin E, Zinc and Selenium (refer to appendixes I & II for sources).
Do not smoke or abuse alcohol since this may interfere with nutrient absorption and may cause other complications.

Exercise regularly to maintain strength, bone density, balance, flexibility, mobility and general well being. Examples include brisk walking, jogging, and body weight exercise (squats, leg lifts and arm raising.)

Take up activities that are good for the heart and lungs such as swimming and gardening. Caution: Remember to begin any new exercise gently to avoid injury.

Micronutrients such as Vitamin A, Vitamin C, Vitamin E, Zinc and Selenium have anti-oxidant effects that keep the cells and tissues in the body healthy and slow down aging. Appendix II shows the role and important functions of both vitamins and minerals.

Oxidation and other metabolic processes in our bodies produce a lot of free radicals that damage cells or cause them to degenerate. This degeneration of cells causes the tissues and organs in our bodies to age by reducing their efficiency and results in overall aging.

Free radicals, therefore, accelerate aging and make the aged more vulnerable to diseases and other related conditions such as cardiovascular diseases, diabetes, stroke, and fractures.
5. WATER

5.1 Introduction

Water is an essential component of the human body. It is needed for proper digestion, nutrient transport and absorption, chemical reactions, excretion, muscle growth and athletic performance to name a few. In fact, it is said that “water is life and life is water”. People can stay without food for several weeks but most people cannot stay without water for more than a few days. The normal body is made up of 70-75% of water. This should be maintained in order to keep all body processes in balance. The development of an appreciation for the daily amount of water each person has to take for healthy living is essential to a healthy lifestyle.

5.2. The Importance and Benefits of Water to the Body

Most of the environment inside our body is occupied by water. Without water the body cannot perform its functions which will lead to serious consequences. The importance of water in our body is indicated by the following:

- Serves as a medium for all body processes
- Transports nutrients and other substances throughout the body
- Removes and flushes waste materials out of the body
- Aids digestion
- Quenches thirst, which is a dehydration crisis that should be avoided
- Lubricates joints and organs
- The fastest hydration agent
- Regulates body temperature

5.3 Current Situation in Ghana

There are several sources of water in Ghana including springs, pipe borne water, bore holes, rain water, deep wells, ponds, rivers, streams, dams, and lakes. The most important issue whether they are all safe to be used in our daily activities and specifically for drinking. It is always important to distinguish between safe and unsafe water. Safe water does not contain germs, toxins or other harmful materials.

Sources of affordable, potable, drinking water are a problem in Ghana. According to the Water and Sanitation Sector monitoring platform (2008), the proportion of the population that uses improved drinking water was 74% as at 2006. This means about 5.7 million Ghanaians did not use improved drinking water. Access to improved drinking water by urban and rural population was 79% and 68%, respectively. It should be noted that these figures did not take into consideration the distances and the drudgery people go through before having access to water. Access to urban water declined from 86% to 79% from 1990 to 2006. In the rural areas access to improved water showed remarkable and consistent progress over the same period. However, increases after that period have not been consistent nor significant. These figures indicate that there are still a proportion of Ghanaians who do not have access to safe drinking water and therefore, continue to drink from unimproved water sources which include ponds, dams, lakes, unprotected wells and springs, vendor provided water, tanker truck water, bottled and sachet water, streams, and rivers. Unimproved or contaminated water sources contain organisms that cause water-borne diseases.
like diarrhoea, dysentery, typhoid, and guinea worm. Guinea worm is still prevalent in the northern regions of Ghana.

It is important also to note that some of those who have access to potable or improved water through household pipe connections, public standpipes, boreholes, protected dug wells and springs, may contaminate the water through improper source maintenance, transportation, storage and usage.

5.4 The Effect of Water on the General Health of the Population

Water is so vital to body function to the extent that when the body is short of water, it may lead to any of several health problems such as headaches, tiredness, constipation, lack of concentration, forgetfulness, memory loss, kidney failure and finally death.

5.5 Recommendations for Water Intake

The body needs at least 3-4 litres of water, preferably at room temperature, a day. This is approximately 6-8 sachets or 8-10 glasses, or about 4-6 pito calabash a day. This should be increased when the weather is hot. At the height of the dry season people should take 8-10 sachets of water daily. From a naturopathic viewpoint it is best when more water is taken earlier in the day.

Make drinking water a priority for every member of your household, your church, your school, your friends, and your colleagues. The concept must be taught at home and in schools. Initially you will meet resistance to the new idea. People will complain about frequent urination but this change is an important step towards engendering a healthy lifestyle and improved health and longevity.

Below in appendix IV you will find a chart that can act as a guide to the daily intake of water for individuals based on age and weight. Pregnant women may require more than the recommended intake due to the increase in body temperature they experience while carrying a baby. It is also important that, in keeping with the Ministry of Health’s recommended policy of exclusive breastfeeding, for infants, from birth to 6 months, mother’s DO NOT give the infants any other liquids. Breast milk is 90% water and babies do not require water in addition to breast milk.

It is essential that the community stakeholders, including local and national government, take charge and ensure that the average Ghanaian has access to a clean source of drinkable/potable water and sanitized toilet facilities. (Chart in appendix III)

Ways to Promote the Drinking of Water

There should be adequate amounts of potable (safe) water in all communities, households, schools, transient places and workplaces among others. The populace should be sensitised on the socio-economic and health benefits of using potable water in general and specifically drinking enough potable water.

5.6 Purification and Proper Storage of Water

Most naturalists recommend pure artesian water or spring water for regular consumption. Artesian water comes from a well in a confined aquifer, Spring water emanates from beneath strata that is formed in prehistoric times, flowing naturally to the surface of the earth and collected at the spring or through a bore hole tapping the underground formation finding the spring. These sources, though available, are limited and, therefore, other sources are relied on in most places, such as streams, rivers, ponds, lakes and treated pipe borne water. However, we cannot rely just on our
sensory perceptions to test the purity of water. Water from pipes in our homes or even from pools, streams or springs may look clean and clear, but unless the correct laboratory tests are applied, we cannot be sure.

Pure water for drinking and food preparation ensures that the organs, processes and functions of the body operate at optimum levels, thus, ensuring optimum health. Therefore, there are two major areas of concern when dealing with water purity:

- Reduction of harmful chemicals, including not adding any additional minerals, vitamins or other so-called nutrients. Reduction of organisms such as bacteria, parasites, viruses, and others.

Effective methods of water purification include:

- Commercial or home-assembled filters designed to remove metals, minerals, chemicals and various pollutants. Charcoal is especially effective in removing impurities in simple, low-cost home assembled water filters (see appendix V for charcoal filtration of water).

- Distilled water is the process of steaming water until vaporization and then collecting the resulting purified water for consumption. Distill your own water or use commercial grade water used in hospitals or clinics for mixing medication meant for injection.

- Boiling may reduce levels of chlorine and organisms, but may leave an unhealthy concentration of heavy metals.

- Exposure to fresh air and/or sunlight. Air will evaporate some chemicals. The sun’s ultra violet rays kill many bacteria and energize the water. Water exposed to these sources need to be protected against dirt or harmful organisms being carried by the wind.

- Powder from crushed Moringea Oliefera seed kernels works as a natural flocculant, binding to the solids in water and causing them to sink to the bottom.

5.7. KEEPING WATER SAFE
Clean water can be contaminated at the source, through transportation, storage and use. Therefore, any attempt to keep water safe all the time should consider the safe water chain from source to usage.

5.7.1 Keeping Water Sources Clean and Safe
- Keep water sources free of refuse, weeds, animals and human excreta.
- Keep the surroundings of water sources well drained.
- Build platform/fence at a fetching point
- Avoid washing, bathing or playing around the water source.
- Keep wells covered.

5.7.2 Safe Transportation of water - Carry water safe from source to the home
- Use clean containers to fetch and carry water
- Clean the water fetching containers regularly
- Avoid using leaves and other unclean materials to stabilize water during transportation
- Avoid dipping hands in water during transportation
- Avoid using bathing buckets/containers for transportation of drinking water
- Cover water during transportation
5.7.3 Storage of Your Safe Water

If water is kept for weeks without continuously being charged with oxygen to keep its freshness, it can become stale, stink and have an unpleasant taste. If you wish to store water for several weeks, use airtight containers like bottled water that is sold in shops. Avoid containers with chemicals in the walls that could eventually dissolve and pollute the water. Alternatively, have your water aerated, since this charges it with oxygen, makes it healthier, prevents smells and tastes better. Each of the following methods will charge your water with oxygen:

- Store water in clean containers
- Use a mini-fountain to keep agitating the water with the container that exposes the water to fresh air
- Use a continuous air pump, similar to the type in fish tanks or aquariums that some people have for decorating their living rooms
- Get the water to fill in drops or drips from a good height into a container from which you fetch the water that you drink or use for cooking. Obviously, the surrounding air should be free from dust and other pollutants
- Always cover water storage containers to keep it safe from contamination
- Clean water storage container regularly and thoroughly

5.7.3.1 Safe use of water

- Use clean hands to fetch water from storage vessel or receptacle
- Fetch water with clean cups, bowl/calabash from storage containers
- Use one cup to fetch water into individual cups or other containers
- Always drink with your own cup
- Wash cups regularly
- Keep fetching cups/containers in a clean place

Drink only safe water, cover water always and avoid contaminating water during use.
6. ALCOHOLIC BEVERAGE

6.1 Introduction

An alcoholic beverage is a drink that contains ethanol (commonly called alcohol). Alcoholic beverages are divided into three general classes: beers, wines, and spirits.

Alcoholic beverages are of varied importance i.e. medicinal and disinfection, social and recreational, economic, artistic inspiration, relaxant and euphoric.

6.2 Uses & Effects of Alcohol

The effects of alcohol are as follows:

1. If taken in small quantities, alcoholic beverages have minimal health benefits such as lowering the risk of heart attack, diabetes, stroke etc
2. As Source of pleasure during social and customary gatherings among most groups
3. Initiates some customary procedures e.g. marriages

Though alcoholic beverages provide energy for the body, they do not contain any other nutrients. Excessive consumption may lead to nutrient deficiency. The mechanisms by which nutrient deficiency results from excessive alcohol intake are:

- alcoholics eat poorly, limiting their supply of essential nutrients
- interference with the nutritional process by affecting digestion, storage, utilization, and excretion of nutrients
- inhibition of the breakdown of nutrients into usable molecules by decreasing secretion of digestive enzymes from the pancreas
- impairment of nutrient absorption by damaging the cells lining the stomach and intestines and disabling transport of some nutrients into the blood
- nutritional deficiencies themselves may lead to further absorption problems. For example, folate deficiency alters the cells lining the small intestine, which in turn impairs absorption of water and nutrients including glucose, sodium, and additional folate
- alteration of nutrient transport, storage, and excretion
- decreased liver stores of vitamins such as vitamin A
- increased excretion of nutrients such as fat indicate impaired utilization of nutrients by alcoholics

Consumption of alcohol may lead to excessive energy intake and consequently lead to overweight.

Table 5 below is a guide to estimate the caloric content of various alcoholic beverages. Examples of serving volumes and their calorie content are shown for beer, wine, and distilled spirits. Alcoholic beverages supply calories with little or no essential nutrients. The amount of calories in an alcoholic beverage is increased when it is mixed with other beverages, such as sweetened soft drinks, tonic water, fruit juice, or cream.
### 6.3. Current Situation in Ghana

In general, alcoholic beverages are consumed in almost every country and at the same time the majority of countries have in place laws to regulate their production, sale, and consumption. The consumption of alcoholic beverages is widespread in Ghana, being an important item in most social functions.

There is a wide variety of alcoholic beverages ranging from beers, such as “pito” in the northern parts of Ghana, wine, like palm wine in the south, spirits including akpeteshie, a high alcoholic content beverage distilled at the cottage level, and other varieties of beers, wines and spirits produced by local breweries and distilleries. The breweries and distilleries have elaborate distribution networks that send their products to all corners of the country. A major area of concern in recent times has been the nature and content of advertisements to promote alcoholic beverages, which has led the Food and Drugs Board to introduce stringent regulations to bring some level of control into the trade.

Alcohol consumption is fast becoming a major problem in Ghana. Some people refer to the menace as “blue kiosk” because the high content alcoholic beverage, akpeteshie, is mostly sold in kiosks painted blue. This same spirit is the main component of most of the beautifully packaged and highly advertised brands of spirits in Ghana.

If not checked, alcohol consumption at the current rate poses a public health problem in Ghana. The effects can be categorized into two broad areas: health and socio-economic. For example, cardiovascular diseases, liver diseases, hepatitis, cancers, drunkenness, hangovers (blackout), amnesia, decreased immunity, foetal disorders and problems at birth among others. Also, poor interpersonal relations, depression, violent and unusual or improper behaviour, absenteeism, high medical bills, low productivity, poor and blurred vision and judgment, low esteem, and poverty are some of the effects of alcohol consumption in Ghana.
6.4 Recommendations

The Ministry of Health does not recommend alcoholic beverage consumption. If one does drink alcoholic beverages:

- It should be in moderation and with caution—moderation is defined as the consumption of up to one serving per day for women and up to two servings per day for men.
- Alcoholic beverages should not be consumed by some individuals, including those who cannot restrict their alcohol intake, women of childbearing age who may become pregnant, pregnant and lactating women, children and adolescents, individuals taking medications that can interact with alcohol, and those with specific medical conditions.
- Alcoholic beverages should be avoided by individuals engaging in activities that require attention, skill, or coordination, such as driving or operating machinery.
- Persons under 18 years should not handle or consume alcoholic beverages.
7. THE FOOD GUIDE

7.1 Introduction

A nutritionally adequate diet, previously referred to as balanced diet, is the basis of a healthy body. In Ghana many people suffer from malnutrition, both under-nutrition resulting from deficiencies in the diet and over-nutrition occurring as a result of excessive food intake.

Foods contain combinations of nutrients and other healthful substances. However, no single food contains all the nutrients our body needs. Eating a variety of foods every day can supply the nutrients our body needs. It is therefore important for all people to know how to make up a varied and nutritionally adequate diet. This can be achieved through the use of a “Food Guide”. The food guide is a tool to assist the individual / family to select foods from the different groups as shown in the 3 Food Steps illustration below.

Foods which are good sources of essential nutrients are not always the easiest to prepare, the least expensive, or the most appealing to the sense of taste. Many of them might be neglected were it not for educational efforts designed to influence food choices of the population with a view to ensure a maximal level of health, in so far as that can be done through good nutrition.

Ordinarily, at least three meals should be eaten each day following a daily meal plan, with food from each of the food groups; milk group, meat group, vegetable and fruit group and the bread and cereal group. More frequent feedings may be adopted if recommended by a health professional.

The division of food among the various meals is immaterial, except that the principle of mutual supplementation of incomplete and complete proteins should be upheld. Foods supplying low quality protein should always be consumed concurrently with some source of high quality protein.

Breakfast should be a substantial meal since it follows a prolonged period of fasting.

7.2 The Healthy Eating Steps

The 3 food steps is a food guide for making healthy choices and for planning meals. It provides possible daily food options based on Ghanaian dietary patterns and takes into account the nutrient content of these foods. Foods have been arranged into three food steps based on the recommended proportions in the meal (see diagram below). That is, the size of the step / box indicates the proportion of the food group / item in the meal. A healthy diet menu is one that consists of choices from all the steps in the right amounts.
The 3 Food Steps

**STEP 3**

**FATS, Refined Sugars and Salt.**

All types of cooking oils, margarine, meat fats, egg yolk, salad cream, avocado pear

**Intake per Person**

2 dessertspoons cooking oil/ 3 soup ladles of soup from oily seeds (palm, groundnut). 2-3 servings a day

**Refined Sugars and Salt** should be used sparingly

**Forms a Small Part of a Healthy Meal**

**STEP 2**

**Animal and Vegetable Protein**

All types of meat, fish, poultry, cheese including local cheese (wagashie), yoghurt, eggs, milk and milk products

All types of nuts, all types of beans and plant seeds: cowpeas, melon seeds (agushie, neri /wrewre) or groundnuts, etc.

**Intake per Person**

Chicken – 2 thighs; Meat – 2 to 3 matchbox sizes; Eggs-2 to 3 per week

Fish - 1 small or 1/2 palm size, Tuna - 2-3 matchbox size

Anchovies (Keta school boys): 8-10 small sizes; Beans - 3 stewing spoons

**Forms the Moderate Part of a Healthy Meal**

**STEP 1**

**Starches, Vegetables and Fresh Fruits**

**Starches** – Cereals (rice, maize, millet, sorghum, wheat), Plantain, Roots (yam, cassava, cocoyam, sweet potatoes)

**Vegetables** – okro, garden eggs, tomatoes, aleefu, ayoyo, kontomire, cassava leaves, sweet potato leaves, onions, green beans, cabbage, carrots, lettuce, bitter leaves, green pea, garden eggs (kwawunsunsuuaa)

**Fresh Fruits** – Orange, pawpaw, mango, watermelon, pineapple, apple, grapefruit, Alaasa, lemon, banana, etc.

**Intake per Person**

Starches : 3-4 servings

Vegetable : 2-3 servings

Fruit : 2-3 servings

**Forms the Bulk of a Healthy Meal**

Source: Adopted by the Ghana Dietetic Association: Courtesy Living Well With Diabetes
7.2.1 FOOD STEP 1

STARCHES, VEGETABLES AND FRUITS

Starches form the basis of most Ghanaian diets around which the rest of the meal is planned. Consuming large amounts of starchy foods means excessive energy intake which, when not utilized, is stored as fat in the body resulting in overweight and obesity. Starches, vegetables and fruits should form the bulk of the meal. It is recommended that starchy foods make up about half of the meal. Starches include cereals such as rice, corn, millet, sorghum and wheat, and roots/tubers such as yam, cassava, cocoyam, potatoes, plantain and their products. These foods supply lots of energy and some protein.

Whole grain starches contain fibre as well as some vitamins and minerals. When making choices of starchy foods, one should choose whole grains and fortified cereals like wheat, unpolished rice or fortified wheat flour whenever possible.

Vegetables and fruits, though very important, are generally not eaten in adequate amounts in Ghana. The World Health Survey 2002-2003 on fruits and vegetables found that 42% of the adult population consumed less than 5 servings of fruits and vegetables daily (14).

It has been documented that insufficient fruits and vegetable consumption is an independent risk factor for cardiovascular disease and cancers, including lung, stomach, colorectal and oesophageal cancer) An adequate consumption decreases the risk for developing chronic diseases.

The recommendation is to eat a variety of fruits and vegetables every day in order to benefit from the different vitamins and minerals each one provides. Consumption of fruits and vegetables should be varied in colour and in type (i.e. leaves, fruits and roots). Dark green leafy and orange or red vegetables and fruits are good sources of vitamins and minerals. Examples of vegetables are garden eggs, okro, kontomire, bitter leaves, salad leaves, cabbage, and carrots. Examples of fruits are orange, pawpaw, mango, watermelon, pineapple and banana.

7.2.2 STEP 2

ANIMAL AND VEGETABLE PROTEIN

In Food Step 2, animal and vegetable protein forms the moderate part of the meal. Vegetable protein sources like legumes and nuts are widely available in Ghana. They are comparatively more affordable than animal protein sources. The main source of animal protein in the Ghanaian diet is fish (15) Poultry and meat on the other hand are more expensive and are not readily available to most Ghanaians. Animal protein like fish, eggs, and meat should be eaten as often as one can afford them. Consumption of meat in moderation and lean cuts of meat should be encouraged to avoid intake of excessive amounts of saturated fats.

Plant proteins such as beans, melon seeds (agushie, neri/wrewre) or groundnuts should be eaten at least once a day or as often as you can afford them. Dry beans and soy foods are high in fibre and low in fat content. Consequently, their consumption offers benefits in the prevention of diabetes.

In general, small amounts of animal source protein should be added to plant source protein, or a fruit rich in vitamin C should be eaten with the meal to improve absorption of iron in the plant food which results in an overall improvement of nutrition.
Milk and milk products are also sources of protein. In general, milk is not consumed in large quantities in Ghana as it is not widely available and it is quite expensive. Milk is usually drunk in hot beverages such as tea, cocoa and coffee and in porridges. Children are more likely to consume milk. For adults who can afford to drink milk, the low fat or skimmed milk is recommended. Soya milk is a source of high protein and low fat. For young children, however, reduced fat milk is not recommended because of their high energy needs.

### 7.2.3 STEP 3

#### FATS

Fats are a source of energy and also provide the body with essential fatty acids such as omega-3 and omega-6, which cannot be produced by the body. However, excessive intake of fats, particularly saturated fat mainly from meat and hydrogenated fats, which are high in trans fats, have been associated with diseases such as cardiovascular disease and certain cancers, like breast, colon and prostate cancer (16). It is recommended to replace saturated fats with mono and poly unsaturated oils such as vegetable oils, fish oils and nut oils.

#### SUGAR

Sugar does not contain any additional essential nutrient beside carbohydrate. Adding a little sugar to food such as porridge enhances the taste and makes the food more enjoyable. However, large intakes of sugar, either through directly adding sugar to food or through the intake of sugary drinks and sweets, is not beneficial to health. It can result in overweight and increase the risk of tooth decay. The recommendation is to limit the intake of sugar.

#### SALT

Salt is used in cooking to enhance the taste or flavour of the food. The consumption of high amounts of salt is associated with high blood pressure, which is a risk factor for coronary heart disease and stroke. It is therefore better to prevent the onset of high blood pressure by limiting salt intake, maintaining a good weight and an overall healthy eating plan. It is better to avoid adding salt at the table to already cooked food. As a rule, always choose iodated salt for seasoning and cooking. An individual’s “taste” for salt is not fixed and, by eating foods low in salt over time, the individual can acquire the taste or preference for low salt foods. Processed foods may contain large amounts of salt so their consumption must be limited.

### Table 6 Caloric Requirements And Equivalence in Serving Numbers per day of Food Groups

<table>
<thead>
<tr>
<th>Foods</th>
<th>How many servings of each per day should you eat?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women - Children - Elderly</td>
</tr>
<tr>
<td>Calorie level</td>
<td>Aprox. 1,600</td>
</tr>
<tr>
<td>Milk Products Group</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Meat Group</td>
<td>2</td>
</tr>
<tr>
<td>Vegetable Group</td>
<td>3</td>
</tr>
<tr>
<td>Fruit Group</td>
<td>2</td>
</tr>
<tr>
<td>Bread and Cereals Group</td>
<td>6</td>
</tr>
<tr>
<td>Total Fat in grams</td>
<td>36 to 53</td>
</tr>
</tbody>
</table>
7.2.4 TIPS FOR ESTIMATING THE AMOUNT OF FOOD CONSUMED

A food serving is simply a reference amount. It helps to understand how much is recommended everyday from each of the different food groups. A serving may sometimes be close to what you eat, such as an apple. With other foods, such as rice or spaghetti, you may need more than one serving. You need enough food in a day for your body to have the nutrients it needs. How much you eat depends on a number of factors such as age, sex, weight, activity level, pregnancy or breastfeeding and any chronic disease or condition.

The following are examples of handy tips to help you estimate the serving amount of food you eat without having to measure or weigh it.

CARBOHYDRATE (STARCHY) FOODS
1 slice of bread (thickness of a radio cassette tape)
1 small bread roll
1 soup ladle porridge (*Hausa koko/corndough porridge*)
2 soup ladles or 1cup breakfast cereal
1 soup ladle or 1/2 cup cooked rice/waakye/spaghetti/macaroni/noodles
1/4 of a medium sized orange (*omotuo/banku'/etew'/tuozaafi*)
1 slice yam or 1/2 sardine tin size
1 slice kenkey or 1/2 sardine tin size (*Ga/Fante kenkey/banku'/etew'*)
1 small finger *apem* (plantain)
1/2 medium finger *apentu'* (plantain)
1 small cocoyam (like one small tin tomato size which is the 70g tin)
1 pancake (like a compact disc CD in thinness and roundness)

FRUITS
(One standard serving = approx 80gms by weight)
1 sardine tin size pawpaw/pineapple
1/6 of small watermelon
1/8 of medium watermelon
1/10 or 1/12 of large watermelon
Medium size orange/mango/apple/tangerine
1 medium finger banana
1 soup ladle or 1/2 cup chopped/cooked/canned fruit
1 soup ladle or 1/2 cup fruit juice
1 soup ladle or 1/2 cup or 15 grapes

VEGETABLES
(One standard serving = approx 80gms by weight)
2 soup ladles or 1 cup raw green leafy vegetable (cabbage/lettuce/spinach/mixed vegetables)
1/2 soup ladle other vegetables cooked or chopped raw (*kontomire/aleefu/bitter leaves/garden eggs
tomatoes/carrots/cabbage/bell peppers/string beans*)
2 stewing spoons vegetable stew
2 soup ladles vegetable soup

PLANT PROTEIN
2-3 stewing spoons beans (cooked)
2 dessertspoons or 1/2 (half) small tin tomato size groundnuts (roasted or shelled boiled nuts)
2 level dessertspoons groundnut paste

**ANIMAL PROTEIN**
- ½ average person’s palm size of fish or 1 medium whole fish
- 5 small-sized anchovies
- 2 small crabs
- 3 small snails
- 10 medium-sized shrimp
- 1 average-sized chicken
- 1 egg
- 2 match box size lean meat
- 1 ½ match box size corned beef (sliced/cut)
- 2 rounded dessertspoons corned beef (forked)
- \( \frac{2}{3} \) bar of 150 mls sweetened yoghurt
- 1 cup fat free or 1% milk (250ml)
- \( \frac{3}{4} \) cup plain non-fat or low fat yoghurt
- 1 cup artificially sweetened yoghurt
- ½ tin small full cream evaporated milk (85g)
- 1 small triangle sectioned cheese
- 1 thin slice cheese

**OILS**

*Per one person for preparing one meal*
- 2 dessertspoons of cooking oil
- \( \frac{1}{4} \) small tin tomato paste tin of oil
- 1 level teaspoon or ½ match box size margarine/she butter

**OILY SOUPS**
- 3 soup ladles groundnut or palm fruit soup

**Preservation of Food Nutrients**
- Most vegetables and grains are best consumed when steamed, because this allows the food to retain moisture, flavour and nutrients.
- Boiling is the most commonly used method for cooking beans, grains and some vegetables (stews and soups).
- Baking involves the use of dry heat in an enclosure. This retains nutrients in foods much more than boiling does. Baked foods tend to have lower calories, as compared to fried foods. Avoid over-baking vegetables, because this can destroy nutrients.
- Roasting/grilling is similar to baking but this is done on an open fire.
- Sautéing vegetables is adding a very small amount of oil to the pan and then gently browning the food. This technique is used to cook vegetables that lose a lot of moisture during cooking – e.g., mushrooms, onions and celery.

**General Points to Consider when making Food Choices**
- Choose a variety of foods especially fruits and vegetables and whole or unpolished grains.
- Fresh fruits are lower in sodium than canned fruits.
- Fresh fruits are higher in potassium, a nutrient which reduces the effects of salt on blood pressure.
• Boil, bake or roast your starches instead of frying to reduce the amount of fatty foods consumed.
• Limit intake of refined starches such as cakes, toffees, pies, doughnuts, sweetened cereals and foods and drinks rich in added sugar.
• Satisfy your desire for sweets by eating fruits.
• Drink water instead of sugared drinks to quench your thirst.

Some Important Information on Breast Feeding
• Breast milk is the ideal food for infants. Colostrum, which is the first milk produced, fights against diseases and prevents infants from gastrointestinal diseases as well as other infections.
• Few allergic reactions occur in breast-fed infants.
• Healthy eating during pregnancy and lactation contributes to successful breast-feeding.
• Losing weight after giving birth does not affect the nursing newborn's weight gain.
• Exercise does not affect the ability to successfully breastfeed.
• It is recommended to breastfeed your baby exclusively for the first 6 months of his/her life.
• Breastfeed as often as the child wants, at least 10 times during the day and night.

Complementary feeding
• Complementary feeding should start in the sixth month. Foods other than breast milk are unnecessary and not advisable during the first six months of life.
  o The following are some reasons why early introduction of solid food during the first six(6) months is to be avoided:
    ▪ Decrease in consumption of breast milk, which is nutritionally superior to all complementary foods.
    ▪ Food allergies may also develop.
    ▪ Early introduction of other foods may lead to frequent infections. Diarrhoea is said to be frequent in infants weaned before the age of six months.
• Complementary feeding recommendations vary for different age brackets and are as follows;
  • 6 months up to 9 months
    o In addition to breastfeeding as often as the child wants, feed an adequate serving of a variety of foods without pepper 3 times per day as well as 1 snack
    o Give fruit every day. Wash the fruit, mash or squeeze into juice
  • 9 months up to 12 months
    o In addition to breastfeeding, feed an adequate serving of a variety of foods without pepper 4 times per day as well as 1 snack
    o Give fruit every day. Wash the fruit, mash or squeeze into juice
    o Serve the child in a separate bowl and feed.
  • 12 months up to 2 years
    o In addition to breastfeeding, feed 3 times per day a variety of family foods with little or no pepper as well as 2 snacks in between main meals
    o Give fruit every day. Wash before eating,
    o Serve the child in a separate bowl and supervise the child when eating.
  • 2 Years and Older
    o Feed 3 times per day a variety of family foods as well as 2 snacks in between main meals.
Give fruit every day and wash before eating
Serve child separately in a clean bowl and supervise eating.

Children and adolescents should be encouraged to:
- Eat plenty of vegetables, legumes and fruits
- Eat plenty of cereals (including breads, rice, maize, millet, sorghum and wheat), preferably wholegrain
- Include lean meat, fish, poultry
- Include milks, yoghurts, cheeses and/or alternatives. Reduced-fat milks are not suitable for young children under 2 years because of their high energy needs; but reduced-fat varieties should be encouraged for older children and adolescents
- Choose water as a drink

And care should be taken to:
- Limit saturated fat and moderate total fat intake. Low-fat diets are not suitable for infants
- Choose foods low in salt
- Consume only moderate amounts of sugars and foods containing added sugars

Adults
- Eat plenty of vegetables, legumes and fruits
- Eat plenty of cereals (including breads, rice, maize, millet, sorghum and wheat), preferably wholegrain
- Include lean meat, fish, poultry and/or alternatives
- Include milk, yoghurts, cheeses and/or alternatives. Reduced-fat varieties should be chosen where possible
- Drink plenty of water
- Limit saturated fat and moderate total fat intake
- Choose foods low in salt
- Avoid alcohol; if you choose to drink, limit your intake
- Consume only moderate amounts of sugars and foods containing added sugar

Aged
- Enjoy a wide variety of nutritious foods
- Keep active to maintain muscle strength and a healthy body weight
- Eat at least three meals every day
- Care for your food: prepare and store it correctly
- Eat plenty of vegetables (including legumes) and fruit
- Eat plenty of cereals, breads, rice, maize, millet, sorghum and wheat
- Eat a diet low in saturated fat
- Drink adequate amounts of water
- Avoid alcohol, if you choose to drink, limit your intake
- Choose foods low in salt and use salt sparingly
- Include foods high in calcium
- Use added sugars in moderation

Pregnant Woman
During pregnancy the baby needs adequate nutrition to grow and develop. Thus, a pregnant woman needs to consume an additional 300 or more calories per day during the second and the third trimesters to ensure adequate growth and development of the baby (see tables 7 and 8).
Although nausea and vomiting during the first few months of pregnancy can make eating difficult, try to eat a nutritionally adequate diet and take prenatal vitamins. Here are some recommendations to keep you and your baby healthy.

Table 7 Recommended additional protein and energy intake during pregnancy

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Additional Protein Requirement (g/day)</th>
<th>Additional Energy Requirement (kcal/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>7.7</td>
<td>285</td>
</tr>
<tr>
<td>3</td>
<td>24.9</td>
<td>475</td>
</tr>
</tbody>
</table>


7.2.6 Suggested Dietary Guidelines for Pregnant Women

Prior to Pregnancy

- Eat iron-rich or iron-fortified foods (meat or meat alternatives, breads, and cereals). Include vitamin C-rich foods (e.g., oranges, mangoes, tangerines, apples, etc) to enhance iron absorption.
- Take folic acid supplements (5mg) daily.
- Eat a well-balanced diet, including 3 to 5 servings of fruits and vegetables per day, with a focus on a variety of different colours of these foods.
- Have milk or calcium-rich foods every day, with a focus on low-fat or skimmed milk products.

During Pregnancy

- Eat a variety of foods to get all the nutrients you need.
- Recommended daily servings include 7-10 servings of starches, two to four servings of fruit, four or more servings of vegetables, and three servings of protein sources (meat, poultry, fish, eggs or nuts).
- Choose foods high in fibre that are enriched such as whole-grain breads e.g. wheat bread, cereals, brown rice, wheat, fruits, and vegetables.
- Make sure you are getting enough vitamins and minerals in your daily diet while pregnant. You should take your vitamin and mineral supplements to make sure you are consistently getting enough vitamins and minerals every day.
- Eat and drink at least four servings of dairy products and calcium-rich foods a day. If your dietary intake is low, you may require calcium supplements.
• Eat at least three servings of iron-rich foods per day.
• Choose at least one good source of vitamin C every day, such as oranges, tangerines, apples, pawpaw, grapefruits, lemon, lime, fresh tomatoes. Pregnant women need 70 mg of vitamin C a day.
• Choose at least one good source of folic acid every day, like dark green leafy vegetables, black beans, or black-eyed peas. Every pregnant woman needs at least 0.4 mg of folic acid per day to help prevent neural tube defects such as spina bifida.
• Choose at least one source of vitamin A every other day. Sources of vitamin A include carrots, mangoes, pawpaw, sweet potatoes, egg yolk, and palm oil. Know that excessive vitamin A intake (>10,000 IU/day) may be associated with foetal malformations.

The extra requirements recommended can easily be met by adding nutritious snacks to the usual meal plan of the mother. The following are suggested nutritious snacks to be taken in addition to the three main meals each day.
### Table 8 Portion Size Options For Pregnant and Lactating Women

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porridge</td>
<td>1 rounded dessertspoon soya flour + 1 egg size corn dough + water for porridge + 1 dessertspoon sugar Or 4 soup ladlefuls weanimix porridge</td>
</tr>
<tr>
<td>Mashed <em>kenkey</em> and nuts</td>
<td>1 sardine tin size <em>kenkey</em> + handful or 2 dessertspoons nuts or 2 dessertspoons milk + 1 dessertspoon sugar Or 1 small level tin tomato gari (4 dessertspoons) + 5 dessertspoons milk or 3 dessertspoons groundnut</td>
</tr>
<tr>
<td>2 egg size <em>fula</em> or</td>
<td>3 small finger size fried anchovies + ½ ball <em>kenkey</em></td>
</tr>
<tr>
<td>2 sardine tin size <em>agidi</em></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Pregnant women should choose one or two portion sizes and Lactating women three or four daily*

### Table 9 Recommended Daily Choices and Portion Sizes of Essential Foods, to Ensure Adequate Intake during Pregnancy and Lactation

<table>
<thead>
<tr>
<th>FOOD GROUP</th>
<th>DAILY CHOICES</th>
<th>PORTION SIZE / FOR ONE CHOICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>All meat including bush meat</td>
<td>2 - 3</td>
<td>2 small match box size meat 1 joint average size chicken 1 medium whole fish 8 anchovies (keta schoolboys) 4 small soft crabs 1 tin 7 dessertspoonful 1 bar</td>
</tr>
<tr>
<td>Chicken and all poultry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All fish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish with soft bones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporated milk</td>
<td>1 - 2</td>
<td>2 stewing spoons 2 dessert spoons 4 soup ladlefuls</td>
</tr>
<tr>
<td>Milk powder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yoghurt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cowpea (boiled)</td>
<td>1 - 2</td>
<td>3 dessertspoons or 1/3 small Tomato tinful oil 4 soup ladles palm soup</td>
</tr>
<tr>
<td>Soya bean powder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundnut soup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palm oil and good vegetable white</td>
<td>1 - 2</td>
<td>3 dessertspoons or 1/3 small Tomato tinful oil 4 soup ladles palm soup</td>
</tr>
<tr>
<td>oils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palm soup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh fruits</td>
<td>1 - 3</td>
<td>One whole or a large slice</td>
</tr>
<tr>
<td>Vegetables of all colours</td>
<td>2 - 3</td>
<td>2 – 3 stewing spoons</td>
</tr>
<tr>
<td>Cereals, grains</td>
<td>3 - 4</td>
<td>As desired to maintain</td>
</tr>
<tr>
<td>Tubers</td>
<td></td>
<td>Expected weight gain</td>
</tr>
<tr>
<td>Plantain</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Foods to Avoid When Pregnant

- Avoid alcohol during pregnancy. Alcohol has been linked to premature delivery, mental retardation, birth defects, and low birth weight babies.
- Decrease the total amount of fat you eat to 30% or less of your total daily calories. For a person eating 2000 calories a day, this would be 65 grams of fat or less per day.
- Limit cholesterol intake to 300 mg or less per day.
8. FOOD HYGIENE AND SAFETY MEASURES

The food we eat must be processed using appropriate methods to maintain the nutrient value and at the same time ensure its palatability. It is important to note that most nutrients cannot stand high temperatures. Cooking at high temperatures for longer periods destroys nutrients and reduces their optimal benefits to the body.

Food and water safety is essential to maintain a healthy state. However, the food and water we drink can be contaminated by infective agents such as bacteria and viruses. It is therefore important to ensure proper food and water processing, preservation and storage procedures.

In Ghana, a high proportion of morbidity at Out-patients Departments is due to water and food related infections; i.e. acute diarrhoea disease, typhoid fever, and food poisoning. These are the results of poor or inadequate supply of portable water especially in rural areas, poor environmental sanitation and personal hygiene, poor handling of foods items in the market place and by food vendors.

**Recommendations for safe handling of food are as follows:**

**Making Food Hygienic**

- Wash hands with soap and dry them with a clean towel:
  - Immediately on returning home from outside
  - Before starting to cook and often during food preparation
  - Before eating
  - After each visit to the toilet
  - After "blowing the nose"
  - After cleaning a child’s bottom
  - After shaking hands at functions e.g. funerals
- Wear clean clothes when cooking
- Keep the kitchen clean and tidy
- Use clean pots & pans for measuring and/or cooking
- Wash all surfaces used for food preparation
- Wash leaves/vegetables thoroughly before adding them to meals
- Clean and wash rice, beans, etc., before cooking
- Cooked food should be eaten warm
- Use spoons, food tong/fork to serve or dish out food
- Food sellers should be neat- cover hair and wear apron
- All uncooked food eaten raw should be washed or treated properly before eaten and they should be eaten fresh
- Separate raw meat, poultry and seafood from cooked foods and those eaten raw (salads)
- Cook food in amounts that satisfy the family and avoid having surpluses
- Cook foods thoroughly and reheat all left-overs thoroughly before consumption
Food Preservation

- Handle food with care
- Keep food items in a clean, dry and well-ventilated store room
- Ensure that food commodities are kept on pallets
- Leave space between food stocks and the walls
- Ensure that the storage space is not accessible to rodents.
- Keep pests out by sealing bags and/or transferring left-over foods into tightly-sealed jars/containers.
- Keep animals away from the kitchen area
- Consume foods before their expiry dates
- Don’t store perishable foods unless proper storage facilities are available
- Don’t leave food commodities in open containers
- Don’t leave food commodities in the rain or sun
- Don’t use hooks or drop the bags to avoid damaging them and causing food leakages
- Don’t litter the storeroom and its surroundings
- Don’t place food items with non-food items (soap, shovels, buckets, etc) in the same room
- Don’t allow sick people to enter the storage area

Remember the five (5) keys to safer food

1. Keep clean
2. Separate raw and cooked
3. Cook thoroughly
4. Keep food at safe temperatures
5. Use safe water and raw materials

Keep Clean, WHY?
While most microorganisms do not cause disease, dangerous microorganisms are widely found in soil, water, animals and people. These microorganisms are carried on hands, wiping cloths and utensils, especially cutting boards and the slightest contact can transfer them to food and cause foodborne diseases.

Separate Raw and Cooked, WHY?
Raw food, especially meat, poultry and seafood, and their juices, can contain dangerous microorganisms which may be transferred onto other foods during food preparation and storage.

Cook Thoroughly, WHY?
Proper cooking kills almost all dangerous microorganisms. Studies have shown that cooking food to a temperature of 70°C can help ensure it is safe for consumption. Foods that require special attention include minced meats, large joints of meat and whole poultry.
**Keep Food at Safe Temperatures, WHY?**

Microorganisms can multiply very quickly if food is stored at room temperature. By holding at temperatures below 5°C or above 60°C, the growth of microorganisms is slowed down or stopped. Some dangerous microorganisms still grow below 5°C.

**Use safe water and raw materials, WHY?**

Raw materials, including water and ice, may be contaminated with dangerous microorganisms and chemicals. Toxic chemicals may be formed in damaged and moldy foods. Care in selection of raw materials and simple measures such as washing and peeling may reduce the risk.
Five keys to safer food

Keep clean
- Wash your hands before handling food and often during food preparation.
- Wash your hands after going to the toilet.
- Wash and sanitize all surfaces and equipment used for food preparation.
- Protect kitchen areas and food from insects, pests and other animals.

Why?
While most microorganisms do not cause disease, dangerous microorganisms can quickly become foodborne illness and spread by handling raw foods.

Separate raw and cooked
- Separate raw meat, poultry and seafood from other foods.
- Use separate equipment and utensils such as knives and cutting boards for handling raw foods.
- Store food in containers to avoid contact between raw and prepared foods.

Why?
Raw foods, especially meat, poultry and seafood, and their juices, can contain dangerous microorganisms which may be transferred onto other foods during food preparation and storage.

Cook thoroughly
- Cook food thoroughly, especially meat, poultry, eggs and seafood.
- Bring foods like soups and sauces to boiling to make sure that they have reached 70°C.
- For meat and poultry, make sure that juices are clear, not pink. Ideally, use a thermometer.
- Reheat cooked food thoroughly.

Why?
Proper cooking kills microorganisms. Studies have shown that cooking foods to appropriate temperatures can help ensure their safety for consumption.

Keep food at safe temperatures
- Do not leave cooked food at room temperature for more than 2 hours.
- Refrigerate promptly all cooked and perishable food (preferably below 5°C).
- Keep cooked food piping hot (more than 60°C) prior to serving.
- Do not store food too long even in the refrigerator.
- Do not thaw frozen food at room temperature.

Why?
Microorganisms can multiply very quickly if food is stored at temperatures between 5°C and above 60°C. The growth of microorganisms is slowed down or stopped, so foods that require special attention include minced meat, uncooked joints of meat and uncooked poultry.

Use safe water and raw materials
- Use safe water or treat it to make it safe.
- Select fresh and wholesome foods.
- Choose foods processed for safety, such as pasteurized milk.
- Wash fruits and vegetables, especially if eaten raw.
- Do not use food beyond its expiry date.

Knowledge = Prevention

5 KEYS TO SAFER FOOD POSTER. Source World Health Organization, 2001
9. PHYSICAL ACTIVITY

9.1 Introduction

Every year more than 2 million deaths from non-communicable diseases (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. 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 2008) in Ghana show an increase of overweight or obesity from 12.7% to 25.3% in non-pregnant women aged 15-49 years. (7) The study also revealed that in Accra, 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, hence the need for a 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 Ghanaian Junior High School students 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 (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 the 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 (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. A 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 without falling. It helps control or manage respiratory disorders like asthma, and bronchitis, promotes psychological well-being and reduces stress, anxiety and 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 follows:
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 the number and size of air sacks in 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 health related benefits: cardiorespiratory endurance, muscular strength and endurance, flexibility and body composition. The other benefits include fitness skills like balance, agility, coordination, reaction time and speed.
For older adults, participation in regular physical activity reduces the functional declines associated with ageing and achieves other benefits of physical activity identified for all adults.

Individuals with different forms of sickness or disability should be advised regarding physical activity in their conditions. 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 complications 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 to vigorous intensity may cause the breakdown of red blood cells with the consequent release of oxygen and other components of haemoglobin e.g. bilirubin. There is a clog of such breakdown products which takes time to flow through the circulatory system. This causes an accumulation in the joints which gives rise to an inflammatory condition in the joints known as a sickle cell crisis
- The type of physical activity suitable for such a 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, reduced rate of inspiration and expiration, and general body weakness
- Physical activity is not recommended for active tuberculosis patients
- Sub acute and fully treated pulmonary TB 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 a 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 a warm-up, main work out and cool down period
6. Restore lost fluid approximately 30 minutes after intense workouts with water, or any sports drink
7. Participate in safe exercise as recommended below
8. Start with low intensive exercises of between 20% to 30% of your target heart rate or less (target heart rate HR\text{max}\text{= }220\text{-age})
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 weeks of 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 target 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 exercises)
12. Jog slowly to cool-down after every activity for the session and stretch

• 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 of exercise
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 fitness 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 (65 years and above) should follow the stated guidelines for youth and young adults, but should always exercise within their physical capacity. Aerobic activity should be performed in bouts of at least 10 minutes duration. Those in this age group with poor mobility should also do exercises that maintain or improve balance and flexibility, 3 or more days a week. When they cannot do the recommended amounts of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow..
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 40 years are prone to having osteoporosis. Therefore, their exercise selection is important and hence they should seek medical attention.

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, and 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 in squared metres. It is important to note that men have more muscle mass and larger bone structure than women.

The formula is:

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

Example;

Weight = 90 kg
Height = 1.83 m

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

<table>
<thead>
<tr>
<th>Weight/Height (kg/m²)</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 18.5</td>
<td>Underweight</td>
</tr>
<tr>
<td>19 – 24.5</td>
<td>Healthy</td>
</tr>
<tr>
<td>25 – 30</td>
<td>Overweight</td>
</tr>
<tr>
<td>30 plus</td>
<td>Obese</td>
</tr>
</tbody>
</table>

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, of exercise, especially strengthening and weight training, for 2 to 3 times in the week
2. When you want to maintain your weight:
   a. do physically active work for 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
   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 appropriate 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 about your health conditions
3. Be concerned and disciplined enough 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 as it keeps you accountable knowing 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 person.
• 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

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Importance /Role</th>
<th>Deficiency</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>Required for maintenance of epithelial cells, mucous membranes, and skin.</td>
<td>Xerophthalmia and night blindness. Increased risk of disease and infection. Common with pregnant women and infants being the most often affected.</td>
<td>Full-cream milk (when fortified), cheese, butter, red palm oil, fish oil, eggs, liver, carrots, mangoes, pumpkin, green leafy vegetables, yellow sweet potatoes.</td>
</tr>
<tr>
<td></td>
<td>Needed for immune system function and resistance to infections. Ensures good vision.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Needed for bone growth.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin B1/Thiamine</td>
<td>Used in energy metabolism, supports appetite, and central nervous system functions.</td>
<td>Beriberi, nervous damage. Other symptoms include loss of appetite, weakness.</td>
<td>Whole-grain cereals, meat, poultry, fish, liver, milk, eggs, oil, seeds, and legumes.</td>
</tr>
<tr>
<td>Vitamin B2/Riboflavin</td>
<td>Used in energy metabolism, supports normal vision, health and integrity of skin.</td>
<td>Dry and scaling skin. Eyes may become bloodshot, itchy, watery and sensitive to light.</td>
<td>Milk, eggs, liver, meat, fish, yogourt, green leaves, whole-grained cereals, and legumes.</td>
</tr>
<tr>
<td>Vitamin B3/Niacin</td>
<td>Essential for energy metabolism, supports health and integrity of skin, nervous and digestive systems.</td>
<td>Pellagra. Other symptoms include irritability, mild diarrhoea, skin rashes, loss of appetite, weakness.</td>
<td>Milk, eggs, meat, poultry, fish, peanuts, whole-grained cereals, unpolished rice.</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>Facilitates metabolism and absorption of fats and proteins, converts tryptophan to niacin. Helps to make red blood cells.</td>
<td>Oily, flaky skin, cracked lips, nausea, diarrhoea. Can usually occur babies fed with infant formula. Also, some TB drugs cause B6 deficiency.</td>
<td>Legumes (white beans), potatoes, meats, fish, poultry, shellfish, watermelon, oil seeds, maize, avocado, broccoli, green leafy vegetables.</td>
</tr>
<tr>
<td>Folate</td>
<td>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.</td>
<td>Megaloblastic anaemia. Some symptoms include, shortness of breath, heartburns, pale skin.</td>
<td>Liver, green leafy vegetables, fish, legumes, groundnuts, oil seeds.</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>Required for synthesis of new cells, helps to maintain nerve cells. Works together with folate.</td>
<td>Peniculous anaemia, Nervous damage, inflammation of tongue and mouth.</td>
<td>Meat, fish, poultry, shellfish, cheese, eggs, milk.</td>
</tr>
<tr>
<td>Pantothenic acid</td>
<td>Forms part of Coenzyme A, used in energy metabolism.</td>
<td>Deficiency is rare because the vitamin is made by the body.</td>
<td>Widespread in foods</td>
</tr>
<tr>
<td>Biotin</td>
<td>Forms part of a coenzyme used in energy metabolism, fat synthesis, amino acid metabolism, and glycogen synthesis.</td>
<td>Inflammation and increased sensitivity. Hair loss, muscle pain, nausea</td>
<td>Widespread in foods</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>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</td>
<td>Scurvy, leading to muscle weakness, joint pains, poor healing of wounds, bleeding and swollen gums.</td>
<td>Citrus fruits such as orange, tangerine, lemon, grape fruits, and also in baobob, guava, pineapple, pawpaw, mangoes; Vegetable; cabbage, green</td>
</tr>
<tr>
<td>Nutrients</td>
<td>Importance /Role</td>
<td>Deficiency</td>
<td>Source</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>Required for mineralization of bones and teeth.</td>
<td>Softening of the bones, a condition called osteomalacia in adults and rickets in children.</td>
<td>Produced by skin on exposure to sunshine, milk, butter, cheese, fatty fish, eggs, liver.</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>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.</td>
<td>Very rare, but deficiency may cause nervous problems.</td>
<td>Green and leafy vegetables, vegetable oils, wheat germ, whole-grain products, butter, liver, egg yolk, peanuts, milk fat, nuts, seeds.</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>Essential in blood clotting.</td>
<td>Bleeding from mouth, genital and urinary tract, intestines and skin.</td>
<td>Cabbage, carrot, avocado pear, spinach, peas.</td>
</tr>
</tbody>
</table>

acts as an antioxidant. Important for protein metabolism.
leaves, tomatoes, peppers.
## APPENDIX II   MINERALS, IMPORTANCE AND SOURCES

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Importance / Role</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>Helps:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ to build strong bones and teeth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ with bone formation and for bone density</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ the heart to beat Keeps the muscles healthy and helps them contract</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Milk, Dairy products, Sardines, Spinach, Fortified, cereals, Fortified margarine.</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>Helps to build strong bones and teeth</td>
<td>Meat, Poultry, Fish, Eggs, milk and legumes</td>
</tr>
<tr>
<td></td>
<td>Forms part of every cell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Important in genetic material</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forms part of phospholipids (phosphorous-containing lipids)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Used in the transfer of energy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Important in pH regulation</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>Vital to many basic metabolic functions as an activator of enzymes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aids in bone growth and the function of nerves and muscles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dark green leafy vegetables , Legumes (dried beans), Nuts and seeds, Whole grains, Milk, Wheat bran</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>Electrolyte that helps control fluid balance in cells</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aids in muscle flexing and the flow of nerve impulses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Table salt, Soy sauce, Cheese, Smoked and cured meats, Processed and canned foods</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>Electrolyte that helps control fluid balance in cells</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helps maintain pH balance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forms part of the acid found in the stomach which is necessary for digestion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Table salt, Sea foods, Milk, Meat, Eggs</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>Electrolyte that aids in the control of blood pressure and water balance in cells</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helps maintain pH balance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vital for muscle contraction and nerve impulses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helps with proper function of heart and kidneys</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Necessary for carbohydrate and protein metabolism</td>
<td></td>
</tr>
<tr>
<td>Sulphur</td>
<td>Forms part of proteins (it has a</td>
<td>All protein-containing foods , Meats, Fish, Poultry, Eggs, Milk,</td>
</tr>
<tr>
<td>Nutrient</td>
<td>Importance / Role</td>
<td>Source</td>
</tr>
<tr>
<td>----------</td>
<td>------------------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>stabilising function)</td>
<td>Cheese, Legumes, Nuts</td>
</tr>
<tr>
<td></td>
<td>Forms part of the vitamins biotin and thiamine, and the hormone insulin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Involved in body’s detoxification processes</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>Healthy blood - helps red blood cells carry oxygen</td>
<td>Fortified cereal, Dried beans, Meat, Chicken, Liver, Kidney, Egg yolks, Sea foods</td>
</tr>
<tr>
<td></td>
<td>Iron plays a role in maintaining a healthy immune system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helps with brain development and function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iron forms part of enzyme reactions that carry messages from one nerve cell to another</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>Involved in the synthesis or degradation of major metabolites such as carbohydrates, lipids and proteins</td>
<td>Meat, Fish, Poultry, Milk products, Whole grain cereals, Dried beans</td>
</tr>
<tr>
<td></td>
<td>Involved in enzyme activity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helps in the stabilization of the protein and genetic structure in cells</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Involved in communication and division of cells</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helps with maintenance of a healthy immune function</td>
<td></td>
</tr>
<tr>
<td>Selenium</td>
<td>Antioxidant properties protect against damage to cells and help maintain their health</td>
<td>Grains, Onion, Sea foods, Kidney, Liver, Meats, Vegetable</td>
</tr>
<tr>
<td></td>
<td>Involved in enzyme activities</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>Needed for the absorption and use of iron in the formation of red blood cells</td>
<td>Liver, Shellfish, Whole grains, Legumes, Kidney, Poultry, Oysters, Chocolate, Nuts.</td>
</tr>
<tr>
<td></td>
<td>Helps to form the protective covering of nerves</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forms part of many enzymes</td>
<td></td>
</tr>
<tr>
<td>Iodine</td>
<td>Forms part of thyroid hormones that helps to regulate growth, development, and metabolic rate</td>
<td>Iodised salt, Seafood, Plants grown in iodine-rich soil</td>
</tr>
<tr>
<td>Manganese</td>
<td>Component of essential enzyme system</td>
<td>Beet greens, Whole grains, Nuts, Legumes, Fruit.</td>
</tr>
<tr>
<td>Fluoride</td>
<td>Present in bone and teeth</td>
<td>Fluoridated water, Food grown or cooked in fluoridated water, Tea, Seafood.</td>
</tr>
<tr>
<td>Nutrient</td>
<td>Importance / Role</td>
<td>Source</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Helps make teeth resistant to decay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>May help to minimize bone loss</td>
<td></td>
</tr>
<tr>
<td>Molybdenum</td>
<td>Constituent of essential enzymes</td>
<td>Legumes, Cereals, Organ meats.</td>
</tr>
<tr>
<td>Cobalt</td>
<td>Part of Vitamin B&lt;sub&gt;12&lt;/sub&gt; and is therefore involved in nerve function and blood formation</td>
<td>Foods of animal origin, Meats, Milk, Dairy products.</td>
</tr>
<tr>
<td>Chromium</td>
<td>Associated the functioning of insulin and glucose metabolism</td>
<td>Whole grain cereals, Vegetable, Meat, Brewer’s yeast</td>
</tr>
</tbody>
</table>
### APPENDIX III DAILY RECOMMENDED INTAKES FOR ENERGY AND NUTRIENTS FOR GROUPS OF PEOPLE

<table>
<thead>
<tr>
<th>Sex and Age group</th>
<th>Body weight</th>
<th>Energy</th>
<th>Protein</th>
<th>Iron</th>
<th>Zinc</th>
<th>Vitamin A</th>
<th>Vitamin C</th>
<th>Folate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both sexes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-6 months</td>
<td>6.0</td>
<td>524</td>
<td>11.6</td>
<td>0(^a)</td>
<td>1.1</td>
<td>375</td>
<td>25</td>
<td>80</td>
</tr>
<tr>
<td>6 months-1</td>
<td>8.9</td>
<td>708</td>
<td>14.1</td>
<td>9</td>
<td>0.8</td>
<td>400</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>1-3</td>
<td>12.1</td>
<td>1022</td>
<td>14.0</td>
<td>6</td>
<td>8.4</td>
<td>400</td>
<td>30</td>
<td>160</td>
</tr>
<tr>
<td>4-6</td>
<td>18.2</td>
<td>1352</td>
<td>52.2</td>
<td>6</td>
<td>10.3</td>
<td>450</td>
<td>30</td>
<td>200</td>
</tr>
<tr>
<td>7-9</td>
<td>25.2</td>
<td>1698</td>
<td>25.2</td>
<td>9</td>
<td>11.3</td>
<td>500</td>
<td>35</td>
<td>300</td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-17</td>
<td>46.7</td>
<td>2326</td>
<td>42.6</td>
<td>14/32(^b)</td>
<td>15.5</td>
<td>600</td>
<td>40</td>
<td>400</td>
</tr>
<tr>
<td>Boys</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-17</td>
<td>49.7</td>
<td>2824</td>
<td>47.8</td>
<td>17</td>
<td>19.2</td>
<td>600</td>
<td>40</td>
<td>400</td>
</tr>
<tr>
<td>Women</td>
<td>55.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-59</td>
<td>2408</td>
<td>41.0</td>
<td>29/11(^c)</td>
<td>9.8</td>
<td>500</td>
<td>45</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Pregnant 3(^a) semester</td>
<td>+300</td>
<td>+6.0</td>
<td>High(^a)</td>
<td>15.0</td>
<td>800</td>
<td>55</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>breastfeeding</td>
<td>+505</td>
<td>+17.5</td>
<td>15</td>
<td>16.3</td>
<td>850</td>
<td>70</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>60 and over</td>
<td>2142</td>
<td>41.0</td>
<td>11</td>
<td>9.8</td>
<td>600</td>
<td>45</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-59</td>
<td>3091</td>
<td>49.0</td>
<td>14</td>
<td>149.0</td>
<td>600</td>
<td>45</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>60 and over</td>
<td>2496</td>
<td>49.0</td>
<td>14</td>
<td>14.0</td>
<td>600</td>
<td>45</td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>


\(^a\) 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 Females

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

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

### Suggested Meal Plan for 6-9 months

<table>
<thead>
<tr>
<th>MEAL PLAN</th>
<th>Time</th>
<th>Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 a.m.</td>
<td>Breast milk</td>
</tr>
<tr>
<td></td>
<td>7 a.m.</td>
<td>Fortified Porridge</td>
</tr>
<tr>
<td></td>
<td>10 a.m.</td>
<td>Fresh fruit</td>
</tr>
<tr>
<td></td>
<td>12 noon</td>
<td>Lunch (Semi - solid)</td>
</tr>
<tr>
<td></td>
<td>3 p.m.</td>
<td>Breast milk</td>
</tr>
<tr>
<td></td>
<td>5 p.m.</td>
<td>As at 12 noon</td>
</tr>
<tr>
<td></td>
<td>7 p.m.</td>
<td>Plain porridge</td>
</tr>
</tbody>
</table>

### Suggested Meal Plan for 9-12 months

<table>
<thead>
<tr>
<th>MEAL PLAN</th>
<th>Time</th>
<th>Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 a.m.</td>
<td>Breast feed</td>
</tr>
<tr>
<td></td>
<td>7 a.m.</td>
<td>Soya rice water</td>
</tr>
<tr>
<td></td>
<td>10 a.m.</td>
<td>Peeled pawpaw</td>
</tr>
<tr>
<td></td>
<td>12 noon</td>
<td>Lunch - beans stew &amp; Ripe plantain</td>
</tr>
<tr>
<td></td>
<td>3 p.m.</td>
<td>Plain koko</td>
</tr>
<tr>
<td></td>
<td>6 p.m.</td>
<td>Light soup + soft mashed yam</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>MEAL PLAN</th>
<th>Time</th>
<th>Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 a.m.</td>
<td>Breast feed</td>
</tr>
<tr>
<td></td>
<td>8 a.m.</td>
<td>Fortified Porridge + Bread</td>
</tr>
<tr>
<td></td>
<td>10 a.m.</td>
<td>Mashed banana</td>
</tr>
<tr>
<td></td>
<td>12 noon</td>
<td>Lunch</td>
</tr>
<tr>
<td></td>
<td>3 p.m.</td>
<td>Plain porridge</td>
</tr>
<tr>
<td></td>
<td>5 p.m.</td>
<td>Light soup + kenkey</td>
</tr>
<tr>
<td></td>
<td>7 p.m.</td>
<td>Plain porridge</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>MEAL PLAN</th>
<th>Time</th>
<th>Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 a.m.</td>
<td>Breakfast</td>
</tr>
<tr>
<td></td>
<td>10 a.m.</td>
<td>mid-morning snack</td>
</tr>
<tr>
<td></td>
<td>12 noon</td>
<td>Lunch beans stew + Rice</td>
</tr>
<tr>
<td></td>
<td>3 p.m.</td>
<td>Mid-afternoon snack</td>
</tr>
<tr>
<td></td>
<td>5 p.m.</td>
<td>Super - Light Soup + yam</td>
</tr>
<tr>
<td></td>
<td>8 p.m.</td>
<td>Bedtime snack</td>
</tr>
</tbody>
</table>
### Suggested Meal Plan for 36-60 months (3-5 years)

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 a.m.</td>
<td>Breakfast Weanimix</td>
</tr>
<tr>
<td>10 a.m.</td>
<td>Mid-morning Banana</td>
</tr>
<tr>
<td>12 noon</td>
<td>Lunch - groundnut soup + rice</td>
</tr>
<tr>
<td>3 p.m.</td>
<td>Snack doughnut</td>
</tr>
<tr>
<td>5 p.m.</td>
<td>Supper - garden egg stew + banku</td>
</tr>
<tr>
<td>8 p.m.</td>
<td>Bedtime</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 a.m.</td>
<td>Breakfast Rice porridge + bread</td>
</tr>
<tr>
<td>10 a.m.</td>
<td>Mid-morning Banana + roasted Groundnuts</td>
</tr>
<tr>
<td>12 noon</td>
<td>Lunch Palm soup + rice</td>
</tr>
<tr>
<td>3 p.m.</td>
<td>Mid-afternoon Snack</td>
</tr>
<tr>
<td>5 p.m.</td>
<td>Supper Kontomire stew + boiled Plantain</td>
</tr>
<tr>
<td>8 p.m.</td>
<td>Bedtime</td>
</tr>
</tbody>
</table>

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 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 grind 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.

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

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