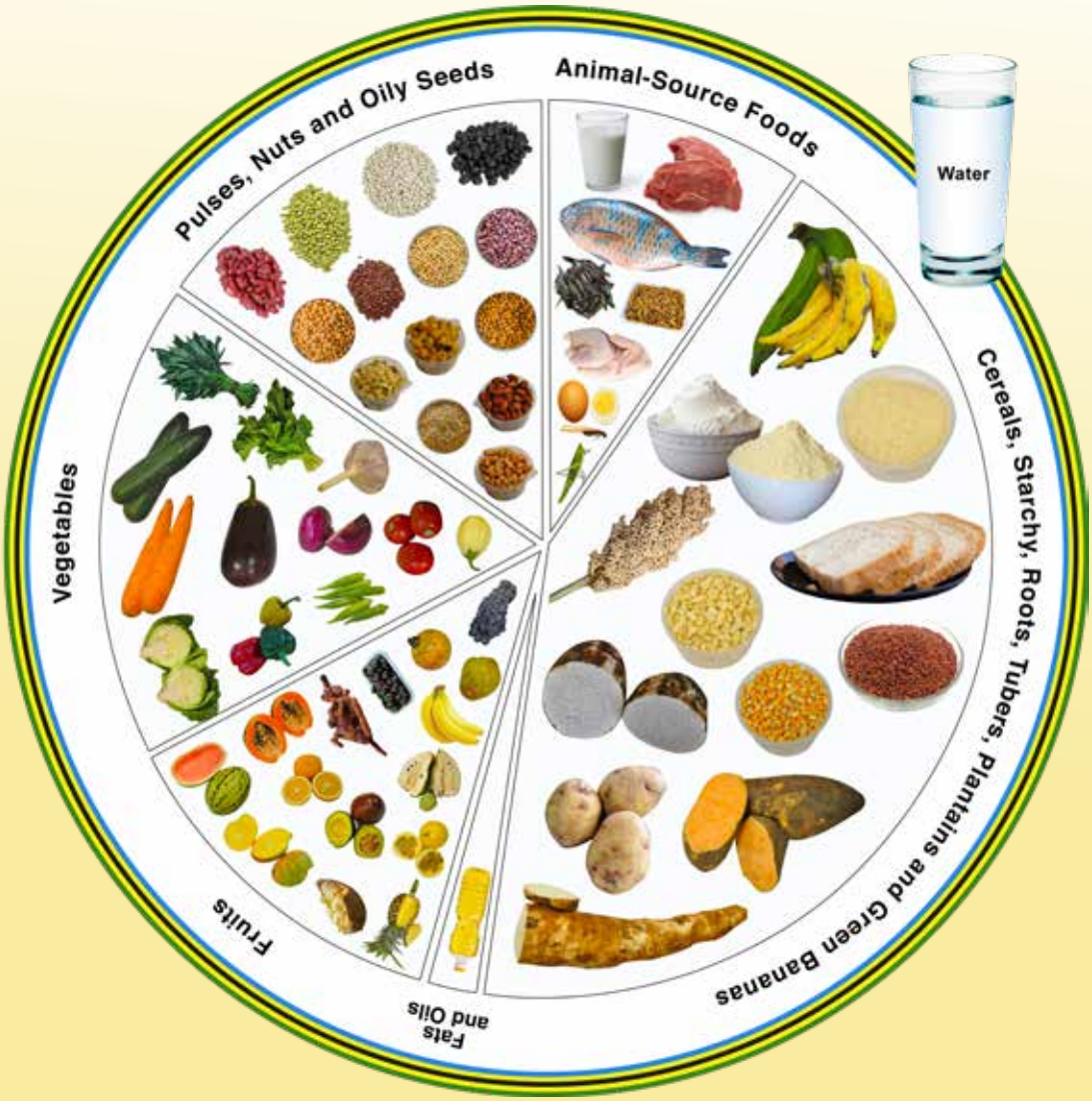
UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH




# TANZANIA MAINLAND

# Food-Based Dietary Guidelines for a Healthy Population

## Technical Recommendations

With the technical assistance of

Food and Agriculture Organization of the United Nations

# Tanzania Mainland Food-Based Dietary Guidelines

## Technical Recommendations

Ministry of Health
2023

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*Note: T = top and B = bottom*

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# ACRONYMS & ABBREVIATIONS

| | |
|---|---|
| BMI | Body mass index |
| CHD | Coronary heart disease |
| COPD | Chronic obstructive pulmonary disease |
| CSO | Civil society organization |
| CVD | Cardiovascular diseases |
| DALYs | Disability-adjusted life years |
| DRNCDs | Diet-related non-communicable diseases |
| FAO | Food and Agriculture Organization of the United Nations |
| FBDGs | Food-Based Dietary Guidelines |
| FBO | Faith-based organization |
| FCT | Food composition table |
| GDP | Gross domestic product |
| HDL | High-density lipoproteins |
| IYCF | Infant and Young Child Feeding |
| LDL | Low-density lipoproteins |
| LGA | Local government authority |
| MDAs | Ministries, departments and agencies |
| MoE | Ministry of Education |
| MoH | Ministry of Health |
| NBS | National Bureau of Statistics |
| NCDs | Non-communicable diseases |
| NCHS | National Centre for Health Statistics |
| NGO | Non-governmental organisation |
| NMNAP | National Multisectoral Nutrition Action Plan |
| PO-RALG | President's Office Regional Administration and Local Government |
| SDG | Sustainable Development Goal |

| | |
|---|---|
| STEPS | STEP-wise approach to Surveillance |
| TAHEI | Tanzanian Healthy Eating Index |
| TDHS-MIS | Tanzania Demographic and Health Survey and Malaria Indicators Survey |
| TFA | Trans-fatty acid |
| TFNC | Tanzania Food and Nutrition Centre |
| TNNS | Tanzania National Nutrition Survey |
| UNICEF | United Nations Children's Fund |
| URT | United Republic of Tanzania |
| WASH | Water, sanitation, and hygiene |
| WHO | World Health Organization |

# DEFINITION OF TERMS

**Carotenoids**: Any of the pigment molecules, typically yellow, red, and orange, that interact with chlorophylls inside chloroplasts when they absorb light primarily for photosynthesis and protection from photo-damage.

**Diet:** The range of foodstuffs (including beverages and snacks) actually consumed by an individual, household or community.

**Energy balance:** The difference between energy intake and expenditure due to physical activity, basal metabolic rate and the obligatory energy expenditure associated with digestion and processing of ingested foods. The value can be zero, positive or negative.

**Energy expenditure**: The amount of energy an individual uses to maintain essential body functions (respiration, circulation, digestion) and engage in physical activities.

**Energy intake:** The amount of energy consumed from foods and drink.

**Exercise:** Physical activity that is planned, structured and repetitive for conditioning any part of the body and used to improve health and maintain fitness. Generally, it involves an increase in heart rate and respiration.

**Food safety:** Actions taken to ensure that food will not cause harm to the consumer when it is prepared and eaten according to its intended use. Food safety entails the proper handling, cooking, and preservation of food to protect consumers from food-borne illnesses.

**Food:** Any substance consisting of proteins, carbohydrates, fats, minerals and vitamins that, when consumed by an organism, sustains growth, maintenance and other vital processes to meet physiological and psychological needs.

**Food-Based Dietary Guidelines:** Evidence-based guidelines on healthy eating habits and lifestyles aimed at providing a basis for public food and nutrition, health and agricultural policies, and nutrition education programmes. They provide advice on foods, food groups and dietary patterns to provide the nutrients necessary for health and the prevention of diet-related diseases.

**Hygiene:** A set of practices performed to preserve health and conditions that help to maintain health and prevent the spread of diseases.

**Lifestyle**: A person's way of living; the things that a person or particular group of people usually do (composed of motivations, needs, and wants) and which are influenced by factors such as culture, family, reference groups, and social class.

**Macronutrients:** A class of chemical compounds that humans get from eating food in relatively large quantities to provide energy and maintain the body's structures. The most common macronutrients are carbohydrates, fat and protein.

**Metabolic equivalent of task (MET):** A MET is a ratio of working metabolic rate relative to resting metabolic rate. Metabolic rate is the rate of energy expended per unit of time. It is one way to describe the intensity of an exercise or activity.

**Micronutrients:** Chemical elements or substances that humans get from eating food that are essential in minute amounts to orchestrate a range of physiological functions for the growth and health of a living organism. They include vitamins and minerals.

**Minerals**: Chemical elements in food required as essential nutrients by an organism to perform functions necessary for life.

**Non-communicable disease (NCD)**: A medical condition or disease that is not caused by infectious agents (non-infectious or non-transmissible). NCDs can refer to chronic diseases that last for long periods of time and progress slowly. They result from a combination of genetic, physiological, environmental, behavioural and dietary factors.

**Nutrients:** Compounds in foods essential to life and health, providing the body with energy, the building blocks for repair and growth and substances necessary to regulate chemical processes.

**Overweight and obesity:** Conditions of abnormal or excessive fat accumulation in the body that may impair health. It is usually classified using body mass index (BMI) defined as a person's body weight in kilograms divided by the square of their height in metres (BMI = $kg/m^2$).

For adults:

- Overweight is a BMI greater than or equal to 25 $kg/m^2$.
- Obesity is a BMI greater than or equal to 30 $kg/m^2$.

For children under the age of 5:

- Overweight is weight-for-height greater than 2 standard deviations above the WHO Child Growth Standards median.
- Obesity is weight-for-height greater than 3 standard deviations above the WHO Child Growth Standards median.

For children aged 5–19:

- Overweight is BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median.
- Obesity is greater than 2 standard deviations above the WHO Growth Reference median.

**Physical activity:** Any bodily movement produced by skeletal muscles that requires energy expenditure. Examples include walking, running, dancing, and doing household chores.

**Phytochemicals:** A wide variety of non-nutritive chemical compounds found in plant foods that may have health benefits. Examples include the flavonoids, phenolic acids and carotenoids.

**Portion:** The amount of food a person eats in one sitting (whether at home, in a restaurant, or other eating places). Depending on the amount of food a person eats per meal, portion size may be one or more servings, as advised by the Food Guide.

**Sedentary behaviour:** Any waking behaviour characterized by an energy expenditure of 1.5 METs or lower while sitting, reclining, or lying. Most desk-based office work, driving a car, and watching television are examples of sedentary behaviours. These can also apply to those unable to stand, such as wheelchair users.

**Serving:** A set standard amount of food used to quantify daily recommended amounts of food as per dietary guidelines. A serving size may also represent quantities used on a Nutrition Facts label for food products. The serving size standard measure can be set using food weight or kilocalorie amounts, which are sometimes converted from food weight or kilocalorie amounts to household measures such as cups or spoons. For example, one serving can be half a cup

of cooked rice, providing 80 calories. A portion that a person eats can be the same, larger or smaller than a serving.

**Vitamins:** A group of substances needed in small quantities for the normal functioning of metabolism in the body. Vitamins usually cannot be synthesized in the body but occur naturally in certain foods.

**Vulnerable groups**: Segments of the population at risk of poor health and health care disparities. Vulnerability is the degree to which a population, individual or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters or disease.

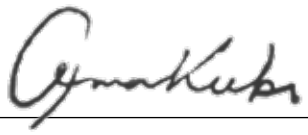
# FOREWORD

The Government of the United Republic of Tanzania is committed to improving the nutrition and health status of all population groups. This is evident in the policies, strategies, development plans and interventions aimed at reducing all forms of malnutrition in the country. Like other developing countries, the United Republic of Tanzania is experiencing multiple forms of malnutrition, leading to impaired cognitive development, reduction in learning abilities, and negatively impacting labour productivity. Although there is good progress in reducing the prevalence of stunting, the rapid increase in overweight and obesity adds a new dimension to the strategies for addressing malnutrition. Some of the contributing factors to this scenario include changing consumption patterns and lifestyles, especially of those living in urban areas.

In response to this, the Ministry of Health, through the Tanzania Food and Nutrition Centre (TFNC) and the Food and Agriculture Organization of the United Nations (FAO), has developed the first national Food-Based Dietary Guidelines (FBDGs) for a Healthy Population through a broad consultative process. The information collected through a literature review generated an evidence report that showed gaps and needs for guidelines. FAO supported this process by providing financial and technical assistance.

These FBDGs Technical Recommendations manual serve as the official document addressing the principles and recommendations of a healthy diet and lifestyle. It will be an important tool to support food and nutrition information and educational activities in the country. The manual complements the existing efforts done through (i) nutrition-specific and nutrition-sensitive interventions, (ii) guidelines on improving micronutrient nutrition, (iii) Infant and Young Child Feeding Policy and Guidelines, and (iv) fortification strategies. It also supports the implementation of the National Multisectoral Nutrition Action Plan (NMNAP II 2021–2026). Furthermore, we envision that these guidelines will help to strengthen the linkages between agricultural, nutrition and health.

The FBDGs Technical Recommendations manual is intended for technical people such as nutritionists, researchers, development partners, community nutrition educators, health personnel, teachers and other stakeholders working towards improving the nutrition and health status of the general population of the United Republic of Tanzania. I, therefore, urge all stakeholders to support the implementation of the FBDGs for the improved nutrition and wellbeing of Tanzanians. I believe that the FBDGs will play a key role in improving the food consumption patterns and nutrition outcomes of Tanzanians.



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The process of developing the FBDGs was led by the Ministry of Health through the Tanzania Food and Nutrition Centre (TFNC) with the support of the multisectoral FBDGs Technical Team facilitated by the National TCP Project Coordinator (Maria Ngilisho). We recognize and appreciate contributions by members of the FBDGs Technical Team from various Government Ministries including the Ministry of Agriculture, Ministry of Education, Ministry of Health, and the National Institute for Medical Research (NIMR). We also extend our appreciation to the higher learning institutions, regional secretaries, civil society organizations and the private sector for their valuable contributions.

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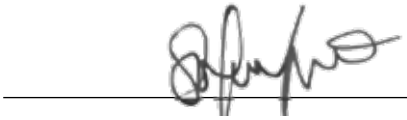

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# EXECUTIVE SUMMARY

The United Republic of Tanzania is facing multiple burdens of malnutrition in the form of stunting (34 percent), underweight (14.6 percent of children below 5 years of age and 7 percent of women) and overweight and obesity (of whom 32 percent are women). In addition, there is high prevalence of micronutrient deficiencies affecting all age groups. However, detailed information is only available for children below 5 years of age and women of reproductive age. Information for other age categories (schoolchildren, adolescents, men and the elderly) is limited. In 2015, the prevalence of anaemia was 58 percent among children and 45 percent among women aged 15 to 49. Pregnant women (57 percent) had the highest prevalence, especially pregnant adolescents.

Inadequate dietary intake and feeding practices contribute to malnutrition in the United Republic of Tanzania. The diets are inadequate in micronutrients and insufficiently diversified. Most diets are monotonous, comprising only two or three food items, sometimes from the same food group (e.g. cereals or roots and beans). Diets also tend to be extremely limited in vegetables and fruits, where the quantities consumed are relatively low compared to the recommended levels for health. The underlying causes of malnutrition in the United Republic of Tanzania include changes in eating habits and lifestyles (nutrition transition). Individuals and households are changing from consuming unrefined, traditional, healthy diets to diets that are high in calories and refined foods coupled with low physical activity levels. Consequently, there is increased prevalence of overweight, obesity, and diet-related non-communicable diseases (DRNCDs). In addition, there is over-consumption of salt, contributing significantly to the dramatic increase in hypertension (high blood pressure), which is now affecting 26 percent of adults in the age-range 25 to 64. An increase in fat intake is contributing to unhealthy accumulation of 'bad' blood lipids (also affecting 26 percent of adults). Diabetes, caused by the failure of the body to manage glucose levels in the blood, affects around 10 percent of the population. The treatment costs for DRNCDs are rapidly becoming a huge challenge for the national budget and resources of the health sector in the United Republic of Tanzania as well as households, and very little is being done to change dietary habits towards increased consumption of fruits and vegetables and reduction of sugar, salt and (unhealthy) fats. Therefore, the FBDGs will help to promote adequate intake and diversity in terms of consuming various foods from the six different food groups and limit consumption of sugar, salt and unhealthy fats.

Food-based dietary guidelines are science-based recommendations to guide healthy eating and lifestyle for a healthy population. The Ministry of Health, through the Tanzania Food and Nutrition Centre (TFNC) and with technical support from the Food and Agriculture Organization of the United Nations (FAO), has therefore developed the first national Food-Based Dietary Guidelines (FBDGs) for a Healthy Population through broad consultation with stakeholders, including the public and an evidence review process. The guidelines consider the nutrient needs, availability of foods to provide the nutrients, and cultural characteristics of the people of the United Republic of Tanzania. The basic principle of the diet-based guidelines is that food

consumption should provide all nutrients needed by the population. It is envisaged that the FBDGs will guide the formulation of food and nutrition policy, agriculture production plans, food marketing strategies as well as health promotion policies related to water sanitation and hygiene, physical activities, and reduction of alcohol and tobacco consumption.

These FBDGs have been developed in line with global nutritional recommendations and complement the existing guidelines in the United Republic of Tanzania. The target audience of this FBDGs Technical Manual includes nutrition and health professionals, educators, policy makers, researchers and other stakeholders interested in promoting nutrition and health in the United Republic of Tanzania. The main purpose of the manual is to guide the target audience to deliver adequate support and counselling to the public on lifestyle behaviours and appropriate dietary practices to ensure consumption of a healthy, nutritionally adequate diet. It also aims to support policies that will promote health and prevent illnesses. The material considers good nutrition throughout the life cycle, focusing on healthy people who are without serious medical conditions or who require special diets. The FBDGs are grounded on nutrient requirements, practicality, life cycle, cultural acceptability, user-friendliness and the foods people commonly eat.

There are six main guidelines with associated recommendations in the Tanzania FBDGs (see Table 1). The first guideline encourages consumption of foods from the six food groups daily to promote health and wellbeing for all age groups. The second guideline focuses on optimal nutrition for special population groups. The third guideline focuses on limiting or avoiding consumption of foods from three food categories. The fourth guideline focuses on food safety and hygiene, the fifth one is on keeping an active lifestyle and the sixth guideline is on avoiding other risk behaviours.

The six food groups in the Tanzania Mainland FBDGs are (1) cereals, starchy roots, tubers, plantains and green bananas, (2) vegetables, (3) fruits, (4) pulses, nuts and oil seeds, (5) animal-source foods, (6) healthy fats and oils. The groups are based on the key nutrients that they supply to the diet and their contribution to a healthy life. These nutrients include carbohydrates, protein, fats/oils, vitamins and minerals.

The development of the FBDGs involved several steps, namely:

i. Planning and formation of a multisectoral technical team comprising members from various sectors in the government and non-government organizations.

ii. Situation analysis and evidence review, which generated a strong scientific backing of the issues related to nutrition and health in the United Republic of Tanzania based on credible, up-to-date sources of information for the development of the Tanzania FBDGs. This step identified key priority problems.

iii. Technical recommendations: Ranking of the identified key priority problems preceded the development of recommendations. The ranking criteria included the urgency for guidance if the problem was of significance or an emerging public health concern, and the feasibility of solving the problem through consumer messages or through the FBDGs. The key priority problems were undernutrition, inadequate infant and young child feeding, food safety and quality, lack of dietary diversity, low consumption of fruits and vegetables, high prevalence of DRNCDs, and poor sanitation and hygiene.

iv. Diet modelling using the FAO Diet Modelling package, which runs on Excel Solver, helped to identify the food groups and establish the proportions of typical quantities to meet the nutrient requirements.

v. Development of a graphic food guide as a pictorial representation of food groups showing the proportion recommended for consumption from each food group.

vi. Development of messages: Communication, marketing and behavioural sciences guided the design of the key messages for specific behaviour change based on technical recommendations generated from the scientific evidence, the gap between current norms/practices and the desired outcomes, and the feasibility of implementing actions prompted by key changes proposed in the recommendations. The process followed general rules governing the development of messages to ensure that the messages were clear and easy to understand, action oriented (including calls to action), positive and direct, short and memorable, culturally acceptable, realistic, and affordable.

vii. To ensure that the messages were clear and understandable, the team conducted field-testing of messages and the graphic food guide in selected regions involving diverse participants to capture their concerns and suggestions on the messages and graphics.

The implementation plan for the FBDGs adopts a multisectoral approach as stipulated in the National Multisectoral Nutrition Action Plan (NMNAP). The Tanzania Food and Nutrition Centre will provide overall technical support and leadership at all stages of implementation. Different institutions will play key roles in the implementation of the FBDGs. The Implementation plan outlines specific mandates, roles and functions of each of the implementing partners.

The key implementers include:

- Government ministries, departments and agencies (MDAs);
- the President's Office Regional Administration and Local Government (PO-RALG);
- communities;
- development partners;
- civil society organizations (CSOs);
- non-government organizations (NGOs) and faith-based organizations (FBOs);
- institutions of higher learning, training and research;
- private-sector institutions;
- the media; and
- political parties.

**Table 1. Summary of the dietary guidelines and recommendations**

| | Guidelines | A set of recommendations |
|---|---|---|
| 1 | Increase dietary diversity through consumption of six foods groups daily, focusing on variety within the food groups to prevent malnutrition and reduce the risk of NCDs. | **Recommendation 1.1**: Everybody, young and old, should enjoy eating a variety of foods from different food groups every day to stay healthy and strong.<br><br>**Recommendation 1.2**: Eat staples such as cereals, starchy roots, tubers, plantains or green bananas every day for a strong and active body.<br><br>**Recommendation 1.3**: Eat different vegetables every day to prevent and reduce risk of diseases.<br><br>**Recommendation 1.4**: Eat at least two types of fruit every day for better health.<br><br>**Recommendation 1.5**: Eat pulses (legumes), nuts and oil seeds every day for good health.<br><br>**Recommendation 1.6**: Eat animal-source foods every day to stay strong.<br><br>**Recommendation 1.7**: Choose unsaturated fats and oils and eat in small amounts. |

*Continued on page 5*

| Guidelines | A set of recommendations |
|---|---|
| **2** Attain optimal nutrition for pregnant and lactating mothers, infants and children to ensure the mother's wellbeing and the child's healthy growth and development. | **Recommendation 2.1**: When pregnant or breastfeeding, eat a variety of foods from the six food groups for your health and the health of your foetus or baby.<br><br>**Recommendation 2.2:** Feed your baby only breast milk for the first six months of life and no food or water because mother's milk contains all the nutrients the baby needs.<br><br>**Recommendation 2.3**: From six months, feed your baby a variety of foods from animal-source foods, pulses, fruits and vegetables and continue breastfeeding up to 2 years of age and beyond for healthy growth and development of your baby.<br><br>**Recommendation 2.4**: Give a variety of foods from the six food groups to children between the ages of 2 and 5 to help them grow to their full potential.<br><br>**Recommendation 2.5**: Provide healthy meals and snacks for school-aged children throughout the day.<br><br>**Recommendation 2.5a**: School-aged children should eat breakfast before going to school to enable them to be productive and perform well.<br><br>**Recommendation 2.5b**: Encourage school-aged children to eat healthy snacks such as fresh fruits, vegetables and nuts.<br><br>**Recommendation 2.5c:** Provide school-aged children with food when they are at school to increase their learning ability. |

*Continued on page 6*

| | Guidelines | A set of recommendations |
|---|---|---|
| 3 | Limit intake of deep-fried foods, saturated and trans fats, sugar and salt. | **Recommendation 3.1:** Limit your intake of deep-fried foods to prevent heart diseases, diabetes and obesity.<br><br>**Recommendation 3.2**: Limit intake of ultraprocessed foods to reduce cardiovascular diseases, cancer, overweight, obesity, and early mortality.<br><br>**Recommendation 3.3:** Limit intake of saturated fats and avoid intake of trans-fats to reduce the risk of cardiovascular diseases, increased cholesterol and type 2 diabetes.<br><br>**Recommendation 3.4:** Reduce intake of free sugars to prevent weight gain and dental caries.<br><br>**Recommendation 3.5**: Reduce salt intake to reduce the risk of incident stroke, fatal stroke, and fatal coronary heart disease. |
| 4 | Ensure a clean home environment and safe food and water. | **Recommendation 4.1:** Keep your home environment, food and water safe and clean to prevent diseases.<br><br>**Recommendation 4.2:** Drink clean, safe water instead of sweetened drinks every day for good health. |
| 5 | Keep an active lifestyle for optimal health and weight. | **Recommendation 5:** Be physically active every day to stay strong and maintain a healthy body weight. |
| 6 | Avoid other risk behaviours such as using tobacco and drinking alcohol to reduce the risk of diseases. | **Recommendation 6:** Avoid drinking alcohol and using tobacco to reduce the risk of diseases. |

SECTION 1

# About the Food-Based Dietary Guidelines for Tanzania Mainland

# 1. DIETARY AND LIFESTYLE PRACTICES AFFECT NUTRITION AND HEALTH STATUS

## 1.1 Nutrition indicators in Tanzania

The United Republic of Tanzania is facing a burden of malnutrition in the form of stunting, micronutrient deficiencies, underweight, and overweight and obesity.

The national surveys of 1996 to 2015 showed a high prevalence of undernutrition throughout the years, with more than one-third of children below five years of age stunted. Although the trend shows a steady decrease in stunting in children under 5 (from 50 percent in 1991/92 to 34 percent in 2015/16), the rates still remain significantly high, affecting more than three million children in this age group. Generally, it affects one in every three children by anthropometric failure (Khamis *et al*., 2020). While wasting remains stagnant at 5 percent, there is an increase in overweight and obesity among all age groups.

The Tanzania National Nutrition Survey (MoHCDGEC *et al.*, 2019) indicated that about 7 percent of women of reproductive age were underweight, and this figure has been ranging from 5 to 10 percent over decades.

Deficiency of micronutrients is also highly prevalent among children and women. The Tanzania Demographic and Health Survey and Malaria Indicator Survey (MoHCDGEC *et al*., 2016) indicated that about 58 percent of children were anaemic, with 30 percent having moderate anaemia. Higher prevalence was observed among children aged between 6 and 24 months compared to older ones. The prevalence of anaemia among women aged between 15 and 49 years was 45 percent in 2015–16, which is very high, with variations across the regions. However, the prevalence was much higher among pregnant women (57 percent) than for non-pregnant women (44 percent). Pregnant teenagers (15 to 19 years of age) had a much higher prevalence of anaemia compared to other age groups (Sunguya *et al*., 2021) (Table 2). Iron deficiency is the main contributing factor for the observed high prevalence of anaemia, mainly due to low intake of animal foods containing iron in a bioavailable form. It is possible that other population groups, for example men, the elderly and adolescents, are equally affected; however, there is limited data available for these population groups.

## 1.2 Obesity and Non Communicable Diseases (NCDs) in Tanzania

Overweight and obesity has tripled from about 11 percent in TDHS 1991–1992 to 28 percent in TDHS-MIS 2015–16 (MoHCDGEC *et al*., 2016) and 32 percent in TNNS 2019 (MoHCDGEC *et al.*, 2019). The 2012 Tanzania STEPS Non-communicable Disease Risk Factor Survey showed that 26 percent of adults were overweight or obese.

Overweight and obesity are risk factors for several non-communicable diseases such as type 2 diabetes, heart diseases, and some cancers. The same survey showed that 9.1 percent of adults had diabetes and more than 25 percent had hypertension, raised cholesterol and raised triglycerides (Mayige and Kagaruki, 2013).

## 1.3 The cost of malnutrition and NCDs

Malnutrition has implications on the attainment of at least 12 of the 17 Sustainable Development Goals (SDGs), including SDG Goal 2.

The economic cost of malnutrition is estimated to contribute up to 11 percent loss in gross domestic product (GDP) every year in Asia and Africa. Globally, GDP per capita is seven percent lower

because some of the workers were stunted in childhood (Galasso and Wagstaff, 2018). Stunted children have poor cognitive functions, impairing their school performance and achievements.

Beyond the economic losses, globally, malnutrition accounts for about 45 percent of all deaths among children below five years of age, most of which occur in low- and middle-income countries (WHO, 2021d).

Vitamin and mineral deficiencies have significant social, economic, health and life expectancy such as:

- Every year, deficiencies of iron, vitamin A and folic acid cost the United Republic of Tanzania over USD 518 million – around 2.65 percent of the country's GDP (World Bank, 2012).

- Over 27 000 infant and 1 600 maternal deaths annually attributable to vitamin and mineral deficiencies. (World Bank, 2012). Globally, iron deficiency anaemia among pregnant women contributes to 20 percent of all maternal deaths in addition to high rates of premature births, low birth weight and neonatal and infant mortality.

- Iron deficiency can also impact a child's cognitive development and slow down learning.

- Iron deficiency can cause tiredness or make a person feel weak impacting productivity for adults and older children.

Under nutrition during foetal development and early infancy has been associated with the occurrence of diet-related non-communicable diseases (DRNCDs) in adulthood (Fall, 2013; WHO, 2016a).

Overweight and obesity and diet related non-communicable diseases such as type 2 diabetes, heart diseases, and some cancers impact on life adjusted disability years and are a major cause of death among adults. According to the World Bank and the WHO, in 2019, 34 percent of deaths among adults in Tanzania was due to NCDs.

**Table 2: Nutrition indicators for Tanzania Mainland**

| Category | Rural | Urban | Total | Total (TDHS 2010) | Trend Since DHS 2010 |
|---|---|---|---|---|---|
| Stunting (6–59 months) | 38.1 | 25.0 | 34.8 | 42.0 | ↘ |
| Wasting (6–59 months) | 4.6 | 3.8 | 4.4 | 5 | ↘ |
| Underweight 6–59 months | 15.2 | 9.1 | 13.6 | 16 | ↘ |
| Overweight/obesity (6–59 months) | 3.5 | 4.1 | 3.7 | 5 | ↘ |
| Anemia (6–59 months) | 58.8 | 53.2 | 57.4 | 58.3 | ↘ |
| Consumption of minimum acceptable diet (4+ food groups) (6–23 months) | 21.3 | 38.7 | 26 | 56.8 | ↘ |
| Minimum meal frequency (6–23 months) | 41.3 | 35.8 | 40 | 33.9 | ↗ |
| Consumed Vit A rich foods (6–23 months) | 73.1 | 81.4 | 75.3 | 61.5 | ↗ |
| Consumed Fe rich foods (6–23 months) | 29.5 | 50.5 | 35.2 | 29.2 | ↗ |
| Women of Reproductive age (15–49 years) | | | | | |
| Overweight/obesity | 20.2 | 41.5 | 28.1 | 21.2 | ↗ |
| Overweight | 23.9 | 15.0 | 18.3 | 15.1 | ↗ |
| Obesity | 5.2 | 17.6 | 9.8 | 6.1 | ↗ |
| Underweight | 10.6 | 7.3 | 9.4 | 11.3 | ↗ |
| Anaemia | 44.5 | 44.1 | 44.3 | 40 | ↘ |
| Households with adequately iodized salt | 74.5 | 93.4 | 80.6 | 59 | ↗ |
| Urinary iodine concentrations WRA <100µg/l | 44.7 | 14.6 | 33.8 | Nd* | ↗ |

*Not determined

Sources: 1) MoHCDGEC, MoH, NBS, OCGS & ICF. 2016. *Tanzania demographic and health survey and malaria indicator survey (TDHS-MIS)* 2015–16. Dar es Salaam and Rockville, Maryland, USA. 2) NBS (National Bureau of Statistics, Tanzania) and ICF Macro. 2011. *Tanzania Demographic and Health Survey 2010*. Dar es Salaam, Tanzania.

## 1.4. Dietary patterns and practices

Dietary inadequacy and lack of diversity constitute a common problem and are associated with low socioeconomic status, poor levels of education, lack of understanding of the role of food in health, and acute poverty. Dietary patterns in the United Republic of Tanzania vary by age and livelihood types and are increasingly examined as predictors of disease outcomes in various settings. In addition, the foods eaten in the country vary according to agroecological zones due to differences in weather, vegetation, biodiversity and soil properties.

The diet of Tanzanians is inadequate in micronutrients and insufficiently diversified. A typical meal pattern starts with a light breakfast, followed by two hot meals that are heavily starch based. Meal frequency and food quality are reduced during the rainy season when compared to the harvest season (Ntwenya *et al*., 2015). Generally, Tanzanian food patterns are characterized by high intake of starchy foods, high frequency of consumption of vegetables (though quantities consumed are relatively low compared to the recommended levels for health), low intake of fruits and extremely limited intake of animal source foods (Safari, Timothy and Masanyiwa, 2020). The 2012 STEPS survey (Mayige and Kagaruki, 2013) showed that 97.2 percent of respondents had less than the recommended five servings of fruits and vegetables per day.

Inadequate feeding practices and limited dietary supply are known to contribute to chronic malnutrition in children. Studies have shown an increasing pattern of exclusive breastfeeding among infants and young children. However, early introduction of complementary foods is still common (MoHCDGEC *et al*., 2016; Muhimbula, Kinabo and O'Sullivan., 2019) (Table 2). Furthermore, the complementary foods lack diversity and nutrients and are low in animal-source content (Kulwa, Mamiro and Kimanya, 2015). Most children in urban settings are fed from complementary foods prepared at home. However, these consist mainly of cereals with limited micronutrient-rich foods (Vitta *et al*., 2016). Data shows that during the complementary feeding period, most children experience diarrhoea. The occurrence of diarrheal disease in the United Republic of Tanzania has been linked to contaminated water, unhygienic practices in food preparation and storage, poor environment and unsafe disposal of excreta (Kihupi *et al*., 2016; MoHCDGEC *et al.*, 2016).

A large body of evidence indicates that the long-term intake of a low-quality diet contributes significantly to most forms of malnutrition, including stunting, micronutrient deficiencies and overweight and obesity (Krasevec *et al*., 2017; Asghari *et al.*, 2017). Increasing prevalence of overweight and obesity is attributed to changes in eating habits and lifestyles, known as a nutrition transition. Individuals and households are changing from traditional meals and healthy diets to diets with calorie-dense and refined foods while adopting relatively more sedentary lifestyles with low physical activity levels.

## 1.5 Physical inactivity, alcohol intake and smoking

In addition to unhealthy diets and sedentary behaviour, other lifestyle behaviours such as smoking and alcohol intake predispose people to over weight and obesity, cardiovascular diseases, cancer, stroke, and diabetes.

### Physical activity

The fourth leading risk factor for death around the world is physical inactivity, which accounts for about 6 percent of all deaths. Overweight and obesity account for 5 percent of deaths globally. High blood pressure, tobacco use, and high blood sugar account for 13 percent,

9 percent, and 6 percent of the deaths respectively (WHO, 2009a).

Regular physical activity reduces the risk of heart disease and stroke, diabetes, hypertension, colon cancer, breast cancer, and depression (Lee *et al*., 2012; WHO, 2020a).

While most Tanzanians are physically active, a high proportion of people living in urban areas are not as active as those living in rural areas. In general, women are less active than men, and children living in urban area are especially physically inactive (Mayige and Kagaruki, 2013). According to the Global School-Based Student Health Survey report (MoHCDGEC, 2017), physical activity among Tanzanian students was low: only 27.9 percent (24.8–31.2) were physically active for a total of at least 60 minutes per day for five or more days.

The evidence from developing countries confirms that physical activity positively influences other chronic disease risk factors such as blood pressure, lipid levels, and obesity. A systematic review on the role of physical activity in prevention of hypertension (Diaz and Shimbo, 2013) reported that elimination of physical inactivity would remove between 6 and 10 percent of the major NCDs of coronary heart diseases, type 2 diabetes, breast and colon cancers, while also increasing life expectancy (although dose–response was not established) (Lee *et al*., 2012).

**Smoking**

Smoking is associated with increased risk of liver and colorectal cancer, diabetes, and general body effects, including inflammation and impaired immune function (WHO, 2021c). Furthermore, for older adults, it increases the risk of cancer, cardiovascular diseases and impaired bone health. The risk of developing diabetes is 30–40 percent higher for active smokers than non-smokers (WHO, 2021c). It increases the risks of heart disease, stroke, and cancers of the bladder, blood, cervix, colon and rectum, oesophagus, kidney, liver, and stomach (American Cancer Society, 2020). Tobacco-attributable diseases include lung and heart diseases, chronic respiratory diseases, cancers, and diabetes – all of which may increase the severity of COVID-19 (WHO, 2021c). According to the STEPS survey (Mayige and Kagaruki, 2013), tobacco users in the United Republic of Tanzania were about 16 percent, and the overall proportion of current smokers was 14.1 percent (men 26.0 percent and women 2.9 percent). Second-hand smoke exposure was reported by 17.5 percent of the studied subjects.

**Alcohol consumption**

Alcohol consumption is one of the most important risk factors for the burden of disease and injury globally. It is the third highest risk for disease and disability after childhood underweight and unsafe sex (Rehm, 2011). It is estimated to cause from 20 percent to 50 percent of all cases of cirrhosis of the liver, epilepsy, poisonings, road traffic accidents, violence, and several types of cancer. Heavy alcohol drinking also increases the risk of cardiovascular diseases (Iranpour and Nakhaee, 2019). Approximately 5 percent of the global burden of disease and injury is attributable to alcohol consumption. Globally, 7.6 percent of all male deaths in 2012 were attributable to alcohol consumption compared to 4.0 percent of female deaths. Men also have a far greater rate of the total burden of disease expressed in disability-adjusted life years (DALYs) attributable to alcohol than women: DALYs for men is 7.4 percent compared to 2.3 percent for women (WHO 2014a). In Africa, alcohol consumption has a large impact on the burden of disease and mortality, and it is estimated that in 2012 it was responsible for 6.4 percent of all deaths and 4.7 percent of DALYS lost in Africa

(Ferreira-Borges, Parry and Babor, 2017). Based on the STEPS survey (Mayige and Kagaruki, 2013), 29 percent (men 38.3 percent and women 20.9 percent) were categorised as current drinkers (i.e. drank alcohol in the past 30 days). Among the 49 percent consumers of alcohol (who drank in the past 12 months), around 11.4 percent (men 13.6 percent and women 8.2 percent) were daily drinkers.

# 2. BACKGROUND TO THE FOOD-BASED DIETARY GUIDELINES DEVELOPMENT PROCESS

## 2.1 Genesis of the FBDGs globally

In 1992, FAO and the WHO organized an international conference on nutrition which aimed to identify and encourage the use of strategies to improve nutritional wellbeing. One of the strategies in the plan of action was to promote appropriate diets and a healthy lifestyle (FAO and WHO, 1998). The plan also urged the governments to disseminate through different media the dietary guidelines and lifestyles relevant for different age groups and appropriate for each country. Food-based dietary guidelines were therefore established to encourage the production and consumption of diversified and culturally acceptable diets; that is, it recognized the need for each nation to identify public health issues related to local dietary patterns and to adopt local strategies for their resolution to improve food consumption patterns and individual wellbeing.

Since then, FAO has been supporting countries to develop FBDGs that are culturally specific and based on their nutrition situation, food availability and eating habits. The FBDGs help the countries to advocate for the reduction of several forms of malnutrition as they represent unique opportunities to impact diets and food systems. In 2021, about 100 countries had developed FBDGs, with nine countries in Africa. These countries include Benin, Gabon, Namibia, South Africa, Sierra Leone, Seychelles, Nigeria and Zambia. Other African countries that have started the process include the United Republic of Tanzania, Zimbabwe, Rwanda, Eswatini, Gambia, Ethiopia, and Botswana.

## 2.2 Rationale for the Tanzania Mainland Food Based Dietary Guidelines

There is strong evidence that undernutrition, overweight and obesity, DRNCDs, and preventable hygiene and sanitation-related morbidities are prevalent and causing harm to the Tanzanian people due to several factors.

- Poor infant and young child feeding practices, and poor hygiene and sanitation practices, adding more challenges to the already food insecure population.
- Tanzanian diet lacks diversity, with limited fruits and vegetables and animal-source foods, leading to the risk for malnutrition and DRNCDs.
- Tanzanians are not benefiting from the diverse foods the country has. Although low diversity is common, the evidence generated shows that the United Republic of Tanzania produces a diversity of crops ranging from tropical to temperate crops, depending on the elevation of the country (Ministry of Agriculture, 2017). In addition, it has the third-highest cattle population in Africa and also ranks high for other animals such as goats and chickens. However, consumption of products from animals is limited (ANSAF, 2017).
- Unequal food distribution within the household.
- Increased availability and marketing of products of low nutritional value.
- Exposure to unclear and misleading dietary information.
- Lifestyle behaviours such as physical inactivity, smoking, and alcohol and tobacco use put people

at risk of non-communicable diseases (Mayige and Kagaruki, 2013).

These multifaceted challenges highlight the need for consistent, simple and practical dietary guidance to enable populations to select healthy diets and healthy lifestyles. A diversified diet and a healthy lifestyle can reduce the risk of malnutrition, non-communicable diseases, and other illnesses while prolonging active, high-quality living with reduced health care expenditures and improved production.

Tanzania will benefit from the national FBDGs Technical Recommendations Manual as it will provide evidence-based guidance and advice to the public to encourage healthy eating and provide harmonized nutrition messages. The FBDGs will provide food-based dietary recommendations centred on six food groups as well as guidance on safe food preparation and storage, alcohol and tobacco use, and physical activity.

The Guidelines, accompanied by key recommendations and food graphics, are used to guide nutrition education and behaviour change programs. Guidelines are also needed to inform the country's food, health, agriculture, education, social protection policy development that affect food production, processing, distribution, food availability, dietary habits and consumption patterns. The guidelines also inform enabling environments that affect lifestyle patterns like infrastructure and planning.

Implementation of the FBDGs will contribute to improving the nutrition situation by addressing diet-related conditions and lifestyle-related problems. The Guidelines will also help to achieve specific outcomes of the National Multisectoral Nutrition Action Plan (NMNAP).

## 2.3 Objectives of the FBDGs

The overall objective of the Tanzania FBDGs is to promote food diversity and the improved health and wellbeing of the Tanzanian population. The Tanzania Food-Based Dietary Guidelines address the following priority problems:

- undernutrition;
- inadequate infant and young child feeding;
- low consumption of fruits and vegetables;
- low consumption of animal source foods;
- poor food safety;
- poor sanitation and hygiene;
- diet-related non-communicable diseases;
- sedentary lifestyle;
- alcohol consumption; and
- tobacco use.

The Tanzania FBDGs will therefore address the following specific objectives:

- to improve and increase nutrient intake through a diversified diet;
- to promote equal distribution of foods within the household;
- to decrease consumption of sugar, salt, trans fat, and saturated fat;
- to improve the nutritional status of infants and young children;
- to increase knowledge of nutrition and the relationship between food and health;
- to improve food safety through hygiene, sanitation, and proper food handling; and
- to promote healthy lifestyle behaviours for non-communicable disease prevention.

## 2.4 The intended targeted population

The FBDGs considered good nutrition throughout the lifecycle, and were developed for healthy people between the ages of 0 months and 65 years who are without serious medical conditions or require special diets.

The FBDGs include guidance for healthy population groups with special nutritional requirements based on their age and physiological status. These include pregnant and lactating women, children from 0 to 59 months and school-aged children from 5 to 18 years of age.

## 2.5 The intended users of this document

The FBDGs are written for various users from different sectors and professionals:

- Nutrition and health professionals, educators and other stakeholders interested in providing guidance and advice on healthy lifestyles.
- People in the field of agriculture to promote the production and consumption of diversified foods for improved nutrition, and to guide the target audience on how to convey diet-related information to the general public.
- Those who develop and implement policies and programmes to improve the nutrition status of the public, as well as those who create an enabling environment for the public to follow recommendations for healthier diets and lifestyles. This includes ministries related to nutrition, agriculture, education, food security, health, water, social welfare, industry, planning, finance, and urban planning.
- Researchers and academics that monitor the implementation of the recommendations and to gather evidence to be used for future improvement of the guidelines.
- General population with the ability to read technical documents.

The FBDGs Technical Recommendation Manual will be accompanied by a Community Manual, which will offer a simplified form of the material aimed at the general public. In addition, other tailored communication and educational materials required to convey/disseminate the FBDGs to specific end-users based on the needs of each target audience will be developed.

## 2.6 Guiding principles

The guiding principles of the FBDGs are grounded on food-based requirements developed using diet modelling tools with nutrient-specific considerations. They are informed by up-to-date science-based evidence on nutrition and health status, food consumption patterns, eating behaviours, and hygiene practices, together with international nutrition recommendations. Other guiding principles include practicality, nutrition sensitivity, cultural acceptability, user-friendliness, and food-based requirements:

### Practicality

The food guide has been designed to be as hands-on as possible for use by the public. The foods recommended are locally available, culturally acceptable, and accessible to most households. The wording of the messages and the graphics were tested to ensure they were understood and conformed to the cultural context of the users.

### Nutrition-sensitive

All the messages in the FBDGs recognize the importance of dietary diversity along the food system. None of the messages can be achieved without linking nutrition to agriculture, health, and other sectors relevant to nutrition.

**Cultural acceptability**
The FBDGs take into consideration the Tanzanian cultural context based on the prevailing patterns of food intake and food habits to ensure the guidelines are acceptable for the population. Furthermore, the FBDGs were tested in three different regions in the United Republic of Tanzania through focus-group discussions to ensure that the recommendations are culturally accepted.

**User-friendly**
The information contained in the FBDGs is user friendly. The wording of the main messages and illustrations were tested for understanding and confirmed during focus-group discussions with stakeholders in the selected three representative regions in the United Republic of Tanzania.

**Food-based**
The FBDGs are grounded on food-based requirements rather than nutrient-specific considerations. The messages encourage intake of a variety of nutrient-dense foods from each group to allow for flexibility in selection of foods based on personal preferences.

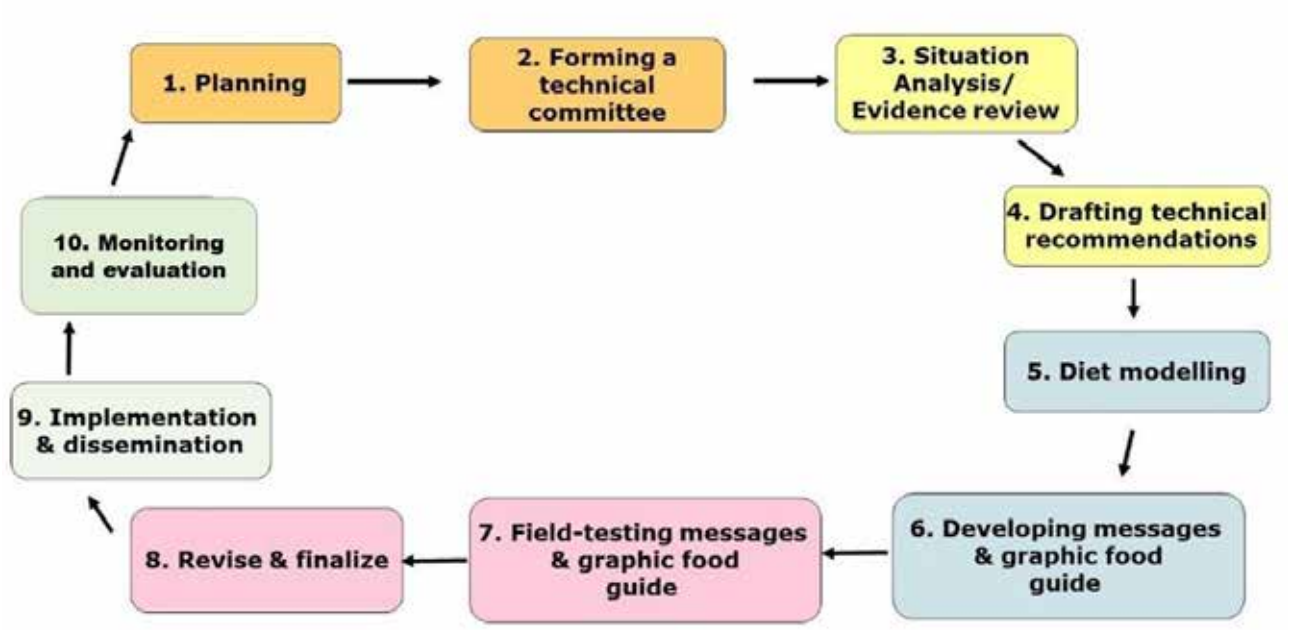
### *2.6.1 Policy framework and environment*

A conducive policy environment is necessary for smooth implementation of the FBDGs. The Tanzania Food and Nutrition Policy and Health Policy strongly support the development of the FBDGs as one of the approaches to guide healthy eating. In addition, the NMNAP, developed in 2016, is an implementation plan for the Food and Nutrition Policy. The Five-Year National Development Plan (FYNDP) 2020/21–2025/26 (Ministry of Finance and Planning, 2016) included a section on food and nutrition security. Specific interventions include the promotion of nutrition programmes focusing on lifestyle and the production and consumption of diversified, nutritious foods. Target indicators include reduction of stunting, anaemia, overweight and obesity, and improved exclusive breastfeeding.

It is anticipated that different sectors will support implementation of the FBDGs for the improved nutrition and wellbeing of Tanzanians. The FBDGs are also in line with the National Strategic Plan for Prevention and Control of Non-Communicable Diseases 2021–2026, which recognizes the importance of addressing risk factors associated with NCDs, such as reducing alcohol intake and smoking. The FBDGs will complement other existing guidelines in the United Republic of Tanzania.

# 2A THE 10 STEP PROCESS OF DEVELOPING THE TANZANIA MAINLAND FBDGS

The FBDGs were developed by the technical task team led by the Tanzania Food and Nutrition Centre (TFNC), which is a research centre under the Ministry of Health. The task team received technical guidance and support from the FAO Country Office in the United Republic of Tanzania, the FAO Subregional Office for Southern Africa Nutrition Officers, the Nutrition and Food Systems Division at FAO headquarters, and the Department of Food Technology, Nutrition and Consumer Science at Sokoine University of Agriculture in Mainland Tanzania. The development of the FBDGs followed the steps laid out in the FAO and WHO guidance manual for FBDG development (FAO and WHO, 1998).




Source: Pena, M. & Molina, V. 1999. *Food-based dietary guidelines and health promotion in Latin America*. Washington, DC, PAHO and Insitute of Nutrition of Central America and Panama.

**Figure 1: FDBGs development process**

### 2A.1 Planning and forming a technical committee

A multisectoral technical task team comprising members from various sectors in the government and non-government organisations (NGOs) was recruited and trained on the process of developing and using the FBDGs. The technical task team consisted of 26 experts from various institutions, including the Ministry of Health, the Ministry of Agriculture, the Ministry of Education, research institutions, academia and NGOs. The trainers included technical experts from FAO. After training and orientation, the team started gathering evidence, which was a significant step in the process.

### 2A.2 Situation analysis and evidence review

The technical task team conducted a situation analysis and evidence review to generate a strong scientific backing for the issues related to nutrition and health in the United Republic of Tanzania based on credible, up-to-date sources of information. The review included all published and specific grey literature related to the topics. Some of the topics covered in the review included nutrition and health status, food systems, food consumption behaviour and dietary patterns, global guidelines and recommendations, lifestyle behaviours associated with nutrition and health, and food and nutrition-related policies. Each of these topics formed a chapter in the review document. From each chapter, the team identified possible priority problems to be addressed in the FBDGs.

After the review exercise, a validation workshop was conducted to validate the evidence, to review documents, to generate a list of priority problems to be addressed in the FBDGs and to draft a list of technical recommendations. The workshop involved a broad range of key stakeholders from different government and non-government organisations who are interested in nutrition.

The evidence review was done in 2018 and updated in 2021 to include other relevant documents published between 2018 and 2021. The updated review included studies on published studies on adolescents and on the link between NCDs and COVID-19. The priority problems remained the same in the updated review, therefore the recommendations remained the same. Nutritionists from FAO headquarters and the subregional and country offices provided technical guidance throughout the evidence review process and reviewed the document.

### 2A.3 Development of technical recommendations

The process of developing technical recommendations was preceded by a ranking of the identified priority problems. The ranking exercise was based on the urgency for guidance, based on an assessment of whether the problem was of significance or was an emerging public health concern that could be addressed through consumer messages in the FBDGs or through implementation of FBDGs in various sectors and settings.

The six priority problems identified were undernutrition, inadequate infant and young child feeding, food safety and quality, lack of dietary diversity, low consumption of fruits and vegetables, high prevalence of DRNCDs, and poor sanitation and hygiene. Each priority problem was analysed critically by looking into the nutrients, foods contributing to those nutrients, and consumers' knowledge, attitudes and practices related to the problem. In addition, a total of 24 technical recommendations to solve the problems were developed. Similar recommendations were combined, rephrased and ranked to select eight

draft technical recommendations to guide formulation of messages (Appendix 1).

### 2A.4 Diet modelling

Diet modelling is a useful tool for formulating optimised diets that meet certain nutrient criteria while being as close as possible to current food habits. A diet-modelling workshop was conducted to decide on population energy and nutrient goals for calculating energy requirements, establishing food groups, and the proportion of typical quantities to be consumed. The FAO technical team used the FAO Diet Modelling package, which runs on Excel Solver, to carry out the diet modelling. Diet modelling helped to establish the proportion of food groups for presentation in the graphic food guide aimed at providing the general population with a visual and practical guide for the selection of foods to best meet their nutrient requirements. Food guides/graphics are usually based on current nutrition recommendations, information about foods commonly consumed by the target population, and nutrient content of those foods.

### 2A.5 Developing messages and the related visual illustrations

With technical support from Stellenbosch University in South Africa, key messages for specific behaviour change were developed based on technical recommendations generated from scientific evidence, the gap between current norms/practices and the desired outcomes, and the feasibility of following actions prompted by key changes. Communication, marketing and behavioural sciences guided the design of the FBDGs messages. In addition, visual illustrations for each message and a graphic food guide with images of the food groups were developed. General rules governing the development of messages were followed to ensure that messages are clear and easy to understand, are action oriented (with call-to-action where appropriate), use direct tone/verb, are short and memorable, are culturally acceptable, and are positive, realistic, and affordable.

The messages and visual illustrations included general food-related messages for everybody, with specific messages for pregnant women, lactating women, infants, and schoolchildren. In addition, messages related to sanitation and hygiene, avoidance of smoking, limiting of alcohol consumption, and encouraging physical activities were included.


### 2A.6 Field testing of messages and related illustrations

Key messages were translated into Kiswahili and, together with the visual illustrations, were tested in three regions in Tanzania Mainland, namely, Iringa, Mwanza and Dar es Salaam. A total of 24 focus-group discussions were conducted, with the respondents being women of reproductive age. Data was transcribed and translated into English then summarised and analysed. In January 2021, a workshop was held with the technical task team to review the results of the analysis and adjust the key messages, illustrations and the graphic food guide based on suggestions received during the

field testing. There were slight changes in the wording of some of the messages and in the illustrations to improve clarity. The second round of message testing involved similar groups of women in two wards of Ubungo district in Dar es Salaam region. This was specific for the visual illustrations and for messages related to vegetable consumption, packed lunches for school children, and safe, clean water. The messages were revised accordingly and validated in a workshop that involved different stakeholders.

### 2A.7 Drafting and review of the FBDGs

An FAO consultant drafted the FBDGs document with support from the technical team under the leadership of the TFNC. The FAO nutrition officers from the Tanzania Office, the FAO Subregional Office for Southern Africa, and the Food and Nutrition Division at FAO headquarters reviewed the document and provided suggestions for improvement. Suggestions and corrections were incorporated into the final document before validation. Stakeholders commented on the document during a validation workshop conducted in October 2021. Minor revisions were incorporated after the workshop. The document was finally professionally edited, typeset, printed and launched as an official document in a national forum.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SECTION 2

# Guidelines and recommendations

# 3. INTRODUCTION TO FOOD GROUPS, THE FOOD GUIDE AND KEY NUTRIENTS

## 3.1 The six food groups for a healthy diet

Tanzania Mainland identified six food groups based on the key nutrients that they supply to the diet and their contribution to a healthy life. The groups are (1) cereals, starchy roots, tubers, plantains and green bananas, (2) vegetables, (3) fruits, (4) pulses (legumes), nuts, and oily seeds, (5) animal-source foods, (6) healthy fats and oils.

Consumers are encouraged to consume food items from these six food groups daily due to their nutritional value and the vital functions they play in the body. However, consumers are cautioned to take the sixth group of oils and fats in moderation because high intake of fats and oils can lead to adverse health outcomes (Hooper *et al*., 2015).

A description of the food groups, the main nutrients contained in each food group, and some examples of commonly available foods in each group are presented in Table 3.

**TANZANIA MAINLAND SIX FOOD GROUPS**

1. Cereals, starchy roots, tubers, plantains and green bananas
2. Vegetables
3. Fruits
4. Pulses (legumes), nuts and oily seeds
5. Animal-source foods
6. Healthy fats and oils

## 3.2 The food guide graphic

The FBDGs include a graphic representation of samples of foods and the proportion of foods to select from each of the six food groups daily. It presents the local foods available in all geographical locations in the United Republic of Tanzania.

The food groups are arranged according to portion sizes obtained through diet optimization modelling that meet the recommended energy and nutrients per day for each population group. The diet modelling calculated the amounts from the recommended food groups, serving sizes and the nutrients this eating pattern will provide each day for each population group. Figure 2 represents the recommended food group intakes for the general population based on 2300 calories.

The food guide graphic is represented in a 'plate' model. This represents the usual way of eating in Tanzanian culture and can easily be understood by the general population. Food guide graphics and tables for energy and key nutrients calculated from diet models for specific population groups are found in the specific sections for these population groups.

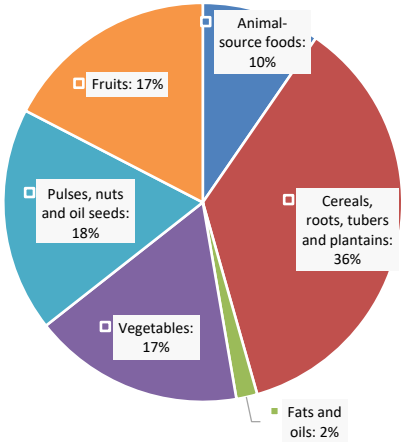



**Figure 2 Proportional contribution to total intake from each food group for the general population**

The segments on the plate model represent the proportion of each food group that should be consumed every day. Illustrated foods within each food group are a combination of available and accessible foods from all agroecological regions of the United Republic of Tanzania. Hence, availability and accessibility may be different regionally, and not all foods shown will be available to everyone.

The food guide is an educational tool to teach the public how to eat a varied diet by choosing foods across the food groups and within the food groups. This tool can also be used to inform policy makers and leaders in agriculture on what types of foods need to be cultivated to improve the nutritional status of the people.

### 3.3 Foods not included in the six food groups

Free sugars, sugar-based sweeteners, non-sugar sweeteners, salty foods and ultraprocessed foods are not part of the recommended six food groups for Tanzania Mainland because they are harmful to health if consumed in large amounts. For example, free sugars and sweeteners lack nutritive value and often replace nutritious foods. Although these categories are not a part of the six food groups, they are included in the guidelines to advise the public about the negative health impacts if consumed in large quantities.

### 3.4 The new food group system compared to the old system

In previous food consumption guidelines and education materials, for example, the Tanzania Nutrition Guideline for People Living with HIV (TFNC, 2016) and the Infants and Young Child Feeding (IYCF) Guidelines (TFNC, 2013), Tanzania used five food groups, namely: (1) cereals, green bananas, roots and tubers; (2) pulses, nuts and animal-source food; (3) fruits; (4) vegetables; and (5) sugar, honey, fats and oils.

The current FBDGs use six food groups and differ from the old food grouping system as follows:

- The additional group was created by breaking the pulses, nuts and animal-source food group into two groups – pulses and nuts, and animal-source food – to emphasize the important roles these foods play in a diet.
- Pulses, nuts, and seeds are key in reducing the risk of NCDs. In addition, pulses nuts and seeds are good sources of plant-based proteins, micronutrients and fibre and are low in fat. Animal source foods are a source of wholesome and more bioavailable protein and micronutrients.
- Furthermore, oil and fats are regarded as a food group and are separated from sugars and honey, but only a small amount is recommended for consumption. This is because a small amount of healthy oils is important for providing necessary fatty acids and helping the body absorb fat-soluble vitamins.
- Conversely, the sugar and honey group contributes to calorie intake only and is therefore not included in the food groups.

**Table 3: The six food groups, with key nutrients and examples**

| Food group | | Key nutrients | Examples of food items |
|---|---|---|---|
| **1** | Cereals, starchy roots, tubers, plantains and green bananas | Carbohydrates, fibre, protein, fat, micronutrients (when eaten as whole-grain products cereals or in biofortified or fortified form) | Maize, wheat, rice, potatoes, sweet potatoes, green bananas, plantains, cassava, yams sorghum, millet, bulrush millet |
| **2** | Vegetables | Fibre, pro-vitamin A, vitamin C, vitamin B9 (folic acid/folate), vitamin B1 (thiamine), vitamin B3 (niacin), vitamin B6, vitamin K, potassium, phytochemicals, iron | Sweet potato leaves (*matembele*), cowpea leaves, cassava leaves, amaranth leaves (*mchicha*), okra, African eggplant (*nyanyachungu*), eggplant, nightshade (*mnavu*), spider plant (*mgagani*), pumpkin leaves, kale, moringa leaves and flowers |
| **3** | Fruits | Fibre, vitamin C, vitamin A, folate, potassium, phytochemicals, sugar | Mango, papaya, pineapple, watermelon, guava, orange, soursop, avocado, passion fruit, tamarind (*ukwaju*), baobab (*ubuyu*), banana, jackfruit |
| **4** | Pulses (legumes), nuts and seeds | Protein, carbohydrates, fibre, folate, B-group vitamins, vitamin E, copper, iron, zinc, phosphorus, magnesium, selenium, calcium, manganese, phytochemicals, healthy fats (nuts and seeds) | Dried kidney beans, soybeans, cowpeas, green gram, pigeon peas (*mbaazi*), chickpeas (*dengu*), bambara (*njugumawe*), peas (*njegere*), groundnuts, sunflower seeds, pumpkin seeds, cashew nuts |
| **5** | Animal-source foods | Protein, fats, iron, vitamin A, B-vitamins, calcium, zinc, magnesium, phosphorous, selenium | Beef, mutton, goat, rabbit chicken, other poultry, mice, milk, fish, sardines, eggs, edible insects (*kumbikumbi*, *senene*) |
| **6** | Healthy fats and oils | Essential fatty acids, fat soluble vitamins | Plant oils from seeds (sunflower, simsim, groundnut), oils from fish |

Source: Lukmanji, Z., Hertzmark, E., Mlingi, N., Assey, V., Ndossi G., Fawzi W. 2008. *Tanzania food composition tables.* Dar es Salaam, Tanzania, MUHAS, TFNC, HSPH.

## 3.5 Nutrients

Food provides nutrients, which are substances that support growth and the maintenance and repair of body tissues. The classes of nutrients required for healthy body functioning include carbohydrates, proteins, lipids, vitamins, and minerals (FAO, 2004). These nutrient classes are not to be confused with the food groups discussed in this publication.

### 3.51 Carbohydrates

Carbohydrates are made up of carbon, hydrogen, and oxygen (thus "carbohydrate"). Carbohydrates are classified according to the length of the sugar chain making up the carbohydrate (polymerization). They are divided initially into three principal groups, namely sugars, oligosaccharides, and polysaccharides (FAO, 1998):

- **Sugars:** Short-chain carbohydrates with one to two chains (monosaccharides, disaccharides) and polyols (sugar alcohols). Monosaccharides are single sugars and are the building blocks from which larger, more complex carbohydrates can be made, for example, glucose, fructose and galactose, which are found mainly in fruits, honey and milk. Disaccharides are made up of two chemically joined sugar molecules, such as sucrose (a combination of glucose and fructose) and lactose (a combination of glucose and galactose) in milk. Polyols (sugar alcohols) include sorbitol and mannitol.
- **Oligosaccharides:** Carbohydrates made up of three to nine sugar chains. They include malto-oligosaccharides, principally those occurring from the hydrolysis of starch, and other oligosaccharides.
- **Polysaccharides**: Long-chain carbohydrates with more than nine chains of sugars. These are also referred to as complex carbohydrates. They include starch polysaccharides, non-starch polysaccharides, and glycogen:
    - Starches are digestible carbohydrates which the body breaks down into glucose for energy. Examples include starches in cereals, roots, tubers, and pulses.
    - Non-starch polysaccharides are carbohydrates which the human body cannot break down (digest). Examples include cellulose, hemicellulose, gums and pectin present in cell walls in vegetables, fruits, cereals (whole grains), nuts and seeds. They are also referred to as dietary fibre, which plays a very important role in human health.
    - Glycogen acts as an energy store in the body. The body makes glycogen from dietary carbohydrates.

Carbohydrates are major energy sources in all human diets. The current recommendation for dietary carbohydrate intake ranges between 55 and 75 percent of total energy (WHO and FAO, 2002). Thus, carbohydrates would provide 1265 kcal to 1725 kcal for a 2300-kcal per day diet for the general population.

Good dietary carbohydrates include whole cereal grains, pulses (legumes), vegetables and intact fruits. These foods also contain high amounts of dietary fibre. WHO and FAO (2002) further recommend that dietary intake of free sugars should be less than 10 percent of total energy.

**Dietary fibre**

Dietary fibre, while not a nutrient group but a polysaccharide carbohydrate, is nevertheless an important component of a balanced diet. Fibre, also known as roughage, includes the parts of plant foods the body cannot digest or absorb and which therefore pass intact through the digestive system. Fibre is commonly classified as soluble, which dissolves in water, or insoluble, which does not dissolve. Diets rich in fibre reduce glucose and lipids in the blood and increase the bulk of the stools, reducing constipation. The increased bulk in the diet also helps create a feeling of satiety. Dietary fibre may reduce the risk of colorectal cancer (Kunzmann *et al*., 2015). According to the Global Burden of Diseases, exposure to a diet low in fibre is defined as average daily consumption of less than 24 grams per day of fibre from all sources including fruits, vegetables, grains, and pulses (legumes) (GBD, 2019).

### 3.5.2 Protein

Protein is made up of amino acids. There are 20 different amino acids needed in the body but only nine of these must be supplied by the diet as the body is not able to synthesise these. These nine are called essential amino acids. The other amino acids can be synthesised in the body from carbohydrates, fats or other amino acids (National Research Council, 1989). The key functions of protein include:

- Helping to help build new cells.
- Aiding growth and repair of tissues.
- Forming essential components of enzymes, hormones and antibodies (for immune function).
- Maintaining the body's PH.
- Regulating water balance and hydrostatic pressure.
- Transporting material in the body, for example, haemoglobin and lipoprotein.
- Providing an energy source (4 kcal/g).

Protein requirements vary with age and physiological status; hence, children, pregnant women, and people recovering from infections and illness need more protein (WHO, 2007).

The main sources of proteins include animal-source foods such as meat, chicken, fish, milk and eggs as well as plant sources such as pulses, nuts and seeds (beans, green grams, cowpeas, peas, pigeon peas, groundnuts).

There is a difference in protein quality between animal and plant proteins. Animal proteins provide all the essential amino acids, while plant proteins are deficient in some of the essential amino acids. However, a combination of complimentary plant proteins such as whole cereals with pulses or nuts improves the protein quality, thereby providing the body with all essential amino acids (Monnet *et al*., 2019).

Protein requirements are derived as amounts per kilogram of body weight for people whose weight is within the acceptable range for height (adults) or age (children) (WHO, 2007). Recommended protein intake is 12–15 percent of energy requirement per day. For a healthy adult, it is about 0.8 g/kg of ideal body weight (for a body weight of 60–70 kg it is equivalent to 48–56 g).

### 3.5.3 Fats and oils

There are three categories of fats: unsaturated fatty acids, saturated fatty acids, and trans fats. These fats affect the body differently.

All fats and oils are a mixture of saturated fatty acids and unsaturated fatty acids (Orsavova *et al*., 2015). Vegetable oils that are liquid at room temperature contain more monounsaturated and

polyunsaturated fatty acids. Fats that are solid at room temperature contain more saturated fatty acids and/or trans-fats. Trans fats may be found in vegetable oils that have been hydrogenated to make them solid at room temperature. Trans fats are also found in vegetable oils that have been heated at very high temperatures for too long (Bhardwaj *et al*., 2016).

Saturated fats and trans fats tend to raise "bad" cholesterol levels in the blood, which in turn increases the risk of heart disease (Orsavova *et al*., 2015; Abete *et al*., 2014). In contrast, unsaturated fats, when eaten in moderation, are essential in promoting good health and preventing NCDs (FAO and WHO, 2010; WHO, 2018d).

Fats and oils provide essential fatty acids that the body cannot produce on its own and which must therefore come from the diet. Essential fatty acids promote growth, transport fat-soluble vitamins (A, D, E, and K), provide storage components of cell membranes, protect vital body organs (e.g. the heart), provide energy, and prevent dermatitis.

Fats and oils are part of the macronutrient group, together with proteins and carbohydrates. Fats and oils are energy dense, providing 9 kcal/g compared to 4 kcal/g for protein and carbohydrates.

The recommended total fat intake is less than 30 percent of energy requirement, while saturated fat intake is less than 10 percent of energy requirement. The fat requirement in children (as a percentage of energy intake) is higher than for adults – children need 30–45 percent of energy from fat (FAO and WHO, 2010).

Consumption of trans fats has no known health benefits and there is no safe level of consumption (Willet *et al*., 2019).

Excess intake of fats and oils can lead to obesity, while consuming trans fats and large amounts of saturated fats (butter, ghee), or fats from red meat and organ meat, can lead to cardiovascular diseases and cancer (WHO, 2015a; Abete *et al*., 2014).

### 3.5.4 Vitamins

Vitamins are essential nutrients that are needed in small quantities to support optimal health and to prevent deficiency diseases. They are essential for numerous body processes and for maintenance of the structure of the bone, nerves, eyes, blood and mucous membrane (WHO, 2005). Some vitamins, such as A, D, E and K, are fat soluble, while others, such as C and B, are water soluble. Fat-soluble vitamins can be stored in the body, while water-soluble vitamins are excreted in urine (Lykstad and Sharma, 2022).

The water-soluble vitamins are heat labile and can easily be destroyed by heat, cooking or processing. Care should therefore be taken during food processing and cooking to preserve vitamins.

The vitamins of public health significance in Tanzania include vitamin A and folic acid. However, vitamin C is also an important nutrient due to its functions in the body.

#### *Vitamin A*

Vitamin A is essential in vision, healthy epithelial tissue and growth, strengthening immunity and preventing infections.

Vitamin A deficiency contributes to maternal mortality and to poor pregnancy outcomes. It is one of the top causes of preventable blindness in children. Vitamin A deficiency weakens the body's immune system and increases the risk of death from common childhood illnesses such as diarrhoea

and respiratory infections. Vitamin A deficiency increases the risk of diarrhoea, and chronic diarrhoea leads to vitamin A loss in young children (WHO, 2011b; Imdad *et al.*, 2010)

Rich sources of vitamin A include liver, palm oil, dark green and yellow leafy vegetables, and fruits.

***Vitamin C***

Vitamin C, also known as ascorbic acid, is necessary for the growth, development and repair of all body tissues. It is involved in many body functions, including the formation of collagen, the proper functioning of the immune system, wound healing, and the maintenance of cartilage, bones, and teeth.

Vitamin C is also important in aiding the absorption of iron, especially from plant-based foods. Vitamin C is one of many antioxidants. Antioxidants are nutrients that block some of the damage caused by free radicals (WHO, 2005).

Vitamin C deficiency is characterised by weakness, bleeding gums, prolonged wound healing and defective bone growth (WHO, 2005).

The body is not able to make vitamin C on its own and it does not store vitamin C. It is therefore important to include plenty of vitamin C-containing foods in the daily diet (WHO, 2005).

Foods rich in vitamin C include citrus fruit, tamarind, baobab fruit, passion fruit and green leafy vegetables. However, this vitamin is very susceptible to destruction by atmospheric oxidation. It is therefore important to cook vegetables when they are still fresh and limit exposure to air of chopped vegetables and fruits (WHO, 2005).

***Folic acid***

Folate or folic acid is essential for the multiplication and maturation of red cells in the body. Its deficiency leads to a type of anaemia characterized by abnormally large red blood cells. Folic acid deficiency increases homocysteine levels in the blood, which is associated with an increased risk of heart disease and stroke (Czeizel *et al*., 2013; WHO, 2005). Hence, folate prevents anaemia and heart diseases for all the population groups.

Low folate levels in pregnant women can lead to birth abnormalities, such as neural tube defects (WHO, 2005; Czeizel *et al*., 2013), and can also cause puerperal sepsis, low birth weight, and preterm birth (WHO, 2016a).

A wide variety of foods contain folate, but it is present in relatively low amounts except in the liver. Diets that contain adequate amounts of fresh green vegetables (i.e. in excess of 400 g per day) are good sources of folate. Other sources include pulses (legumes), nuts, liver, fortified wheat flour, and maize flour (WHO, 2005)

### 3.5.5 Minerals

Minerals are inorganic substances required by the body in small amounts for a variety of functions. These functions include the formation of bones and teeth, constituents of body fluids and tissues, components of enzyme systems, and normal nerve activity.

Minerals of public health significance for the United Republic of Tanzania include iron and iodine. Zinc and calcium are also noted as increasingly important minerals due to their functions and inadequate consumption. Zinc intake is inadequate among Tanzanian women and children (Gowele *et al*., 2021; Stuetz *et al*., 2019). Furthermore, zinc deficiency rises with increasing prevalence of iron deficiency, meaning it is most likely to be high in the United Republic of Tanzania. Likewise,

calcium deficiency is likely to be high due to low intake of milk (Kinabo *et al*., 2016).

***Iron***

Iron is an essential element necessary for the formation of haemoglobin, the red pigment present in red blood cells. Haemoglobin plays an important role in the transportation of oxygen to the tissues. Reduction in haemoglobin in the blood leads to anaemia, a condition characterised by paleness, unexplained tiredness and increased susceptibility to infections (WHO, 2005).

Iron deficiency is common, especially among women of reproductive age and children. During pregnancy, iron deficiency increases the risk of low birth weight and maternal mortality (WHO, 2005). In children, it impairs learning ability, reduces concentration, and increases vulnerability to infection (Jáuregui-Lobera, 2014).

Iron is plentifully available in green leafy vegetables and in pulses (legumes), but the absorption of iron from these plant-based foods is limited, so vitamin C-rich foods must be consumed daily to improve iron absorption. Iron that is easy for the body to absorb is obtained from meat, eggs, liver, and poultry. Fortified cereals also supply iron (WHO, 2005).

***Calcium***

Calcium salts provide rigidity to the skeleton and calcium ions play a role in many, if not most, metabolic processes (WHO, 2005).

Calcium is one of the main bone-forming minerals, and an appropriate supply is essential at all stages of life. Sufficient intake of vitamin D and calcium together reduces the risk of osteoporotic fracture in older people (WHO, 2005).

Dietary animal sources of calcium include milk, cheese, yoghurt, and small fish when eaten with bones. Very good sources of plant-based calcium include baobab fruit or leaves, moringa, amaranth, cowpeas, cassava and tamarind leaves (FAO, 2019). Other vegetables and pulses also provide some calcium.

***Zinc***

Zinc is essential for growth, bone metabolism, activation of enzymes, and releasing vitamin A from the liver. Zinc plays a central role in the immune system, protein synthesis, wound healing, DNA synthesis and cell division (WHO, 2005). It supports normal growth and development during pregnancy, childhood, and adolescence.

The clinical features of severe zinc deficiency in humans are growth retardation, delayed sexual and bone maturation, skin lesions, diarrhoea, alopecia, impaired appetite, increased susceptibility to infections mediated via defects in the immune system, and the appearance of behavioural changes (WHO, 2005).

Main sources include meat, liver, seafood (especially oysters) milk, whole-grain cereals, and pulses (legumes). Other sources are processed cereals with low extraction rates, polished rice, chicken, fish, roots and tubers, green leafy vegetables, and fruits.

***Iodine***

Iodine makes thyroid hormones in the body, which are important for metabolism. The main physiological actions of thyroid hormones are growth and development. Specifically, these hormones play a major role in the growth and development of the brain and the central nervous system in humans from the 15th week of gestation to three years of age. These hormones also control carbohydrate, fat, protein, vitamin, and mineral metabolic processes in the body (WHO, 2005).

Iodine deficiency disorders may result in impaired cognitive development and function, hypothyroidism, congenital anomalies, cretinism, or endemic goitre. Iodine intake is below the required amount in 57 million children in Africa (Hailu *et al*., 2016). Global estimates show that iodine deficiency lowers the total intellectual capacity by 10 to 15 percentage points. Iodine deficiency in pregnancy causes mental impairment in approximately 20 million babies every year.

The WHO, UNICEF and the International Council for the Control of Iodine Deficiency Disorders (ICCIDD) Global Network recommend an intake of 150 µg iodine/day for adults and 220–290 µg/day for pregnant and lactating women (WHO, 2014b).

Dietary sources of iodine include iodized salt and other foods like marine fish, shellfish, eggs, meat, milk, cereal grains, pulses (legumes) and freshwater fish. The iodine content of these food sources depends on the iodine content of the soil or the environment.

### 3.5.6 Water

Water, though not considered a nutrient, is essential for life (Jéquier and Constant, 2010). It is important in the body for the following functions:

- carrying nutrient and waste products;
- maintaining the structure of large molecules like proteins and glycogen;
- taking part in metabolic reactions;
- acting as a solvent for minerals, vitamins and amino acids;
- providing lubrication and cushioning around joints, eyes and the spinal cord;
- regulating body temperature; and
- maintaining blood volume.

The body is continuously losing water through sweat, urine and faeces, which must be replaced by drinking enough clean and safe water. Contaminated water can transmit diseases such as diarrhoea, cholera, dysentery, typhoid and polio. Diarrhoea diseases can lead to malnutrition and reduce immune resistance in infants and young children, which in turn may increase the risk of prolonged and recurrent diarrhoea (Marino, 2007).

# 4. THE DIETARY GUIDELINES AT A GLANCE

The Tanzania FBDGs are structured around six guidelines:

- **Guideline 1** is about increasing dietary diversity through consumption of the six food groups daily to promote health and wellbeing for all age groups.
- **Guideline 2** encourages optimal nutrition for populations with special needs (pregnant and lactating women, infants, and young children, as well as school-aged children).
- **Guideline 3** contains a set of recommendations on limiting calories from sugars, saturated fats, trans fats, ultraprocessed foods and reducing salt intake for all age groups.
- **Guideline 4** provides guidance on keeping food, water and home environment clean to support better nutrition and healthy outcomes for all age groups.
- **Guideline 5** promotes an active lifestyle for healthy weight for all age groups.
- **Guideline 6** is on limiting alcohol consumption and restricting tobacco use to reduce non-communicable disease (NCD) risks for all age groups.

Each guideline is accompanied by key recommendations intended to inform individuals and households on how to choose combinations of foods and beverages as well as behaviours to promote health and prevent malnutrition. In each recommendation, there are specific tips to help the consumers practise a healthy lifestyle.


LIDER

# **GUIDELINE 1:** Increase dietary diversity through consumption of six foods groups daily, focusing on variety within the food groups to prevent malnutrition and reduce the risk of NCDs

# 5. RECOMMENDATION 1.1

## EVERYBODY, YOUNG AND OLD, SHOULD ENJOY EATING A VARIETY OF FOODS FROM DIFFERENT FOOD GROUPS EVERY DAY TO STAY HEALTHY AND STRONG

### 5.1 What is a diversified diet?

Eating diversified foods means eating different foods from the six food groups in the right proportions every day. Dietary diversity also means eating different food within each food group regularly.

The human body requires more than 50 different nutrients and phytochemicals to stay healthy. There is no single food or food group that supplies all the daily energy and nutrient requirements for infants, children, and adults (breast milk is an exception but is only applicable to the first six months of life) (Ballard and Morrow, 2013).

Each food group contains key nutrients it can supply to the body. It is therefore important to eat a variety of foods from each of the six food groups to meet these nutrient needs.

In addition, within each food group, different foods provide different types and amounts of nutrients and phytochemicals. For example, although vegetables are a great source of vitamin C, only dark-green leafy vegetables and orange-coloured vegetables contain large quantities of pro-vitamin A (Slavin and Lloyd, 2012). All fish, milk and meat provide the body with protein, however, milk and small fish like sardines (when eaten with bones) contain a lot of calcium, while liver is the richest source of iron in this food group.

Thus, eating from each of the six groups, and choosing a variety of foods within each group (depending on availability and affordability), will help people get all the nutrients they need.

## 5.2 Benefits of a diversified diet

A diversified diet provides the body with the different essential nutrients and phytochemicals it needs to stay nourished and maintain basic body functions such as breathing, body temperature regulation and blood circulation. They also strengthen the immune system so that the body can resist diseases (WHO and FAO, 2002; Ruel, 2003; Arimond and Ruel, 2004).

- Macronutrients provide energy, support growth and development, produce and utilize hormones, and protect organs.
- Micronutrients are needed in small quantities and support the body's unique functions, such as being able to see, contracting and relaxing muscles, healing wounds, strengthening immunity and clotting the blood.
- Phytochemicals are substances found in plants that fight infections and maintain a healthy blood pressure.

Eating a variety of foods from the six groups in the right amounts helps to maintain a healthy body weight and reduces the risk of diseases such as diabetes, heart disease and cancers.

According to the Global Burden of Disease report (GBD, 2017) risk factors associated with diet are based on a mix of foods and food groups:

Diets that lower the risks are:

- diets high in fruits, vegetables, pulses (legumes), whole grains, nuts, seeds, and milk; and
- diets low in red meat, processed meat and sugar-sweetened beverages).

Diets that increase the risks are:

- diets low in fibre, calcium, seafood, omega-3 fatty acids, polyunsaturated fatty acids, and diets high in trans-fatty acids and salt.

## 5.3 Food groups and recommended quantity per day for Tanzania

Table 4 shows the food groups, recommended quantity and number of servings to be consumed per day by the general population based on the energy requirement of 2300 kilocalories per day, calculated using diet modelling. However, specific dietary recommendations for special groups like pregnant and lactating women, children below the age of 5, and school children are provided in Guideline 2. This is necessary to take into account the increased needs for nutrients during these physiological states.

**Table 4 Optimized key nutrient intake for the general population of Tanzania Mainland**

| Food groups | Servings per day | Food weight | Energy | Protein | Fat | Carbohy-drates | Calcium | Iron | Zinc | Vit-A-RAE | Folate | Vit C | Fibre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (g) | (kcal) | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mcg) | (mcg) | (mg) | (g) |
| **Cereals, starchy roots, tubers, plantains and green bananas** | 4 | 580 | 822 | 15 | 1.6 | 182.6 | 57.7 | 2.1 | 1.5 | 40.2 | 54.9 | 28.6 | 8.2 |
| **Vegetables** | 2 | 280 | 134 | 13 | 0.9 | 15.6 | 750.5 | 10.8 | 1.2 | 589.6 | 127.3 | 52.1 | 6.6 |
| **Fruits** | 2 | 280 | 206 | 3 | 4.6 | 35.6 | 46.8 | 1.2 | 0.5 | 213.5 | 68.0 | 87.1 | 5.8 |
| **Pulses (legumes)nuts and oily seeds** | 3 | 290 | 410 | 27 | 8.0 | 48.3 | 100.0 | 7.3 | 3.3 | 0.0 | 354.2 | 2.9 | 18.5 |
| **Animal-source Foods** | 2 | 155 | 270 | 40 | 11.9 | 0.8 | 126.1 | 3.8 | 5.2 | 43.6 | 23.8 | 0.6 | 0.0 |
| **Fats and oil** | 2 | 28 | 252 | 0 | 28.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **-** | **1613** | **2312*** | **97.5** | **55.0** | **337.1** | **1083.1** | **25.2** | **11.9** | **886.9** | **628.6** | **171.3** | **39.2** |
| *217 kcal came from discretionary calories that are not part of the six food groups. | | | | | | | | | | | | | |

## 5.4 Serving sizes for each food group

A serving size is a recommended, standardised amount of food from each of the six food groups to help guide the public on the amounts to eat. Diet modelling for the Tanzania Mainland provides a model of standard serving sizes for the six food groups based on the kilocalorie amounts shown in Table 5.

A serving size can also be translated to food weights. However, food weights per serving may vary within the same food groups, depending on the energy density, specifically for animal-source foods and fruits. For example, 185 g of whole milk with 3.5 percent fat will provide the same calories as 57 g of lean meat (120 kcal). Likewise, for fruits, 270 g of watermelon will provide about 80 kcal, equivalent to 50 g of avocado or 75 g of ripe banana.

A serving size can also be translated to household measures such as cups, spoons and other everyday utensils for easy measurement during cooking, serving, or eating. Table 5 shows the translation of the standard kilocalorie amount to an average food weight within the food group as well as household measures.

The proportional contribution of each of the six food groups to a target of 2,300 kcal per day was determined through diet modelling, while the optimisation process determined the number of serving sizes for each of the six food groups. The diet modelling also considered energy and nutrient intake recommendations for the population groups, commonly consumed foods, and dietary pattern. Based on the kilocalorie serving definition, the diet model also provided the food weight equivalents of a serving in grams.

Table 5 One serving size standard measure of different food groups

| | Standard 1 serving kcal | Average food weight (g) per serving | Common household measures for one serving size equivalent | Total servings sizes per day |
|---|---|---|---|---|
| **Cereals, starchy roots, tubers, plantains and green bananas** | 200 | 145 | • About 1 cup of rice or pasta<br>• 1 cup boiled diced sweet potato, cassava, yams, plantain or green banana<br>• ¾ cup of cooked ugali (stiff porridge)<br>• About 145 g of cereals, roots, tubers, plantains | 4 |
| **Vegetables** | 60 | 140 | • 1 cup (one big serving spoon) cooked vegetables<br>• 2 cups raw leafy or salad vegetables<br>• About 140 g cooked vegetables | 2 |
| **Fruits** | 80 | 140 | • One medium banana or apple; one large orange or peach; two small tangerines or plums<br>• 1 cup cut fruit like papaya or mango; 1 cup small fruit like berries, java plums, grapes<br>• A piece of pineapple<br>• A piece of watermelon<br>• ¼ cup baobab or tamarind pulp (with no sugar added)<br>• ½ small avocado<br>• About 140 g of fruit | 2 |
| **Pulses, nuts and oily seeds** | 120 | 100 | • ½ cup cooked beans, bambara, soya beans or cowpeas<br>• 1/3 tablespoons peanuts or seeds like flax, chia, sunflower and pumpkin<br>• 1½ teaspoon peanut butter or peanut flour<br>• 1/3 cup coconut milk<br>• About 100 g of pulses or 30 g** of nuts and seeds | 3 |

*Continued on page 41*

| | Standard 1 serving kcal | Average food weight (g) per serving | Common household measures for one serving size equivalent | Total servings sizes per day |
|---|---|---|---|---|
| **Animal-source foods** | 120 | 60-100* | • Two eggs (95 g)<br>• Two matchbox size (~60 g) red meat (beef, goat, sheep); beef liver and insects<br>• Three matchboxes size (~90 g) fish, poultry or rabbit<br>• four dice-size pieces of cheese (30 g) | 2 |
| | | 200-250 g* | • 1 cup milk or sour milk (245 g)<br>• ¾ cup or one small tub yoghurt (200 g) | |
| **Healthy fats and oils** | 130 | 14 | 1 tablespoon (15 ml) of cooking oil | 2 |
| **Notes** | * Food weights for animal and animal-source foods that provide 120 kcal vary a lot, given the different energy densities of foods from this food group.<br>** Nuts are energy dense, thus requiring lower amounts than pulses per serving.<br>Each food guideline has a detailed food exchange list for one serving size with calorie, weight and house measures for common food items in each food group. | | | |

## HOW TO USE THE SERVING SIZE RECOMMENDATIONS

**The following suggested diet outline provides an example of how to spread the total servings shown in Table 5 throughout the day.**

**Cereal, roots, tubers, and plantains (four servings per day):**

- 1 cup cooked sweet potato in the morning, and
- 2 cups rice in the afternoon, and
- one plantain in the evening

**Vegetables (two servings per day):**

- 1 cup cooked amaranth leaves for lunch, and
- 1 cup cooked okra for dinner

**Fruits (two servings per day):**

- One orange for breakfast, and
- One mango or a cup of cut papaya or *mabungo* as a snack in the afternoon or evening

**Pulses, nuts and seeds (three servings per day:**

- ½ cup of cooked beans in ½ of a cup of coconut milk for lunch, and
- Three tablespoons of groundnuts as a snack

**Animal-source foods (two servings per day):**

- ½ a cup of milk for tea, and
- Pick any one of the foods in the given amounts for dinner (e.g. two eggs or three matchboxes of fish)

**Fats and oils:**

- 2 x 15-ml tablespoons of cooking oil per person per day (added to meals when cooking)

### Table 6 Example of a diversified diet for a day chosen from the six food groups

| Meal Name | Food examples | Number of servings per food group** | | | | | |
|---|---|---|---|---|---|---|---|
| | | CRTP | PNS | ASF | Veg | Fruit | Oil |
| **Breakfast** | •1 cup boiled yam or sweet potato or cassava or green banana | 1 | | | | | - |
| | •A glass of milk (250 ml) | | | 1 | | | |
| | • An orange | | | | | 1 | |
| **Lunch** | •1.5 cups ugali | 2 | | | | | |
| | •1 cup cooked sweet potato leaves | | | | 1 | | * |
| | •90 g sardines | | | 1 | | | * |
| **Mid-morning or afternoon snack** | •A fruit (e.g. a piece of watermelon or a ripe banana or mango) | | | | | 1 | |
| | •3 tablespoons nuts | | 1 | | | | |
| **Dinner** | •1 cup beans | | 2 | | | | * |
| | •1 cup amaranth leaves | | | | 1 | | * |
| | •1 cup rice | 1 | | | | | |
| **Total per day from all six food groups** | | **4** | **3** | **2** | **2** | **2** | * |

* Fats and oils are added to meals during cooking. The total amount should not exceeded.
** Food group abbreviations:

1. CRTP - Cereals, roots, tubers and plantains
2. PNS - Pulses, nuts and seeds
3. ASF - Animal-source foods
4. Veg - Vegetables
5. Fruit - Fruits
6. Oils - Fats and oils

## 5.5 Key messages for eating a variety of foods from the six food groups

1. Everybody, young and old, should enjoy eating a variety of foods from different food groups every day to stay healthy and strong.
2. Eat staples such as cereals, starchy roots, tubers or plantains every day for a strong and active body. Make whole-grain products a major part of your staples.
3. Eat different coloured vegetables every day to prevent and reduce the risk of diseases.
4. Eat at least two different fruits every day for better health.
5. Eat pulses, such as beans, lentils, peas or nuts every day for good health.
6. Eat animal-source foods, including seafood, meat, milk or eggs, every day to stay strong.
7. Limit your intake of deep-fried and highly processed foods that contain fat, sugar and salt to prevent diseases such as high blood pressure, diabetes and heart diseases.

## 5.6 Tips for eating diversified meals

1. Choose different types of staples in a week, including whole grains, green bananas, starchy roots, and tubers.
2. Make your plate colourful. Combine different coloured vegetables, roots, tubers, and pulses in your meals.
3. Eat mixed food. Adding different food groups to relish is a great way to eat many food groups in one meal.
4. Share a variety of meals with the whole family.
5. Planning your meals ahead can help you eat a greater variety of foods.
6. Grow different types of vegetables and fruits in a backyard garden for a continued supply of a variety of foods.
7. Keep animals such as chickens, rabbits, goats and fish to help you access animal-source foods easily.
8. Store food safely to ensure a sustainable supply of various food types.
9. Avoid drinking tea during or soon after a meal. Tea binds dietary iron and makes it unavailable.
10. Eat the right amounts food from each food group.

# 6. RECOMMENDATION 1.2

## EAT STAPLES SUCH AS CEREALS, STARCHY ROOTS, TUBERS, PLANTAINS OR GREEN BANANAS EVERY DAY FOR A STRONG AND ACTIVE BODY

### 6.1 What are the starchy staples?

Cereals, starchy roots and tubers and green bananas are starchy staples that make the main part of a meal. These include maize, sorghum, rice, wheat, millet, cassava, yam, potatoes, sweet potato, and green bananas, among others. Non-starchy roots such as carrots are excluded from this group and are classified as vegetables.

When the grains retain all their parts, like the hull and bran, they are considered wholegrain. When flours or meals are made from unprocessed grains, without being bleached or whitened, they are also considered wholegrain.

Refined or dehulled grains are grains that have had the outer hulls removed, such as white rice, white maize flour, white bread, white bleached wheat flour, and white pasta. The process of dehulling removes the bran and seed germ, making refined grain products less nutritious than whole grains. However, cereal grains may be contaminated with mycotoxins.

### 6.2 Mycotoxins in grain cereals

Mycotoxins are compounds produced by moulds that are usually found in the soil and can contaminate crops in the field or after harvesting.

Mycotoxins can contaminate cereals such as maize, sorghum, millet and other grains (Neme and Mohammed, 2017; Tola and Kebede, 2016; FAO, 2004c). The common mycotoxins in the United Republic of Tanzania are fumonisins and aflatoxin (Kimanya *et al*., 2008).

Aflatoxin is also found in nuts, pulses (legumes) and spices. It may also be present in milk and meat from the animals that have consumed feeds contaminated with it (Nakavuma *et al*., 2020).

Eating foods contaminated with moderate to high levels of aflatoxin can cause severe illness and sometimes

death. Long-term exposure to low levels of aflatoxin increases the risk of liver cancer and is also associated with low birth weight, impaired child growth, and immune suppression (Kimanya *et al*., 2021; Mollay *et al*., 2020).

Tanzanian children are at a higher risk of exposure to aflatoxin than adults. This is because maize and groundnuts (the main sources of dietary aflatoxins) are used as the main ingredients of complementary foods. Reliance on maize as a staple presents high risks of exposure to aflatoxins and fumonisins (Kimanya *et al*., 2008; Wild, Miller and Groopman, 2015). It is therefore important to eat a variety of staples to reduce the risk.

High temperatures, moisture content, heavy rains, and poor grain handling practices during harvesting and transportation accelerate mycotoxin contamination (Massomo, 2020; Neme and Ibrahim, 2017). It can also happen when foods are stored for too long at high temperatures and in a humid environment.

**Recommendations to reduce mycotoxins in cereals include:**

- ensuring hygienic precautions during harvesting, storage and processing of agricultural crops and feedstuffs;
- hand sorting to remove contaminated grains;
- rapid drying on platforms to avoid direct contact with soil;
- proper shelling methods;
- use of clean and aerated storage structures;
- controlling insect damage;
- good transportation practices;
- avoiding long storage periods;
- washing and winnowing maize grains; and
- avoiding feeding animals contaminated crop residues.

(List sources: Anitha *et al*., 2020; Ayalew *et al*., 2017; Kamala *et al*., 2018; Nyamete, Bennink and Mugula, 2016; Seetha *et al*., 2017; Siwela *et al*., 2005; Suleiman, Rosentrater and Chove, 2017).

## 6.3 Benefits of eating cereals, roots tubers, green bananas and plantains

Cereals, starchy roots and tubers, plantains, and green bananas are staple foods that provide carbohydrates as the primary energy source for the body.

Whole grains such as brown rice and unhulled maize flour (*dona*) provide dietary fibre and some nutrients, such as iron, zinc, copper, magnesium, selenium, and B vitamins.

Fibre reduces the risk of developing various conditions, including heart disease, diabetes, diverticular disease, and constipation. High intake of dietary fibre has been linked to a lower risk of heart disease (Pereira *et al*., 2004). In addition, dietary fibres found in whole grains and other plant-based foods protect against colorectal cancer, weight gain, overweight, and obesity (WCRF, 2018). Higher fibre intake has also been linked to a lower risk of metabolic syndrome, a combination of factors that increases the risk of developing heart disease and diabetes. These factors include high blood pressure, high insulin levels, excess weight (especially around the abdomen), high levels of triglycerides, and low levels of HDL (good) cholesterol (Mayor, 2019; McKeown *et al*., 2004). Fibre intake is also associated with reduced risk of some disorders of the gastro-intestinal tract, including constipation and diverticulosis.

## 6.4 Consumption pattern of cereals, starchy roots and tubers, and green bananas in Tanzania

Tanzanian diet is mainly made up of refined starchy staples with a small amount of vegetables or pulses (legumes) as a relish.

Starch-based foods account for nearly 70 percent of the calorie share, pulses (beans) 6.2 percent, fat 5.1 percent, animal-source food 2.3 percent and fruits 0.9 percent (Cochrane and D'Souza, 2015). However, there are variations in regions and zones, mainly due to climatic conditions, therefore it is important to eat the different kinds of cereals that are locally available.

Maize and wheat contribute the highest calories of all the cereal staples. To improve micronutrient contents, bulk-produced maize and wheat flour are fortified with folic acid and iron.

## 6.5 Global guidance on how much starchy staples to eat every day

The Global Burden of Disease Study (GBD, 2019) recommends that about 55–75 percent of daily energy intake should come from carbohydrates. For a 2,000 kcal diet this is about 1,100 Kcal to 1,500 kcal for total carbohydrates. Staples make up a big part of carbohydrate intake. Therefore, as part of healthy staple consumption, the GDB recommends that at least 125 g per day should be from whole grains. This is equivalent to one serving of the staples, or two slices of brown bread, a cup of brown rice or a cup of sorghum or whole maize ugali (thickened or stiff porridge) (GBD, 2019).

## 6.6 Recommended intake for Tanzania mainland

The diet modelling carried out for the Tanzanian FBDGs recommends a daily intake of 822 kcal for an adult person, which is equivalent to one serving of the staples, or about four servings of cereals per day (about 145 g and approximately 200 kcal per serving). These amounts can be estimated using a cup, small bowl, serving spoon or a fist. At least one of the four servings should be whole grains.

## Table 7 One serving size equivalents and key nutrients a serving provides as per Tanzania Mainland modelling

| Make four servings daily by picking or combining any of the options from this table | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cooked foods** | **One serving measure** | | **Nutrient values per serving** | | | | | | | |
| | **Cups*/ size** | **Grams* (g) (rounded)** | **Avg. serving (rounded)** | **Pro-tein** | **Folate** | **Iron** | **Cal-cium** | **Zinc** | **Fi-bre** | **Vit A** |
| | | | kcal | (g) | (mcg) | (mg) | (mg) | (mg) | (g) | (mcg) |
| **Ugali (stiff porridge)** | 3/4 cup | 161 | 210 | 5.3 | 1.6 | 0.2 | 3.2 | 0.2 | 2.1 | 0 |
| **Rice** | 1 cup | 160 | 205 | 4.2 | 8.6 | 0.9 | 8 | 0.7 | 0.9 | 0 |
| **Sweet potato (boiled)** | 1 cup | 200 | 225 | 2.9 | 65.5 | 2.0 | 51.9 | 0.7 | 6 | 6.1 |
| **Cassava (boiled) diced** | 1 cup | 132 | 210 | 1.6 | 21.0 | 0.9 | 56.5 | 0.4 | 2.5 | 1.7 |
| **Plantains (ripe, boiled without salt)** | - | 150 | 200 | 1.65 | 19.5 | 1.2 | 9 | 0.15 | 3.3 | 58.5 |
| **Plantains (green, boiled)** | 1 cup | 154 | 179 | 1.2 | 40 | 0.9 | 3.1 | 0.2 | 3.5 | 69.3 |
| **Yams** | 1 ¼ cup | 170 | 230 | 3.4 | 29.7 | 1.4 | 43.9 | 1.0 | 7.3 | 4.2 |
| **Irish potato (boiled)** | 1 ½ cup | 230 | 187 | 4.3 | 25.4 | 1.9 | 23.3 | 0.7 | 4.2 | 2.5 |
| **Pasta** | 1 cup | 124 | 190 | 6.7 | 6.2 | 0.6 | 12.4 | 0.7 | 2.0 | 0 |
| **Bread (thick slice)** | 3 slices | 90 | 225 | 8 | 40.5 | 1.8 | 44.1 | 1.3 | 5.6 | 0 |
| **White bread rolls, small rolls (5 cm square, 5 cm high)** | 3 small rolls | 75 | 200 | 6.8 | 21 | 0.9 | 19.5 | 0.6 | 2 | 0 |
| **Fried potato chips/fries*** | | 70 | 223* | 2.4 | 21 | 0.6 | 12.6 | 0.4 | 2.7 | 0 |

The cup measures and food weights are based on USDA (240 ml cup measure) and occasionally Australian food composition tables (FCTs). The kilocalorie output is based on the Mainland diet model FCT.

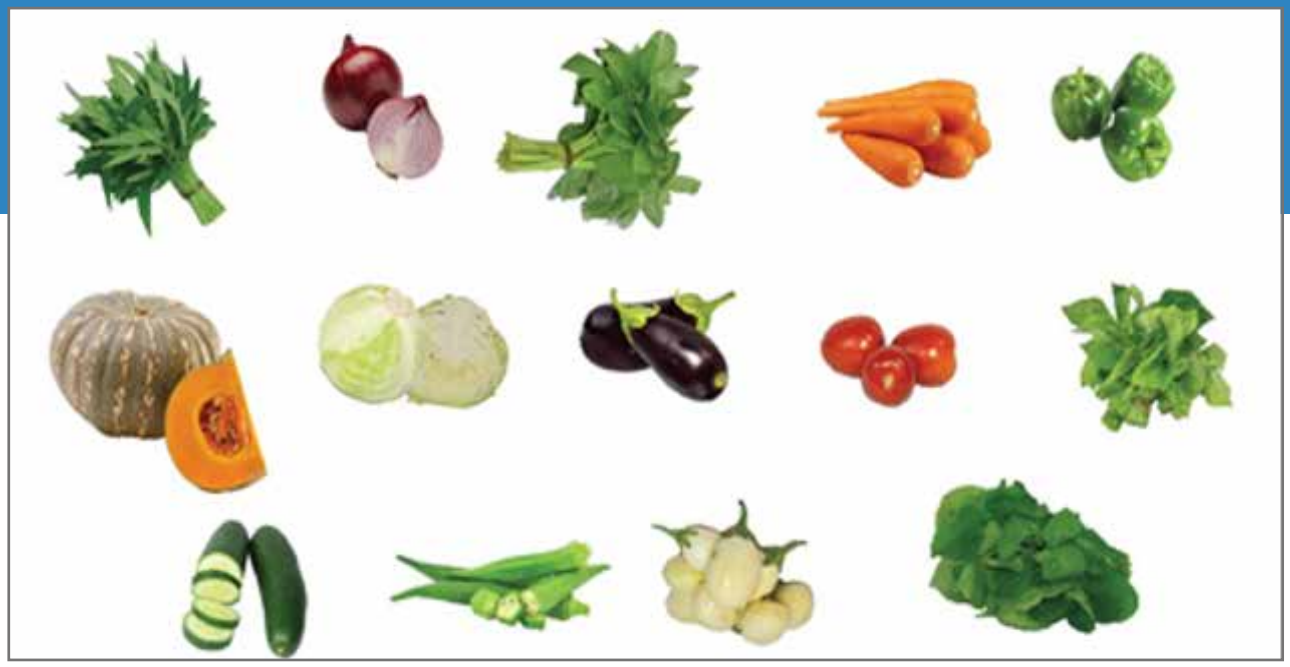
* One fast food order of chips more than doubles the number of calories (427 kcal) for the same 150 g of other starchy foods. In addition, chips have high a fat content, which is discussed under the guideline to limit intake of oils, fats, salt and sugars.

## 6.6 Key messages for eating staples

1. Eat four servings of staples per day and make at least one serving wholegrain for a strong and active body.
2. Eat different varieties of cereals, starchy roots, tubers, plantains and green bananas throughout the week as a good source of energy and vitamins.
3. Make staples one-third of your plate, not all of your plate.
4. Choose fortified maize or wheat flour over unfortified products.
5. Sort to remove mouldy or discoloured grains before processing as they may contain harmful toxins.

## 6.7 Tips for increasing intake of whole grain cereals and eating a variety of staples

1. Replace refined grains such as white maize and rice with whole grains such as unrefined maize, sorghum ugali and brown rice whenever possible.
2. Include whole grains in your daily meals to get fibre that aids digestion and reduces the risks of overweight and NCDs.
3. Make starchy foods part of a meal, taken together pulses or animal source foods, and vegetables.
4. Add a variety of starchy roots and tubers such as sweet potato, cassava, yams, and taro to your diet.



# 7. RECOMMENDATION 1.3

## EAT DIFFERENT VEGETABLES EVERY DAY TO PREVENT AND REDUCE THE RISK OF DISEASES

### 7.1 What are vegetables?

Vegetables include parts of a plant such as leaves, flowers, stems and roots in different colours. Vegetables can be fresh, dried, frozen or canned.

Examples of vegetables include sweet potatoes leaves (*matembele*), cowpea leaves (*majani ya kunde*), cassava leaves (*kisamvu*), amaranth leaves (*mchicha*), okra (*bamia*), African eggplant (*nyanyachungu*), eggplant (*biringanya*), nightshade (*mnavu*), spider plant (*mgagani*), pumpkin leaves (*majani ya maboga*), tomatoes, and sweet peppers. Examples of root vegetables are radishes, carrots, beetroots, and onions.

Potatoes, yams and cassava and green maize are not part of vegetables because of their high starch content.

Vegetables are a great source of vitamins such as pro-vitamin A, vitamin C, and folic acid (one of the B vitamins). They are also rich in minerals such as iron, potassium, and magnesium. Vegetables provide dietary fibre as well as phytochemicals.

### 7.2 Benefits of eating vegetables

Vegetables provide vitamins and minerals without excess calories. Different vegetables contain different amounts of nutrients, so it is important to eat a variety of vegetables every day to meet various nutrient needs. For example, dark-green leafy vegetables (amaranth, sweet potato leaves, cowpea leaves) are good sources of iron, while orange or red coloured vegetables (carrots, tomatoes) contain high amounts of carotene, a precursor for vitamin A (Willet *et al*., 2019; Slavin and Lloyd, 2012).

Vegetables also contain vitamin C, which is important for iron absorption, among other functions. However, more than 50 percent of Vitamin C may be lost during cooking due to heat destruction and leaching, especially when cooking water is discarded, which is a common practice in the United Republic of Tanzania. Vitamin C is water-soluble and is sensitive to both temperature and oxygen, so it is easily degraded during cooking. A combination of high temperatures and long cooking duration results in severe losses of vitamin C (Tian *et al*., 2016). These FBDGs recommend the following for cooking vegetables:

- Wash vegetables before chopping.
- Cover pot when cooking.
- Cook at a low temperature and for a short period.
- Do not discard cooking water.
- Prepare vegetables closer to consumption time so they are not left standing for a long time (which can lead to oxidation and loss of nutrient value).

Vegetables also contain phytochemicals that protect the body from certain cancers. They are rich in dietary fibre, which promotes healthy bowel movements. Adequate vegetable intake has been shown to reduce the risk of obesity, heart disease, stroke and common types of cancer (Williams and Hord, 2005; Nour *et al*., 2018; Hartley *et al*., 2013). Consuming at least 400 g of fruits and vegetables (about four to five servings) every day reduces blood pressure and decreases the risks of heart disease and stroke (WHO, 2003; WHO, 2015a). Vegetables also have low energy density.

## 7.3 Vegetable consumption in the United Republic of Tanzania

Vegetables are commonly consumed, especially by women and children, but only in relatively small amounts, so vegetables do not contribute significantly to the overall nutrient intake (Kinabo *et al.*, 2016; Keding, 2011; Mayige and Kagaruki, 2013). A study in rural settings reported that only a small proportion of women reached recommended daily intakes for vitamin A (27 percent), iron (17 percent), and zinc (7 percent). The amount of dark-green leafy vegetables consumed was the main determinant of vitamin A and iron intake by women and corresponded to higher haemoglobin, serum retinol and iron status (Stuetz, *et al*., 2019). High intake of vegetables is therefore important to reduce iron and vitamin A deficiencies, which are highly prevalent in the United Republic of Tanzania.

## 7.4 Global guidance on how much vegetables to eat every day

According to the GBD study, a diet low in vegetables is defined as an average daily consumption of less than 360 g of vegetables (fresh, frozen, cooked, canned or dried vegetables) (GBD, 2019). The Healthy Reference Diet proposed by the EAT Lancet Commission recommends consumption of 300 g/day of vegetables (range 200–600 g), consisting of 100 g each of dark-green vegetables, red and orange vegetables, and other vegetables (Willett *et al*., 2019). Both GBD and Eat Lancet exclude pulses (legumes) and salted or pickled vegetables, juices, nuts and seeds, and starchy vegetables such as potatoes, cassava, and fresh corn from this vegetable group.

## 7.5 Recommendation for Tanzania

According to diet modeling for Tanzania, eating at least two servings (280 g) of different vegetables per day is recommended for Tanzania Mainland.

One serving of vegetables provides about 60 kcal and about 140 g. Using household utensils, this is about:

- 1 cup or 2 serving spoons of cooked vegetables; or
- 1 cup of hard vegetables such as carrots, green beans, or green peas; or
- 2 cups of raw leafy vegetables or salad vegetables.

To make two total servings per day, choose and combine any of the vegetables from the list in Table 8 to make the two servings per day. Consider the nutrient composition of vegetables as detailed in Table 8.

| | |
|---|---|
| **One cup** raw or cooked hard vegetables |  <br>Carrots, beetroot, green peas, green beans, radishes, cabbage, broccoli, celery, etc. |
| **Two cups raw** leafy, or soft vegetables and salads |  <br>Leafy vegetables: cowpeas, beans, pumpkin, sweet potato, cassava, moringa, okra and baobab leaves, amaranth leaves, blackjack, Chinese cabbage, mustard greens |
| **One cup** cooked leafy and soft vegetables |  <br>Leafy vegetables: cowpeas, beans, pumpkin, sweet potato, cassava, moringa and okra leaves, amaranth leaves, blackjack, Chinese cabbage, and mustard greens<br><br>Soft vegetables: mushrooms, eggplants, etc. |

**Table 8 List of vegetables and estimated amounts in grams and key nutrients provided per serving**

| Food description | Make two vegetable servings daily by picking any of the vegetable amounts below. Each food amount is one serving equivalent. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | One-serve measures (rounded values) | | | One-serving food weight and nutrient values from the Mainland Diet Model FCT (rounded values) | | | | | | | |
| | Cup (250 ml) | Food Weight (g) | (15 ml Tbsp) | Energy | Vit C | Vit A | Iron | Folate | Calcium | Zinc | Fibre |
| | | | | (kcal) | (mg) | (mcg) | (mg) | (mcg) | (mg) | (mg) | (g) |
| **Cowpea leaves, boiled** | 1 | 160 | 10 | 69.8 | 38.4 | 227.2 | 6.4 | 108.6 | 424.6 | 0.6 | 6 |
| **Cassava leaves, boiled** | 1 | 160 | 10 | 162.4 | 26.2 | 432.8 | 7 | 99.2 | 441.8 | 0.8 | 6 |
| **Amaranth leaves, boiled** | 1 | 132 | 8 | 57 | 25 | 301 | 6.4 | 55.4 | 501.6 | 0.8 | 2 |
| **Cooked okra (lady's fingers)** | 1 | 160 | 10 | 36 | 26 | 22.4 | 0.4 | 73.6 | 124 | 0.6 | 4 |
| **Boiled okra leaves** | 1 | 160 | 10 | 68.2 | 24.2 | 85 | 0.8 | 99.2 | 475.2 | 1.2 | 8.2 |
| **Boiled green beans** | 1 | 125 | 8 | 54 | 14.6 | 30.8 | 1.2 | 45.8 | 60 | 0.4 | 3.4 |
| **Baobab, leaves boiled*** | 1 | 160 | 10 | 118.8 | 32 | 626 | 5 | 78.4 | 501.4 | 1.2 | 12.2 |
| **Cooked moringa/ drumstick leaves** | 1 | 136 | 10 | 81.6 | 42.2 | 4106 | 3.2 | 31.2 | 784 | 1 | 2.8 |

*Continued on page 54*

| Food description | Make two vegetable servings daily by picking any of the vegetable amounts below. Each food amount is one serving equivalent. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | One-serve measures (rounded values) | | | One-serving food weight and nutrient values from the Mainland Diet Model FCT (rounded values) | | | | | | | |
| | Cup (250 ml) | Food Weight (g) | (15 ml Tbsp) | Energy | Vit C | Vit A | Iron | Folate | Calcium | Zinc | Fibre |
| | | | | (kcal) | (mg) | (mcg) | (mg) | (mcg) | (mg) | (mg) | (g) |
| **Cooked Chinese cabbage*** | 1 | 170 | 12 | 22.2 | 76.6 | 379.2 | 1.4 | 112.2 | 178.6 | 0.4 | 1.8 |
| **Boiled green mustard*** | 1 | 140 | 10 | 36 | 35.4 | 865.2 | 1.2 | 12.6 | 165.2 | 0.2 | 2.8 |
| **Cooked green peas** | 1 | 160 | 10 | 68 | 76.6 | 83.2 | 3.2 | 46.4 | 68 | 0.6 | 4.4 |
| **Cooked pumpkin mashed*** | 1 | 244 | 16 | 48.8 | 12 | 264 | 1.4 | - | 36.8 | - | 2.6 |
| **Raw tomato** | 1 | 148 | 10 | 32 | 43.8 | 77 | 0.8 | 31.4 | 19.2 | 1 | 2 |
| **Raw onion** | 1 | 160 | 10 | 60 | 16.4 | 0 | 0.4 | 25.6 | 40.2 | 0.4 | 2.8 |
| **Onion boiled** | 1 | 160 | 10 | 72 | 6.8 | 0 | 0.4 | 16 | 46.4 | 0.4 | 3.6 |
| **Boiled sweet potato leaves** | 2 | 128 | 8 | 68 | 6.4 | 592.6 | 0.8 | 53.8 | 184 | 0.2 | 3 |
| **Boiled pumpkin leaves** | 2 | 142 | 10 | 42 | 6.6 | 258.4 | 2.6 | 27 | 504 | 0.2 | 3.6 |

*Continued on page 55*

| Food description | Make two vegetable servings daily by picking any of the vegetable amounts below. Each food amount is one serving equivalent. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | One-serve measures (rounded values) | | | One-serving food weight and nutrient values from the Mainland Diet Model FCT (rounded values) | | | | | | | |
| | Cup (250 ml) | Food Weight (g) | (15 ml Tbsp) | Energy | Vit C | Vit A | Iron | Folate | Calcium | Zinc | Fibre |
| | | | | (kcal) | (mg) | (mcg) | (mg) | (mcg) | (mg) | (mg) | (g) |
| **Cooked eggplant** | 2 | 200 | 14 | 64 | 8.2 | 5 | 1.6 | 30.6 | 26.4 | 0.2 | 5.6 |
| **Raw carrot, chopped*** | 2 | 256 | 18 | 104 | 15.2 | 2137.6 | 0.8 | 48.6 | 84 | 0.6 | 7.2 |
| **Raw cucumber** | 2 | 208 | 14 | 32 | 5.8 | 10.4 | 0.6 | 14.6 | 33.2 | 0.4 | 1 |
| **Raw moringa powder*** | 2 Tb spoon | 20 | 2 | 76 | 4.25 | 4725 | 24 | - | 500 | - | 5 |
| **Cooked kale/rape*** | 1 | 130 | 8 | 46 | 23.2 | 189.8 | 1 | 84.6 | 195 | 0.4 | 5.2 |
| **Seaweed dried*** | 2 Tb spoon | 28 | 2 | 102 | 24.2 | - | 3.6 | - | 101.2 | - | 10.2 |
| **Seaweed cooked in oil*** | 1 | 96 | 6 | 58 | 28.8 | 216 | 1.6 | 94 | 61.4 | 1 | 0.2 |

* Values based on USDA FCT and Food Exchange list.
- values not available

## 7.5 Key messages for eating vegetables

1. Eat at least two servings (280 g) of seasonally available vegetables every day.
2. Choose different coloured vegetables throughout the week to increase the variety of nutrients. A variety of colours will provide different types of phytochemicals.
3. To enhance absorption of pro-vitamin A, add a small amount (1–2 teaspoons) of vegetable oil when cooking leafy green or yellow vegetables.
4. Choose fresh or frozen vegetables rather than vegetable juices.

## 7.6 Tips for eating a variety of vegetables every day

1. Wash vegetables with clean water just before cutting/chopping to prevent loss of nutrients.
2. Cover and cook for a short time in a small amount of water at low temperature to preserve nutrients.
3. Avoid discarding water after boiling vegetables.
4. Buy fresh vegetables in-season for better value and quality.
5. Start your own home vegetable garden to increase accessibility of vegetables every day.
6. Include cucumbers, mushrooms, tomatoes, pumpkin and carrots as part of vegetables.
7. Do not add bicarbonate of soda (*magadi*) or ash (*majivu*) to cooking vegetables as it destroys some nutrients.
8. Do not overcook vegetables as heat destroys some vitamins.
9. Eat vegetables such as cucumber, carrots and tomatoes as a snack.
10. Preserve vegetables by drying so they can be enjoyed when out of season.

# 8. RECOMMENDATION 1.4

## EAT AT LEAST TWO TYPES OF FRUIT EVERY DAY FOR BETTER HEALTH

### 8.1 What are fruits?

Fruits are the sweet, soft and fleshy product of a tree or other plants that contain seeds and are eaten as food.

Examples of fruits include mangoes, papayas, bananas, pineapples, guavas, watermelons, avocados, oranges, lemons and wild fruits such as tamarind (*ukwaju*), baobab (*ubuyu*) and jackfruit (*fenesi*). The fruits can be fresh, canned, frozen, or dried.

### 8.2 Benefits of fruits

Adequate fruit intake decreases the risk of high blood pressure, heart diseases, and some cancers (Kjøllesdal *et al.*, 2016; Hartley *et al.*, 2013).

They are good sources of minerals and vitamins such as vitamin A, vitamin C, folate, and potassium. Orange-coloured fruits, such as papaya and mango, are good sources of vitamin A, which helps prevent night blindness.

Fruits improve body immunity. Fruits also contain fibre which is beneficial to health (Wallace *et al.*, 2020; Hartley *et al*., 2013; Hosseini *et al*., 2018).

It's best to eat fruits in their whole form rather than making them into juices. The process of making juices discards healthy dietary fibre. If it is necessary that fruits are taken in the form of liquid, then blend the whole fruit and no additional sugar should be added as the fruit juice contains natural sugars.

### 8.3 Fruit consumption in Tanzania

Fruits are for everyone – men, women, children, and the ageing. However, more than 90 percent of Tanzania's population do not meet the recommended amount of fruit intake per day. In addition, Tanzanian adults, especially men in rural areas, do not consider fruits as important components of a diet (Safari, Timothy and Masanyiwa, 2020; Lyana and Manimbulu, 2014; Kinabo *et.al*, 2016).

### 8.4 Global guidance on how much fruit to eat every day

The WHO and FAO recommend 400–500 g per day, or ≥ 400 g per day of fruit and vegetables (WHO, 2003). Similarly, the World Cancer Research Fund (WCRF, 2018) recommends at least five portions or servings (approximately

80 g per serving) per day of a variety of non-starchy vegetables and fruit (giving an approximate total of 400 g per day). The Global Burden of Disease report defines a diet low in fruit as an average daily consumption of less than 250 g per day of fruit (fresh, frozen, cooked, canned, or dried, excluding fruit juices and salted or pickled fruits) (GBD 2017). The EAT Lancet Commission proposes an average daily fruit consumption of 200 g per day of fruits (range 100–300 g) (Willett *et al*., 2019).

### 8.5 Recommendation for Tanzania

Individuals should eat two servings per day (a total of 280 g). One serving provides approximately 80 kcal. One serving of fruit is about 140 grams, equivalent to one large orange or one medium-sized banana, apple, or mango, or half of a small avocado. For small fruits, the serving size can be two fruits, for example, two small guavas, peaches, tangerines, plums, kiwifruits, or apricots. A serving of small fruits can also be measured as a handful, for example, a handful of tamarind or baobab fruit. For berries and diced fruits, such as papaya, watermelon, and mango, one serving is one cup. Choose fruits from the list in Table 9 while watching calorie the contribution from each fruit.

**Table 9 Fruits and estimated amount in grams and key nutrients per serving**

| Food description | Consume two servings of fruits daily by choosing any of the two fruit options below. Each food amount is one serving equivalent. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | One-serve measures | | Food weight and nutrient values from the Mainland Diet Model FCT or otherwise specified (values are rounded up) | | | | | | | |
| | Measure Size | Serving size (g) | Energy | Vit C | Vit A | Iron | Folate | Calcium | Zinc | Fibre |
| | | | (kcal) | (mg) | (mcg) | (mg) | (mcg) | (mg) | (mg) | (g) |
| **Banana, white flesh** | 1 medium (17–19 cm) | 120 | 120 | 13 | 5 | <1 | 23 | 8.4 | 0.2 | 2.4 |
| **Apple, raw, with skin** | 1 medium (7 cm diameter) | 140 | 75 | 6 | 4 | <1 | 4 | 8.4 | <1 | 3.4 |
| **Orange** | 1 large (7.5–8 cm diameter) | 185 | 80 | 87 | 14 | <1 | 62 | 57 | <1 | 3.1 |
| **Peaches (yellow)*** | 1 large | 175 | 70 | 12 | 28 | 0.4 | 7 | 10.5 | <1 | 2.6 |
| **Small pear*** | 1 | 150 | 85 | 7 | 1.5 | <1 | 11 | 13.5 | <1 | |
| **Tangerines*** | 2 small (5–6 cm) | 150 | 84 | 40 | 51 | <1 | 24 | 55.5 | <1 | |
| **Guava, raw, without refuse‡** | 2 | 110 | 65 | 287 | 39 | <1 | 8 | 25.3 | <1 | 6.2 |
| **Granadilla/passion fruit, raw, without refuse*** | 5 fruits | 90 | 87 | 27 | 58 | 1.4 | 13 | 10.8 | 0.1 | 9 |

*Continued on page 60*

| Food description | Consume two servings of fruits daily by choosing any of the two fruit options below. Each food amount is one serving equivalent. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | One-serve measures | | Food weight and nutrient values from the Mainland Diet Model FCT or otherwise specified (values are rounded up) | | | | | | | |
| | Measure Size | Serving size (g) | Energy | Vit C | Vit A | Iron | Folate | Calcium | Zinc | Fibre |
| | | | (kcal) | (mg) | (mcg) | (mg) | (mcg) | (mg) | (mg) | (g) |
| **Tamarind (ripe, raw)** | _+ | 30 | 75 | 3.1 | 0.3 | <1 | 5 | 45.3 | <1 | 5,5 |
| **Baobab (pulp)†** | _+ | 45 | 136 | 111 | 2.6 | 2.5 | NA | 124.1 | <1 | 3.1 |
| **African locust bean, fruit, pulp, raw** | _+ | 30g | 86 | 67 | 58 | 1 | NA | 34 | 0.28 | 3.6 |
| **Grapes*** | 1 cup | 90 | 60.3 | 4 | 4.5 | 0.3 | 3.6 | 12.6 | 0 | 0.8 |
| **1 cup diced fruit (papaya, other cut fruits)** | 1 cup | 145 | 51.9 | 84 | 116 | 1.0 | 36.3 | 29.6 | <1 | 2.8 |
| **Peaches 1 cup (sliced)*** | 1 cup | 154 | 60 | 10 | 25 | | 9.5 | 9.2 | <1 | 2.3 |
| **Mango (orange flesh), raw** | 1 cup | 165 | 106.2 | 60 | 276 | 1.1 | 42 | 28.5 | <1 | 3.5 |
| **Watermelon, raw** | 1.5 cups | 230 | 67.2 | 17 | 96 | <1 | 8.8 | 16.1 | <1 | 0.8 |
| **African black plum/ Java plum (wild), ripe raw (WA)** | _+ | 71.4 | 80 | 7.1 | trace | 0.8 | NA | NA | 17.9 | 0.0 |
| **Jackfruit*** | _+ | 84.2 | 80 | 11.5 | 4.2 | 0.2 | 24.0 | 20.2 | 0.1 | 1.3 |

*Continued on page 61*

| Food description | Consume two servings of fruits daily by choosing any of the two fruit options below. Each food amount is one serving equivalent. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | One-serve measures | | Food weight and nutrient values from the Mainland Diet Model FCT or otherwise specified (values are rounded up) | | | | | | | |
| | Measure Size | Serving size (g) | Energy | Vit C | Vit A | Iron | Folate | Calcium | Zinc | Fibre |
| | | | (kcal) | (mg) | (mcg) | (mg) | (mcg) | (mg) | (mg) | (g) |
| **Custard apple/sweet apple, raw (DM)** | _+ | 87.5 | 80 | 31.5 | 0.2 | 0.6 | NA | NA | 20.6 | NA |
| **Soursop, raw (WA)** | _+ | 103.9 | 80 | 62.3 | 0.0 | 0.4 | 6.0 | 6.2 | 20.8 | 0.2 |
| **Pomegranate raw (DM)** | _+ | 102.3 | 80 | 15.4 | 2.0 | 0.7 | 24.0 | 24.6 | 12.3 | 0.4 |
| **Avocado, pulp, raw (DM)** | _+ | 51.9 | 80 | 7.3 | 3.1 | 0.4 | 35.3 | 18.3 | 7.8 | 0.3 |
| **Dates (DM)** | _+ | 53.6 | 80 | 7.5 | 1.1 | 0.2 | 25.0 | 13.4 | 12.9 | 0.1 |
| **Star fruit, raw (WA)** | _+ | 60.6 | 80 | 77.0 | 0.0 | 0.9 | NA | NA | 14.5 | 0.6 |
| **Pears, raw *** | _+ | 140.4 | 80 | 6.0 | 1.4 | 0.3 | 7.0 | 9.8 | 12.6 | 0.1 |
| **Java plums, raw *** | _+ | 133.3 | 80 | 19.1 | 0.0 | 0.3 | NA | NA | 25.3 | NA |

***** USDA Food Composition Table sources
**†** FCT only has values for baobab pulp (without seeds). Eat baobab with little or no sugar to get the health benefits.
**‡** "Refuse" is the part of the fruit that is not consumed, for example, the skin and seeds.
**DM** Diet model
**WA** West Africa Food Composition Table
**_+** Cup or household measurements not available or could not be estimated
**NA** Data not available
Note: Other fruits like shoki-shoki, bilimbi, rambutan, durian, wild rubber vine (eaten with little or no sugar), fracassis, mobola plum, jelly palm, and pomelo also provide plenty of vitamins and minerals.

## 8.6 Key messages for eating fruits

1. Eat two servings of fruits every day.
2. Choose different coloured fruits throughout the week to increase the variety of phytonutrients consumed.
3. Eat fresh fruit in place of fruit juices.
4. Wash fruit with clean water before eating to prevent diseases.
5. Consume wild fruits such as baobab, tamarind and wild loquat when available as they are rich in vitamin C and calcium.
6. Limit processed fruit juices because they contain high amounts of added sugars and lack dietary fibre. Rather drink blended whole fruit or smoothies.

## 8.7 Tips for eating two types of fruits per day

1. Eat varieties of seasonally available fruits every day.
2. Eat fruit as snacks between meals instead of deep-fried foods, sweets or sweetened beverages.
3. Add a serving of fruit to your breakfast or meals.
4. Include varieties of wild fruits such as baobab, tamarind, *ntalali, mabungo*, and *furu*.
5. Grow your own fruit trees.


AZAM
P.P.F.
WHEAT FLOUR
UNGA SAFI MWEUPE
5 kg net
ATTA
NAIM
0783-38939

# 9. RECOMMENDATION 1.5

## EAT PULSES (LEGUMES) OR NUTS AND OILY SEEDS EVERY DAY FOR GOOD HEALTH

### 9.1 What are pulses, nuts and oil seeds?

Pulses are the dried seeds of the legume plants. Legumes are plants with seedpods that have two halves. They include beans, lentils and all types of peas, such as pigeon peas (*mbaazi*), chickpeas (*dengu*), cowpeas (*kunde*), green gram (*choroko*), and bambara (*njugumawe*).

Nuts are dry single-seeded fruits enclosed inside an outer layer. Nuts are energy dense due to their oil content. Examples of nuts include groundnuts and cashew nuts.

Oil seeds include pumpkin seeds, sunflower seeds and sesame seeds.

### 9.2 Benefits of eating pulses, nuts and oil seeds

Pulses, nuts, and oil seeds are affordable sources of protein. They are also a good source of iron, zinc, phosphorus, magnesium, B vitamins, folate and dietary fibre.

Nuts and oil seeds provide proteins, vitamin E, niacin, and minerals such as selenium, iron, zinc, magnesium and copper that help to improve the body's immune function. They are recognized for their protein, but they have more fat than protein (making them a great source of unsaturated fats). Unsaturated fats are healthy fats that help reduce bad cholesterol in the body and reduce the risk of heart disease. The nutrients in nuts and seeds makes them a healthy option.

Since pulses are great sources of iron, because of this, they are key to preventing iron deficiency anaemia, especially in low-income countries. They should be soaked overnight, drained, and cooked with fresh water to enhance the availability of iron. This process can reduce the amount of phytic acid, which prevents the iron from being released from the food and absorbed by the body. Iron from beans, lentils, and peas is best absorbed by the body when taken with foods that contain vitamin C (such as green leafy vegetables and citrus fruits) or when eaten with meat, fish and other seafood. Vitamin C helps to change the iron in beans to a more absorbable form.

Pulses are affordable sources of protein. Plant-based proteins, unlike proteins from animal sources, do not contain all the amino acids that make up complete proteins. However, when foods are eaten in combination, such as maize and beans, or beans and rice, the amino acids from two food groups will make the protein complete.

Pulses contain fibre, folate and phytochemicals that are beneficial to the functioning of the heart. The fibres in pulses help to lower blood cholesterol even without weight changes and may prevent sharp rises in blood sugar, both of which are risk factors for cardio-vascular diseases. A meta-analysis of mostly observational studies showed that eating pulses about four times per week was associated with a 14 percent reduced risk of coronary artery disease (Marventano *et al*., 2017).

Since pulses, nuts and seeds are affordable sources of proteins, iron, healthy fats and micronutrients, they should also be offered as complementary foods to infants and young children from 6 to 24 months to increase their iron, protein, and micronutrient intake.

In the United Republic of Tanzania, pulses are commonly consumed in all the regions among adults. Pulses are also the main protein source in institutions such as schools, prisons and colleges.

### 9.3 Coconut and coconut milk

Coconut milk is an aqueous extract of grated coconut kernel. It is commonly obtained through hand squeezing of grated coconut. It is traditionaly added when cooking vegetables, beans, cassava, sweet potatoes, plantains and rice. Coconut is a high calorie food due to the presence of lipids, sugars and protein, with most of the calories coming from fats (Nadeeshani *et al*., 2015).

About 90 percent of the fats are saturated fats, with most being the medium and short-chain triglycerides (Nadeeshani *et al*., 2015; Deen *et al*., 2021). The saturated fatty acid content is significantly greater than in other commonly consumed vegetable oils, so it should be consumed in moderation (Deen *et al*., 2021).

Apart from fats, sugars and proteins, coconut milk also contains carbohydrates, fibre, vitamins and minerals (including folate, iron, calcium, zinc, vitamin C, selenium, copper, magnesium and manganese).

In a systematic review that included eight clinical trials and 13 observational studies, it was observed that the consumption of coconut flesh or squeezed coconut does not lead to adverse cardiovascular outcomes. However, in intervention studies, replacing coconut oil with unsaturated fats affected the blood lipid profiles, thereby reducing the risk of cardiovascular diseases (Eyres *et al*., 2016).

In another systematic review and meta-analysis, consumption of coconut oil increased low-density lipoprotein (LDL) cholesterol and also increased high-density lipoprotein (HDL) cholesterol compared with non-tropical vegetable oils. However, it did not significantly affect markers of glycemia, inflammation, and adiposity compared with non-tropical vegetable oils (Neelakantan, Seah and van Dam, 2020).

The WHO (2018d) recommends that intake of saturated fats should be less than 10 percent of total energy intake. Based on the Tanzania Mainland diet model, for a 2300-kcal diet, 10 percent is equivalent to 230 kcal.

Based on the food composition table (FCT) used for the Mainland diet model and the USDA Food Composition Table, one cup (226 g) of coconut milk provides 445 kcal in total, of which 384 kcal is saturated fats, thus exceeding the total recommended maximum of saturated fats. It is therefore recommended that the intake of coconut milk be limited to a third of a cup (about 85 ml) or less per day. This amount provides 148 kcal, which is about one serving from the pulses, nuts and seeds group.

### 9.4 How much pulses, nuts and oil seeds to consume per day

According to diet modelling for Tanzania, three servings of pulses, nuts and oils seeds are recommended every day. One serving is 120 kcal. Given the different energy densities between pulses, nuts and oil seeds, the serving sizes can vary considerably. For instance, one serving of pulses is about 100 g and provides about 130 kcal, whereas one serving of nuts and oil seeds is about 30 g and provides the same 130 kcal.

One serving is equivalent to either of the following:

- ½ cup cooked lentils, cowpeas, or beans
- ½ cup cooked bambara
- ⅓ cup coconut milk
- 3 tablespoons (27–30 g) of sesame seeds, dehulled sunflower seeds, or pumpkin seeds (dried and shelled)
- 3 tablespoons cashew nuts, peanuts or almonds
- 1½ tablepoons peanut butter or peanut flour or cashew nut flour

**Table 10 Pulses, nuts and oil seeds household measure serving size equivalents and estimated key nutrients amounts**

| | Food description | Consume three servings daily by choosing any of the foods below. Each food amount listed is one serving equivalent. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | one-serve measures | | Food weight and nutrient values from the Mainland Diet Model FCT or otherwise specified (values are rounded up) | | | | | | |
| | | 1 serving measure | 1 serve food weight (g) | Energy | Protein | Iron | Folate | Calcium | Zinc | Fibre |
| | | | | (Kcal) | (mg) | (mg) | (mcg) | (mg) | (mg) | (g) |
| Pulses | **Cowpeas** | ½ cup | 80 | 94 | 6.3 | 1.8 | 61.8 | 20.6 | 1.2 | 4.5 |
| | **Boiled red kidney beans*** | ½ cup | 90 | 111 | 8.6 | 2.5 | 66.6 | 39.6 | 0.81 | 8.4 |
| | **White beans** | ½ cup | 90 | 111 | 7.4 | 1.6 | 65.7 | 20.7 | 1.1 | 3.4 |
| | **Bambara nuts boiled** | ½ cup | 90 | 125 | 6.7 | 0.9 | missing | 18.5 | 1 | 1.3 |
| | **Soya beans** | ½ cup | 85 | 151 | 11.8 | 2.4 | 69.7 | 72.7 | 1.6 | 3.4 |
| | **Coconut milk†** | ⅓ cup | 75 | 148 | 1.6 | 2 | 11.3 | 12.8 | 0.5 | 1.7 |

*Continued on page 68*

| | Food description | Consume three servings daily by choosing any of the foods below. Each food amount listed is one serving equivalent. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | one-serve measures | | Food weight and nutrient values from the Mainland Diet Model FCT or otherwise specified (values are rounded up) | | | | | | |
| | | 1 serving measure | 1 serve food weight (g) | Energy | Protein | Iron | Folate | Calcium | Zinc | Fibre |
| | | | | (Kcal) | (mg) | (mg) | (mcg) | (mg) | (mg) | (g) |
| Nuts and seeds | Dry roasted peanuts* | 3 tablespoons | 27 | 159 | 6.5 | 0.4 | 26.2 | 15.7 | 0.756 | 2.3 |
| | Peanuts raw* | 3 tablespoons | 27 | 153 | 7 | 1.3 | 64.8 | 24.8 | 0.9 | 2.3 |
| | Seeds, flax, chia sunflower* roasted | 3 tablespoons | 25–30 | 145–175 | 4.8–5.7 | 1–1.14 | 59–71 | 18–21 | 13–1.6 | 2.8–3.3 |
| | Pumpkin and squash seeds (shelled), dried* | 3 tablespoons | 30 | 145* | 9 | 2.6 | 17.4 | 13.8 | 2.3 | 1.8 |
| | Sesame seeds | 1½ tablespoons | 25 | 144 | 4.6 | 3 | 24 | 245.8 | 1.9 | 3 |
| | Peanut butter* | 1½ tablespoon | 24 | 134 | 5.3 | 0.5 | 8.4 | 13 | 0.6 | 1.4 |

* Calculated from the USDA FCT. The rest are calculated from the Mainland Diet Model FCT.
† Given the high amounts of fat (especially saturated fats) and lower amounts of other nutrients, limit intake of coconut milk to one serving per day. Choose other pulses, nuts and seed options to make a second serving from this food group.

## 9.5 Key messages for eating pulses, nuts and oily seeds

1. Eat pulses such as beans, peas, lentils, cowpeas, pigeon peas, and soya daily.
2. Eat a handful of unsalted nuts or oil seeds every day as a snack.
3. Eat pulses, nuts or seeds together with fruits or vegetables. Vitamin C in fruits and vegetables enhances iron absorption.
4. Feed cooked beans, lentils and peas to infants and young children aged 6–24 months to increase iron and protein intake.
5. Include pulses (legumes), nuts, and oil seeds in the diet of pregnant and lactating women.

## 9.6 Tips for eating three servings of pulses, nuts and oil seeds every day

1. Soak beans overnight to get rid of gas-producing antinutrients and make them easier to cook.
2. Add the paste and/or flours of nuts or oil seeds to your relish, vegetables and porridge.
3. Avoid adding soda or ash when cooking pulses.
4. Mix pulses with whole grains to improve protein quality.

# 10. RECOMMENDATION 1.6

## EAT ANIMAL SOURCE FOODS EVERY DAY TO STAY STRONG

### 10.1 What are animal and animal-source foods?

Animal and animal-source foods are foods derived from animals, fish and insects. They include red and white meat, fish, sardines, octopus, organ meats, blood, egg, milk, and insects.

White meat includes meat from chicken, ducks, pigeons, birds and fish. Red meat includes beef, goat, mutton, and pork.

Animal products such as butter, ghee, lard and icecream are excluded from this food group and are classified as oils and fats because of their high fat content.

Processed meats are not included in this group because they are risk factors for developing chronic diseases.

When eating from this food group, select seafood and insects as much as you can, take milk and milk products daily, and eat white meat regularly.

Limit intake of red meat and avoid eating processed meats.

Fish, poultry, and insects are the healthiest options among animal-source foods due to their healthy fatty acids and oils. They are associated with a reduced risk of cardiovascular diseases and stroke. Insects are rich in micronutrients and are cheap to produce. Farming them is more environmentally friendly than farming other animal-source foods.

### 10.2 Benefits of eating animal-source foods

- They are rich in proteins.
- They have a complete profile of amino acids, thus providing the body with higher quality protein than the plant-based proteins found in pulses, nuts, and seeds.
- They are a good source of iron, zinc, and vitamins A and B, which are especially important for growth and development.
- They have bioavailable iron and can prevent iron-deficiency anaemia.
- They aid in the growth and repair of tissues.
- They help to build the framework (collagen) of bones and teeth, tendons and ligaments, and blood vessels.

- Excess protein that is not used for any of these functions is usually broken down and converted to energy.

**Eggs:** Eating an egg can greatly improve the quality of a child's diet and reduce stunting (Iannotti *et al*., 2017). Eggs, though high in cholesterol, are not associated with the risk of heart disease or stroke, except in people with diabetes (Rong *et al*., 2013), and consuming up to one egg per day may decrease the risk of stroke (Alexander *et al*., 2016).

**Fish:** Fish provides protein, healthy fats that are good for the heart and normal cell functions, and a range of other important nutrients such as vitamin A and calcium (Willet *et al*., 2019). Eating at least two servings of fish per week during pregnancy can promote brain development of the foetus. Fish also helps with a child's brain development (Oken, *et al*., 2008). Eating sardines or small fish with bones provides additional benefits as a source of calcium.

**White meat:** White meat from chicken, poultry and birds (without skin) and fish, including small fish eaten with bones, are healthier options than red meat such as beef, lamb and pork. White meat is lower in saturated fat than red meat.

**Edible insects:** Insects are good sources of complete protein and high levels of vitamin B12, iron, zinc, fibre, essential amino acids, omega-3 and omega-6 fatty acids, and antioxidants. By weight, insects contain higher amounts of protein than traditional sources of protein such as meat, dairy products and seeds (Hlongwane, Slotow and Munyai, 2020; Oibiokpa *et al*., 2018).

Insects contain between 12 g and 77 g of protein per 100 g (Hlongwane, Slotow and Munyai, 2020) while fish, chicken and beef contain between 13 g and 31 g of protein. Protein digestibility of insects ranges from 76 percent to 98 percent (Ramos-Elorduy, 1997).

Studies have shown that in insects such as crickets, grasshoppers and mealworms, micronutrients like copper, zinc, manganese, magnesium and calcium are more readily available for absorption than the same nutrients found in beef. Some insects, like crickets, contain more omega-6 and omega-3 than beef. Insects also contain comparatively high amounts of iron, zinc, manganese, selenium and phosphorus (Rumpold and Schluter, 2013).

Grasshoppers provide 12–73 g of protein per 100 g while winged termites provide 32–37 g per 100 g (Hlongwane, Slotow and Munyai, 2020; Bukkens,1997).

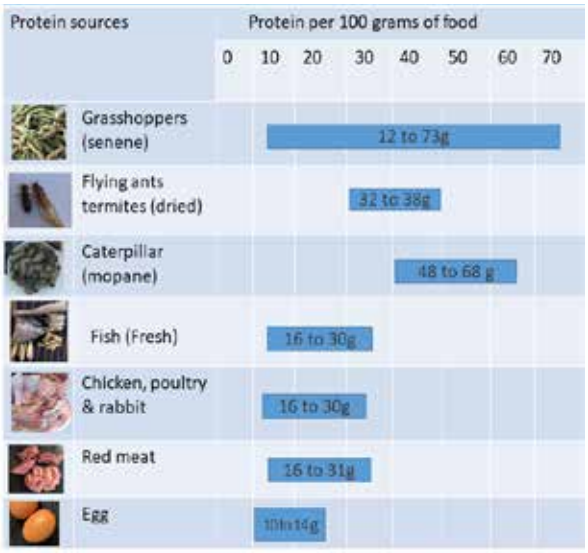



**Figure 3 Protein content of animal-source foods**

*Sources: Hlongwane, et al., 2020; Bukkens,1997, Oibiokpa et al., 2018, Ramos-Elorduy, 1997]*

**Milk:** Fresh milk, fermented milk and yoghurt are the three most important forms of milk available in the United Republic of Tanzania. Milk and milk products are the good sources of calcium, which helps build strong bones. They also supply protein, riboflavin (vitamin B2), cobalamin (vitamin B12), retinol (vitamin A) and potassium. Milk fat serves as a vehicle for the important fat-soluble vitamins A, D, E and K. However,

milk fat contains mainly saturated fat, so skimmed or low-fat milk is a better option for those on a low-fat diet. Whole milk or milk fat is good for growing children.

**Red meat:** Although red meat contains more B vitamins, iron and zinc than white meat, people are advised to limit their consumption of red meat as high consumption has been correlated with an increased risk of NCDs. Red meat contains higher amounts of saturated fats than white meat, which can lead to heart disease. Saturated fats are found in white marbling (intramuscular fat) of the red meat and in the skin of poultry, as well as in milk cream and cheese. Red meats also contain trans-fats, which increase the risk of coronary heart disease.

When eating animal source foods, choosing fish and chicken or duck over red meat is recommended. Higher intakes of poultry, fish and nuts have been shown to be associated with a significantly lower risk of coronary heart disease (WHO, 2015a; Abete *et al*., 2014).

**Processed meats:** Processed meat is meat that has been transformed through salting, curing, fermentation, smoking or other processes to enhance flavour or improve preservation. Nitrite is the most commonly used meat preservative in processed meat (WCRF, 2018). Examples of processed meat are luncheon meats, corned beef, sausages, hot dog sausages, burgers, smoked/cured products, and beef salami.

The WHO places the risk of eating processed meat in the same category as smoking (WHO, 2015). The Global Burden of Disease report defines exposure to a diet high in processed meat as an average daily consumption greater than 22.5 grams of processed meat (GBD, 2019). Thus, avoiding processed meats is recommended.

## 10.3 Consumption patterns of animal-source foods in Tanzania Mainland

In the United Republic of Tanzania, consumption of animal-source foods is low in all population groups. In the rural areas, less than 20 percent of the households reported having consumed meat, eggs or milk, despite most of these foods being available in most areas (Khamis *et al*., 2020; Ochieng *et al*., 2017; Kinabo *et al*., 2016).

## 10.4 How much animal-source foods to eat

Based on the Tanzania Diet model, it is recommended that individuals consume two servings of animal-source foods per day. One serving is equivalent to 135 kcal per day, which is between 60–100 g depending on the food.

The amount of animal-source foods can be estimated using the size of the palm or other measures. For example:

- two eggs (~95 g and 135 kcal)
- two matchbox size pieces of red meat (beef, goat, sheep), beef liver. Limit intake to less than 160 g equivalent per week to help protect against heart disease and some cancer
- three matchboxes size pieces (or size of a palm*) fish, poultry or rabbit (~90 g and ~130 to ~135 kcal)
- 1 serving spoon sardines canned in tomato, drained (68 g and 121 kcal)
- ½ cup insects (different types), dried (50 to 100 g and 135 to 220 kcal)
- 1 cup milk or sour milk (245 g and ~123 Kcal)
- ¾ cup or one small tub yoghurt (200 g and ~114 kcal)
- ⅓ cup cheese, shredded (40 g and 161.1 kcal)
- four dice-size pieces of cheese (30 g and ~135 kcal)

One-serving equivalents of animal-source foods are shown in Tables 11a and 11b.

* The palm comprises the underside of the human hand; a linear measurement approximating the width of the palm of the hand, from 6.3 to 10.2 cm.

**Table 11a: Red meat, poultry, eggs and insects: household measure serving size equivalents and estimated key nutrition amounts**

| | Food description | 1 serving food weight | Energy | Protein | Iron | Folate | Zinc | Vitamin B12 | Calcium |
|---|---|---|---|---|---|---|---|---|---|
| | | | (kcal) | (g) | (g) | (mcg) | (g) | (m) | (mg) |
| Red meat | **Beef meat, lean, boiled* (without salt)** | 65 | 137 | 23 | 2.3 | 5.2 | 4 | 0.9 | 4.6 |
| Red meat | **Goat meat, boiled* (without salt)** | 65 | 135 | 17.0 | 2.3 | 2.9 | 3.3 | 0.7 | 8.3 |
| Rabbit | **Rabbit meat, stewed or grilled** | 70 | 135 | 22.0 | 1.2 | 3 | 1.7 | 7.0 | 13.3 |
| Poultry | **Chicken liver, braised* (without salt)** | 80 | 135 | 22.0 | 9.6 | 596.8 | 3.5 | 19.2 | 12 |
| Poultry | **Chicken, light meat, flesh, boiled* (without salt)** | 95 | 135 | 29.5 | 0.6 | 5.7 | 1.0 | 0.2 | 9.5 |
| Eggs | **Eggs, hard-boiled (2 large)** | 100 | 135 | 12.6 | 1.7 | 38 | 1.2 | 0.7 | 53 |

*Continued on page 76*

| | Food description | 1 serving food weight | Energy | Protein | Iron | Folate | Zinc | Vitamin B12 | Calcium |
|---|---|---|---|---|---|---|---|---|---|
| | | | (kcal) | (g) | (g) | (mcg) | (g) | (m) | (mg) |
| **Fish** | **Anchovy steamed** | 85 | 135 | 23.5 | 3.2 | 6 | 2.2 | 0.7 | 109.7 |
| | **Tilapia, steamed** | 115 | 135 | 25.4 | 1.4 | 23 | 1.1 | 1.7 | 23 |
| | **Sardine, steamed* (without salt)** | 101 | 130 | 24.3 | 1.8 | 3.2 | 2.0 | 11.1 | 89.7 |
| | **Mackerel, boiled* (without salt)** | 107 | 130 | 20.7 | 0.7 | 0.7 | 0.5 | 2.0 | 29.1 |
| | **Tuna, boiled* (without salt)** | 82 | 130 | 24.0 | 0.9 | 10.7 | 0.5 | 4.2 | 14.8 |
| | **Swordfish, cooked, dry heat** | 79 | 130 | 18.5 | 0.4 | 1.6 | 0.6 | 1.3 | 4.7 |
| | **Barracuda, steamed* (without salt)** | 133 | 130 | 29.8 | 1.1 | 9.3 | 0.8 | 2.7 | 41.2 |
| Other fish to choose from are whitebait, trevallies, pilchards, herring, kippers, eels, mussels and kingfish. | | | | | | | | | |

*Continued on page 76*

| | Food description | 1 serving food weight | Energy | Protein | Iron | Folate | Zinc | Vitamin B12 | Calcium |
|---|---|---|---|---|---|---|---|---|---|
| | | | (kcal) | (g) | (g) | (mcg) | (g) | (m) | (mg) |
| Insects | **Flying ants** | 50 | 257** | 21 | 11 | 47 | 4.9 | NA | 56 |
| | **Mopane worms (cooked)** | 140 | 135 | 19.7 | 9.8 | 5 | 4.5 | 7 | 54 |
| | **Grasshoppers (cooked)** | 100 | 145 | 21 | 5 | NA | NA | NA | NA |
| | **Mole crickets blanched** | 105 | 137 | 16 | 44 | NA | NA | NA | 79.8 |
| | **Grasshoppers, locusts and crickets (dry)** | 50 | 217 | 27 | 13 | 185 | 6.9 | 6 | 122 |

NA = No value available in the food composition table.

* To match and reach adequate intake of the key nutrients, the quantity gives a higher than targeted energy.

Sources: General food groups: FAO, 2019. Insects: FAO, 2019; Hlongwane *et al.*, 2020; Van Huis et al., 2013; Steiner-Asiedu et al., 1993.

**Table 11b: Milk and milk products: household measure serving size equivalents and estimated key nutrient amounts**

| Food description | Measure | 1 serving food weight | Energy | Protein | Iron | Folate | Zinc | Calcium | B12 | Fibre |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | (kcal) | (g) | (g) | (mcg) | (mg) | (mg) | (mcg) | (g) |
| **Cow milk 2 percent low fat*** | 1 cup | 245 | 122.5 | 8.1 | 0 | 12.3 | 1.2 | 294 | 1.2 | 0 |
| **Cow milk 3.5 percent fat (whole milk)** | 1 cup | 245 | 158 | 8.3 | 0.1 | 24.5 | 1 | 294 | 1.5 | 0 |
| **Yoghurt, low fat*** | 2 small tins** | 200 | 114 | 8 | 0 | 22 | 1.8 | 308 | NA | 0 |
| **Yoghurt, low fat*** | ¾ cup | 200 | 114 | 8 | 0 | 22 | 1.8 | 308 | NA | 0 |
| **Yoghurt, whole milk, plain** | ¾ cup | 185 | 135.1 | 7 | 0.2 | 22.2 | 1.1 | 281.2 | 0.6 | 0 |
| **Cheese shredded*** | ⅓ cup | 40 | 161.1 | 9.2 | 0.1 | 10.8 | 1.5 | 283.9 | 0.4 | 0 |

* FDC 2020 (USDA) sources
** Smallest tin of commercial yogurt is 100 g
NA = no value available in the food composition table.
Source: FAO. 2019. *FAO/INFOODS Food Composition Table for Western Africa*. 2019: User Guide & Condensed Food Composition Table. Rome.

## 10.5 Key messages for healthy eating of animal-source foods

1. Eat at least two servings of fish, poultry, milk, or egg every day.
2. Eat fish as often as possible each week. One or two servings should be from fatty fish, such as Nile perch (*sangara*).
3. Choose small fish eaten with bones, such as fresh sardines, to get the benefits of calcium.
4. Eat more white meat, insects, and eggs than red meat. White meat, such as fish and poultry (without skin), are lower in saturated fat than red meat.
5. Limit intake of red meat to less than 160 g (size of two palms) per week.
6. Avoid eating processed meats such as sausages, luncheon meats, polony and ham.
7. Avoid eating cheese with a lot of salt.
8. Limit intake of ice cream, butter, and cream which are high in fat, sugar and salt.
9. Pregnant and lactating women should take special care to include poultry and meats in their diet.
10. Offer poultry, meats and eggs to infants and young children aged 6–24 months.
11. Give plain, full-cream milk only to children above one year whenever possible.

## 10.6 Tips for healthy intake of animal-source foods

1. Add an egg or milk to porridge or meals intended for children.
2. Eat unsweetened yoghurt and add fresh fruit to reduce sugar intake.
3. Use low-fat or skim milk to lower the amount of saturated fat for adults.
4. Use milk and milk products with little or no added sugar.
5. Share fish, sardines, chicken, milk, eggs and meat with everyone in your family.
6. Trim fat off the fish, meats and discard poultry skin before eating.
7. Grill, pan-fry, steam, boil or bake instead of deep frying.
8. Cook meat thoroughly to prevent food-borne illnesses.


# 11. RECOMMENDATION 1.7

## CHOOSE UNSATURATED FATS AND OILS AND EAT IN SMALL AMOUNTS

### 11.1 What are fats and oils?

Fats and oils are extracted from plant and animal sources. Oils are liquid and fats are solid at room temperature.

Oils from plant sources are usually referred to as vegetable oils. Vegetable oils include oils from sunflowers, groundnuts, canola, olives, coconuts, palm and other nuts, oil seeds, and other plant oils.

Animal-source fats include butter, ghee, lard, and fish oil.

Other examples of fats are margarine, mayonnaise, shortening, coconut cream and coconut flesh.

### 11.2 Types of fats and oils

All fats are made up of carbon, hydrogen, and oxygen molecules. The difference between the fats is their chemical structure, particularly in the number of double bonds in the fatty acid chain.

There are three types of fats – unsaturated fats, saturated fats and trans-fatty acids. Some fats are essential in promoting good health and preventing NCDs, while others are linked to negative health effects (and thus are not included in the six food groups). Knowing the difference is important to determine which fats to avoid, which to eat in moderation and which fats to limit.

#### *11.2.1 Unsaturated fats*

Unsaturated fatty acids (unsaturated fats) are made up of one or more double bonds in their fatty acid chain. The double bonds allow saturated fats to remain liquid at room temperature but can also be found in solid foods.

Unsaturated fats are usually referred to as good or healthy fats. Unsaturated fats are therefore part of the six food groups for a healthy diet when taken in moderation. The two main types of unsaturated fats are monounsaturated fats and polyunsaturated fats:

- Monounsaturated fatty acids (MUFAs) are made up of one double bond. Some sources of MUFAs include peanut, canola,

groundnut, olive, sunflower and safflower oils, most nuts, and avocados. Chicken and poultry also contain MUFAs.

- Polyunsaturated fatty acids (PUFAs) are made up of more than one double bond. These fats are sources of omega-3 and omega-6 fatty acids. Sources include corn, soybean, sunflower, and cottonseed oils. Nuts such as walnuts and pine nuts and seeds such as sesame, flaxseed, sunflower, pumpkin and chia seeds also contain PUFAs. Cod liver oil and oily fish such as sardines, kippers, mackerel, salmon, herring, pilchards, eels, whitebait and tuna are also sources of PUFAs (WHO, 2018d).

### *11.2.2 Saturated fats*

Saturated fats have no double bonds in the fatty chain. They are "saturated" with hydrogen atoms, which means they naturally have the greatest number of hydrogen atoms possible. With a few exceptions, saturated fats are usually solid at room temperature.

Saturated fats mostly come from animal sources and include butter, ghee, and cream. In beef and poultry, white marbling and the skin of the poultry contain large amounts of saturated fats. Some plant oils, such as palm and coconut, have saturated fats. Other sources of saturated fats are coconut cream, coconut flesh and coconut milk.

The WHO recommends that total fat intake be less than 30 percent of the total daily energy intake and that saturated fat intake be less than 10 percent of the total daily energy intake (FAO and WHO, 2010).

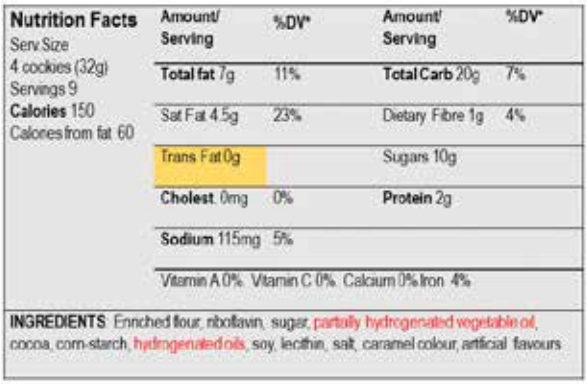
### *11.2.3 Trans fats*

Trans fats occur in both natural and artificial forms. The artificial trans fats are created in an industrial process known as partial hydrogenation. Hydrogenation turns a liquid unsaturated oil into a solid fat (trans fatty acid) by adding hydrogen to the double bonds of unsaturated oil.

Trans fats are common ingredients found in ultraprocessed foods such as snack foods, fried food, frozen pizza, pies and cookies (WHO, 2021b).

Trans fats are also found in margarine, fat spreads, mayonnaise and shortening. They are referred to as partially hydrogenated oils in the ingredients list. They are inexpensive to produce and give food products a desirable taste and texture.

Naturally occurring trans fats are found in ruminant fat in dairy and meat products (WHO, 2021b). Eating products with trans fats increases the risk of developing heart disease and stroke (Islam *et al*., 2019). The WHO is working with countries to eliminate industrially produced trans-fatty acids (WHO 2021b).



| Nutrition Facts | Amount/ Serving | %DV* | Amount/ Serving | %DV* |
|---|---|---|---|---|
| Serv.Size 4 cookies (32g) Servings 9 Calories 150 Calories from fat 60 | Total fat 7g | 11% | Total Carb 20g | 7% |
| | Sat Fat 4.5g | 23% | Dietary Fibre 1g | 4% |
| | Trans Fat 0g | | Sugars 10g | |
| | Cholest. 0mg | 0% | Protein 2g | |
| | Sodium 115mg | 5% | | |
| | Vitamin A 0% Vitamin C 0% Calcium 0% Iron 4% | | | |

INGREDIENTS: Enriched flour, riboflavin, sugar, partially hydrogenated vegetable oil, cocoa, corn-starch, hydrogenated oils, soy, lecithin, salt, caramel colour, artificial flavours

**Figure 4 Product ingredients list showing trans fats and hydrogenated oils**

## 11.3 The importance of fats and oils

### *11.3.1 Oils and fats are necessary for the functioning of the human body.*

They play various key roles:

- Fats and oils provide essential fatty acids. Common examples of essential fatty acids are omega-3 and omega-6. The body cannot produce essential fatty acids on its own, so they must come from the diet. Very good

sources of essential fatty acids are fish, flaxseed oil and walnuts.

- Fats and oils help the body to absorb the fat-soluble vitamins A, D, E, and K. Many women and children in the United Republic of Tanzania are deficient in Vitamin A.
- Fats are an energy source for the body. They provide more energy than other food groups. Fat typically contains around 9 kcal of energy per gram while carbohydrates and proteins provide 4 kcal. Therefore, excessive intake of oils and fats can contribute to significant weight gain over a short period of time.
- Fats help slow down the passage of food from the stomach, thereby helping a person to feel full and satisfied for a longer period. They also make food delicious.

Of the three types of fats, unsaturated fats are better for the body and help to promote good health when taken in moderation, while trans fats are harmful and should be avoided. Limiting the intake of saturated fats is also essential for better health.

### *11.3.2 Unsaturated fats are critical to a child's cognitive development*

Unsaturated fatty acids are crucial to proper development and survival during the early stages of life (embryonic development, early growth after birth and through infancy and childhood).

Fatty acids are important for brain and cognitive development, especially in infants and children (FAO and WHO, 2010). There is a positive relationship between polyunsaturated fatty acid status and cognition, growth and executive function in children (Adjepong *et al*., 2018; Jumbe *et al*., 2016; Hahn *et al*., 2015).

Unsaturated fatty acids are considered key nutrients that affect the embryo's development during pregnancy and the early stages of an infant's life. The role of long-chain omega-3 fatty acids as structural components for the development of the brain and the central nervous system is now recognized (FAO and WHO, 2010).

Fats and fatty acids are important for cell membrane functions and control gene transcription during pregnancy.

**TAKE UNSATURATED FATS IN MODERATION**

**While unsaturated fats are healthier than saturated fats and trans fats, just like all other oils and fats, they have higher concentrations of calories than other food groups. Therefore, excessive intake of oils and fats can contribute to weight gain.**

### *11.3.3* Unsaturated fats reduce the risk of developing non-communicable diseases

Unsaturated fats, especially the long-chain polyunsaturated fatty acids alpha-linolenic acid, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), contribute to the prevention of coronary heart diseases (Ghamarzad *et al*., 2021).

## 11.4 Health risks of excessive intake of saturated and trans fats

### *11.4.1 Saturated fats*

Excessive intake of saturated fat, especially from animal sources, can raise the bad cholesterol and the risk of heart disease (Clifton and Keogh, 2017).

There is a possible relationship between intake of saturated fats and increased

risk of diabetes. On the other hand, there is convincing evidence that replacing saturated fats with polyunsaturated fats decreases the risk of cardiovascular heart diseases (FAO, 2010b). Reducing fat intake from processed foods which contain lots of fat is important for keeping the bad cholesterol or LDL at a normal level. Evidence shows that taking in palm oil from processed foods raises the LDL (Sun *et al*., 2015).

Many studies, including a systematic review of 15 studies with over 59,000 participants, found that cutting down on saturated fat led to a 17 percent reduction in the risk of coronary heart diseases (including heart disease and strokes), but found no effects on the risk of dying (Hooper *et al.,* 2015). Furthermore, the study found no clear health benefits of replacing saturated fats with starchy foods or protein. Changing the type of fat, replacing saturated fats with polyunsaturated fats, seems to protect the body better, reducing the risk of heart and vascular problems. The greater the decrease in saturated fat, and the more serum total cholesterol is reduced, the greater the protection.

### *11.4.2 Trans fats*

- Avoid consumption of trans-fats or partially hydrogenated vegetable oils to prevent heart diseases. (FAO, 2010a; GBD, 2017).
- These fats raise the LDLs and lower the good cholesterol or HDLs (GBD, 2019).
- There is probable evidence that trans-fatty acids increase the risk of metabolic syndrome components that increase the chance of developing type 2 diabetes (FAO, 2010a; GBD, 2017). Other metabolic syndromes include inflammation and endothelial dysfunction (Mozaffarian, Aro and Willett, 2009).
- Trans fats have no known health benefits and there is no safe level of consumption (Islam *et al.*, 2019).
- The Global Burden of Disease report defines a high trans-fatty acid diet as one that has an average daily consumption greater than 0.5 percent of trans-fats from all sources, mainly partially hydrogenated vegetable oils and processed ruminant products (Willet *et al*., 2019). For a 2200-kcal diet, this is equivalent to 1 g of fat, which is less than one teaspoon (note that one teaspoon of oil is about 5 g). Most ultraprocessed foods contain more than this amount per serving. In countries with laws on labelling, companies are only required to report amounts of more than 0.5 g per serving.

## 11.5 Global guidance on recommended amounts of healthy fats and oils

The WHO recommends that total fat intake be less than 30 percent of total energy intake to avoid weight gain. It further states that saturated fat intake should be less than 10 percent of total energy (FAO, 2010a; WHO, 2018e). FAO and WHO recommend that dietary fat should contribute a minimum 15 percent of total energy requirements per day of essential fatty acids and fat-soluble vitamins (FAO, 2010) to enable the body to meet the requirements for dietary fat and to ensure adequate intake of essential fatty acids and fat-soluble vitamins.

In the rural setting of Tanzania Mainland, fat and oil intake contributes about 9–14 percent of energy intake (Kinabo *et al*., 2016). Most of the cooking oil is palm and sunflower oil. There could be a higher intake of oils and fats in urban areas where there is a high frequency of consumption of deep-fried foods in schools (FAO, 2007).

In addition, fats and oils also come from processed foods like biscuits and potato crisps and from meat and other foods. In practice, therefore, only a small amount of oil should be used for cooking to ensure less than 30 percent energy intake is from this group.

## 11.6 Recommended fat intakes for Tanzania

Based on the diet modelling for Tanzania mainland, this guideline recommends about 28 g or 2 tablespoons of added oil to foods per day. Intake of saturated fats such as ghee, palm oil, or coconut oil should be limited to about 1 teaspoon (5 g).

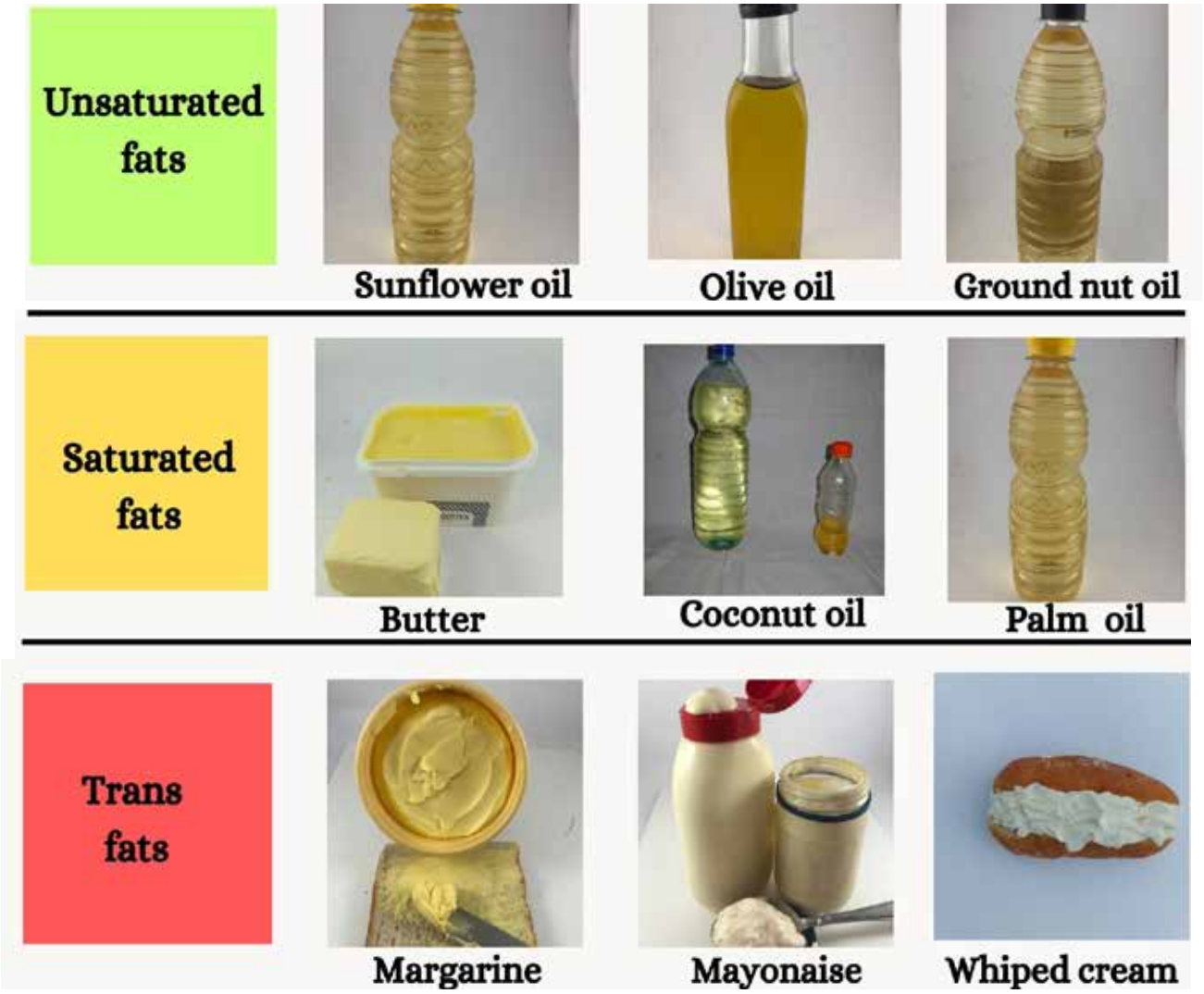


**Table 12 Fats and oils household measure serving size equivalents and estimated key nutrient amounts**

| One serving of fats and oils | Household measure | Serving size | Energy | Protein | Fat | Carbohydrate | Calcium | Iron | Zinc | Vit A-RAE | Folate | Fibre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 ml tbsp | (g) | kcal | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mcg) | (mcg) | (g) |
| **Coconut oil** | 1 | 14 | 126 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Cottonseed oil** | 1 | 14 | 126 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Groundnut oil** | 1 | 14 | 126 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Palm oil, red** | 1 | 14 | 126 | 0 | 14 | 0 | 0 | 0 | 0 | 800 | 0 | 0 |
| **Palm oil, refined** | 1 | 14 | 126 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Shea butter** | 1 | 14 | 126 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Soya oil** | 1 | 14 | 126 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Vegetable oil** | 1 | 14 | 126 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Butter, from cow's milk** | 1 | 14 | 100 | 0.4 | 11 | 0 | 2.4 | 0 | 0 | 96 | 0 | 0 |
| **Margarine, fortified** | 1 | 14 | 102 | 0.1 | 11.5 | 0 | 0 | 0 | 0 | 115 | 0 | 0 |


## 11.7 Key messages for healthy eating of unsaturated oils and fats

1.Use 28 g or 2 tablespoons of added oils to food per day.

2.Choose liquid vegetable oils (e.g. sunflower, groundnut, olive, sesame (simsim) and avoid palm oil, coconut oil, butter or ghee.

3. Eat oily fish and oily seeds and nuts often to get essential fatty acids.
4. Avoid intake of trans fats mostly found in ultraprocessed foods and fried fast foods.
5. Use coconut milk in moderation; not more than one-third of a cup per person per day.

## 11.8 Tips for eating small amounts of unsaturated oils and fats

1. Stir-fry foods instead of deep-frying foods.
2. Cut out visible fats from meats and discard poultry skin before cooking. Animal fats contain large amounts of saturated fats.
3. Choose lean cuts of meats with less visible white streaks of fat.
4. Do not add extra oil or fat when cooking meats and poultry.
5. Avoid processed foods containing trans-fatty acids.
6. Read food labels and avoid buying foods with partially hydrogenated oils in the ingredients list. Partially hydrogenated oils are made industrially in commercial settings to boost flavour and increase shelf life.

# **GUIDELINE 2:** Attain optimal nutrition for pregnant and lactating mothers, infants and children to ensure the mother's wellbeing and the child's healthy growth and development

# 12. RECOMMENDATION 2.1

## WHEN PREGNANT OR BREASTFEEDING, EAT A VARIETY OF FOODS FROM THE SIX FOOD GROUPS FOR YOUR HEALTH AND THE HEALTH OF YOUR BABY

The first 1,000 days refers to the period from conception until the baby is two years old. This period has a lifelong effect on health and wellbeing. Providing good nutrition to the foetus in the womb and through early life is essential for a child's future health. What a mother eats, her weight and her lifestyle habits can influence the development of the baby's metabolism, brain and immune system as well as its general growth.

Poor nutrition during pregnancy and early life can lead to obesity, heart disease and stroke later in in the child's life.

Pregnant women are at risk of micronutrient deficiencies, especially iron, iodine, calcium, folic acid, and vitamin A (FAO, 2004a). Micronutrient deficiencies, particularly of vitamin A and iron, can lead to maternal deaths.

Thus, pregnant and lactating women need additional energy, protein, vitamins (A, D, B3, B6, B9, B12, C) and minerals (iron, calcium, selenium, zinc) to support their health and survival, and to sustain growth of the foetus (Jouanne *et al*., 2021; Gernand *et al*., 2016).

### 12.1 Benefits of adequate nutrient intake

Adequate nutrient intake during pregnancy coupled with exclusive breast feeding and optimal complementary feeding is good for the child in the following ways:

- enhances foetal development and growth;
- ensures healthy birth weight;
- reduces the risk of birth defects;
- reduces the risk of stunting;
- promotes good brain development

for the foetus and child improves school enrolment and attendance;

- improves cognitive and academic performance; and
- improves the health of children throughout their lifecycle.

## 12.2 Nutrient needs during pregnancy

***Energy requirements***

A pregnant woman needs extra energy to support the changing metabolism of her body, the growth of the foetus, the status of the placenta, and maternal tissues (Institute of Medicine, 1990). Pregnant women require extra energy to maintain adequate maternal weight, body composition and physical activity during pregnancy (FAO, WHO and UNU, 1981; FAO, WHO and UNU, 2001).

It is recommended that pregnant women consume an additional 360 kcal per day in the second semester and 475 kcal per day over and above the non-pregnancy energy intake level (FAO, 2004b). However, the energy requirement may vary depending on the woman's age, body weight, and activity level.

***Protein requirements***

Proteins are building blocks of life, present in every cell of the body. After someone eats proteins, the body breaks them down into individual amino acids, which are then used to build, maintain and repair tissues, bones, muscles, cartilage skin and build cells.

Thus, protein is essential during pregnancy for the growth and development of a baby's tissues and organs, including the brain. Protein is important for uterine tissue development needed to accommodate and nourish a growing baby. Blood volume and supply increase during pregnancy to support the growing baby and protein is essential in facilitating the transport of blood around the body and to the baby. In addition, proteins support the increased growth of breast tissue.

Protein requirements vary during the various stages of pregnancy. Additional requirements during pregnancy are 1 g, 9 g and 3 g during the first, second and third trimesters respectively (FAO, WHO and UNU, 2007).

In light of the findings of some literature indicating neonatal death associated with supplements that are high in protein (34 percent of protein: energy), it is recommended that the additional protein requirements must come from normal foods and not from commercially prepared protein supplements (WHO, FAO and UNU 2007).

***Iron***

Women need extra iron during pregnancy for the proper development of their babies and to prevent anemia. Iron-deficiency anaemia during pregnancy increases maternal mortality and incidences of low birth weight.

Iron is needed for the baby's haemoglobin synthesis, mental function, and to provide immunity against diseases during pregnancy and after birth. Insufficient iron intake during pregnancy is associated with increased cardiovascular risk of the child at adulthood (Alwan *et al*., 2015).

Iron is obtained from plant and animal-source foods. However, the bioavailability of iron from plant foods is poor, so consumption of vitamin C-rich foods (such as citrus fruits, tamarind, baobab and guava) is recommended to improve iron absorption. It is also important for pregnant women to take animal source foods in addition to plant sources.

***Folic acid (vitamin B9)***

Folic acid is important during periods of rapid growth, such as during pregnancy

and fetal development, particularly during the first trimester. Low folate levels in pregnant women lead to birth abnormalities, such as neural tube defects, anencephaly and spina bifida, in which the baby's spinal cord and brain fail to develop properly (Czeizel *et al.,* 2013; Fanzo, 2013). Folic acid is required to make healthy red blood cells (Fanzo, 2013), so it plays an important role in preventing maternal anaemia during pregnancy. Adequate folic acid prevents low birth weight and preterm birth (WHO, 2012b; WHO 2016b). Folate also helps to form DNA and RNA and is involved in protein metabolism.

***Iron and folate supplementation***

It is recommended that pregnant women should take iron and folic acid supplements throughout pregnancy and continue for up to three months after delivery (WHO, 2016b; WHO, 2016d).

- Folic acid supplementation for the prevention of neural tube defects is only beneficial pre-pregnancy and during the first 28 days. Where possible, women should take folic acid supplements before conception (WHO, 2016b; WHO, 2016d).
- It is important for women who are pregnant or plan to become pregnant to have their iron levels checked and to bring any symptoms of anaemia to medical attention

The use of iron and folate supplementation for pregnant women is among the interventions that have been used in the United Republic of Tanzania for a long time. In the 2015/16 TDHS-MIS (MoHCDGEC *et al.*, 2016) it was observed that 20 percent of women aged 15–49 took iron tablets or syrup for at least 90 days during their last pregnancy. The proportion of pregnant women taking iron and folic acid supplements has increased over time from 3.5 percent in TDHS 2010 to 17.5 percent in TNNS 2014, to 21.4 percent in TDHS 2015–16, and further to 28.5 percent in 2018. The prevalence of anaemia significantly decreased from 44.8 percent in 2015–2016 to 28.8 percent in 2018 at national level.

***Vitamin A***

During pregnancy, vitamin A is important in foetal growth and development (Gutierrez-Mazariegos *et al,* 2011). Inadequate intake of Vitamin A can lead to night blindness and preterm delivery (West, 2003).

In Tanzania Mainland, prevalence of vitamin A deficiency among women of reproductive age is about 42 percent (NBS and ICF Macro, 2011).

Good sources of vitamin A include liver, eggs, fish, red palm oil, mangoes, papayas, carrots, pumpkins, orange-fleshed sweet potatoes, and dark green leafy vegetables such as cowpea leaves, spinach and amaranth.

***Calcium***

Calcium is important in pregnant women to help prevent pre-eclampsia (WHO, 2013). Insufficient calcium intake during pregnancy has been linked to the development of maternal hypertension, an important cause of maternal morbidity, foetal growth restriction (FGR), and preterm birth (Duley, 2009; WHO, 2013).

Dietary sources of calcium include milk, yoghurt, small saltwater and freshwater fish (sardines) when eaten with bones. Other sources such as dark-green leafy vegetables, baobab pulp and pulses also provide some calcium.

***Vitamin D***

Vitamin D is needed during pregnancy to reduce the risk of pre-eclampsia, gestational diabetes mellitus, preterm

birth, low birth weight and other tissue-specific conditions (FAO and WHO, 2004). Maternal vitamin D intake during pregnancy is important to ensure adequate vitamin D status in the infant during the neonatal period to prevent neonatal hypocalcemia, early onset of rickets and long-term consequences for the bone and other health outcomes of the offspring (Fuleihan *et al.,* 2015).

Vitamin D is found in oily fish such as salmon, sardines, herring and mackerel, as well as in liver and egg yolks. It can also be produced in the skin through exposure to sunlight.

***Zinc***

Zinc is essential for embryogenesis (formation and development of an embryo), fetal growth and protein synthesis. Poor maternal zinc status has been associated with foetal loss, congenital malformations, intrauterine growth retardation, reduced birth weight, and prolonged labour (Chaffee and King, 2012; Raimi *et al*., 2012). Zinc requirement during pregnancy increases significantly in the third trimester (FAO and WHO, 2004).

Food sources are adequate to provide zinc requirements during pregnancy. The best sources of zinc are lean red meat, whole-grain cereals, pulses (legumes). Other sources include processed cereals with low extraction rates, polished rice, chicken, pork or meat with high fat content, fish, roots and tubers, green leafy vegetables and fruits. Zinc from animal sources is highly bio-available for the body (FAO and WHO, 2004).

***Iodine***

Iodine is required for thyroid hormone synthesis. Thyroid hormone is important in the growth and development of the brain and central nervous system of the foetus and young children (WHO and FAO, 2004). During pregnancy, iodine requirements increase by about 50 percent due to maternal thyroid stimulation, an increase in renal iodine clearance and iodine transfer to the foetus for synthesis of fetal thyroid hormones (Jouanne *et al*., 2021). The recommended daily intake of iodine to provide for the needs of the foetus is 250µg (WHO *et al*., 2007).

Iodine deficiency in pregnant women can lead to maternal and foetal hypothyroidism. Other effects of iodine deficiency during pregnancy include spontaneous abortion, stillbirth, congenital anomalies, perinatal mortality, decreased intelligence and cretinism (WHO, UNICEF and ICCIDD, 2007; Pearce, 2017).

Iodine needs are met by simply eating fish and other seafood, meat, milk and eggs, and using iodised salt of less than 5 mg per day.

### *12.2.1 Recommendations for pregnant women*

Pregnant women should eat a variety of foods from all the six food groups as stated in the dietary guidelines for the general population, with emphasis on eating additional amounts of animal-source foods, pulses, nuts, seeds, fruits, vegetables, and whole grains to get energy and the key nutrients needed during pregnancy (WHO, 2016a).

Pregnant women should take an additional 360 kcal per day in the second semester and 475 kcal per day in the third (FAO, 2004b). However, depending on the woman's age, body weight, and activity level, the energy requirement will vary. Pregnant women should therefore consume carbohydrate-rich foods such as whole grains, roots, tubers, pulses, nuts and seeds. Not only are these foods rich in carbohydrates, they are also rich in other important nutrients such as vitamins, minerals, fibre and

some proteins. Nutrient requirements for lactating women are summarized in Appendix 2.

Pregnant women should add foods rich in protein from animal-source foods such as liver, meat, chicken, fish and eggs and plant sources such as pulses, nuts and seeds. It is important for pregnant women to eat more animal and animal products because they contain more bioavailable protein as well as iron and zinc.

Pregnant women should eat dark-green vegetables and orange-coloured fruits and vegetables such as pumpkin, amaranth, sweet potato leaves, papaya, mango, orange flesh, sweet potatoes, yellow pumpkins, pumpkin flowers and carrots for vitamin A and other key micronutrients.

Pregnant women should take daily oral iron and folic acid supplementation with 30 mg to 60 mg of elemental iron and 400 mcg (0.4 mg) of folic acid from the clinic or as prescribed by the doctor to prevent maternal anaemia, puerperal sepsis, low birth weight, and preterm birth (WHO, 2016b). Where possible, women should take folic acid supplements before conception.

In addition to a diversified diet, pregnant women need to make sure they drink enough water and have sufficient exercise and physical activity. Keeping physically active during pregnancy prevents excessive weight gain (WHO, 2016b).

Pregnant woman should have periodic weight check-ups to ensure appropriate weight gain. A well-nourished woman is expected to gain about 10 to 12 kg during pregnancy. Women who are overweight or obese before conception should gain less weight, ranging from 5 to 11 kg, depending on preconception or early pregnancy weight.

Pregnant woman should have periodic health checkups for blood pressure and anaemia.

### *12.2.2 Recommended intake during pregnancy*

The diet modelling for pregnant women aims to maximize micronutrient intake and additional calorie requirements during pregnancy. The serving sizes and nutrients supplied by the recommended diet model are shown in Table 13.

## Table 13 Recommended daily intake and the nutrients this eating pattern provides for pregnant women

| | Servings per day | Food weight | Energy | Protein | Fat | Carbohydrate | Fibre | Calcium | Iron | Magnesium | Zinc | Vitamin A-RAE | Thiamin | Riboflavin | Niacin | Vitamin B6 | Folate | Vitamin C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (g) | (kcal) | (g) | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mg) | (mcg) | (mg) | (mg) | (mg) | (mg) | (mcg) | (mg) |
| **Total nutrient intake** | | 1898.0 | 2624.3 | 100.8 | 64.5 | 388.6 | 43.1 | 1114.0 | 26.1 | 518.1 | 12.3 | 998.7 | 1.2 | 1.6 | 16.9 | 2.2 | 669.5 | 218.6 |
| **Cereals, starchy roots tubers, plantains and green bananas** | 4.5 | 652 | 925.1 | 17.1 | 1.8 | 205.4 | 9.2 | 65.0 | 2.3 | 106.2 | 1.7 | 45.2 | 0.2 | 0.3 | 2.6 | 0.4 | 61.8 | 32.2 |
| **Vegetables** | 2 | 281 | 134.3 | 12.7 | 0.9 | 15.6 | 6.6 | 750.5 | 10.8 | 121.5 | 1.2 | 589.6 | 0.2 | 0.6 | 2.0 | 0.4 | 127.3 | 52.1 |
| **Fruits** | 3 | 413 | 308.9 | 3.9 | 6.9 | 53.4 | 8.7 | 70.3 | 1.8 | 79.5 | 0.7 | 320.3 | 0.1 | 0.2 | 2.2 | 0.7 | 102.0 | 130.7 |
| **Pulses, nuts and oily seeds** | 3 | 293 | 410.2 | 27.1 | 8.0 | 48.3 | 18.5 | 100.0 | 7.3 | 175.1 | 3.3 | 0.0 | 0.6 | 0.2 | 3.9 | 0.4 | 354.2 | 2.9 |
| **Animal-source foods** | 2 | 155 | 270.1 | 39.8 | 11.9 | 0.8 | 0.0 | 126.1 | 3.8 | 35.2 | 5.2 | 43.6 | 0.1 | 0.4 | 6.1 | 0.2 | 23.8 | 0.6 |
| **Fats and oil** | 2.5 | 35 | 315.0 | 0.0 | 35.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sugary foods and sweets** | 1.5 | 69 | 260.7 | 0.1 | 0.0 | 65.1 | 0.0 | 2.2 | 0.1 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.1 |

### *12.2.3 Nutrient requirements for lactating women*

Eating a variety of foods from the six food groups is important for everyone, including breastfeeding women. However, breastfeeding women require additional calories, proteins and nutrients such as vitamin A, zinc, folate and vitamin C to maintain the mother's health and support milk production. These requirements can be met with a small extra meal each day (FAO, 2004a; FAO, 1981).

#### *Energy*

Breastfeeding women need additional calories as the production of milk and breastfeeding burns up a lot of energy.

While energy needs for breastfeeding are met from the fat that was stored during pregnancy, during exclusive breastfeeding in the first six months, women need an additional 505 kcal per day on top of their pre-pregnancy requirements (FAO, 1981; Dewey, 1997). Undernourished women and those with insufficient gestational weight gain should add 675 kcal per day during the first six months of lactation. After six months, the energy requirements for milk production are dependent on the rates of milk production influenced by the baby's age and breastmilk intake, the mother's activity levels, body size, and the percentage of the mother's body fat reserved during pregnancy (Dewey, 1997). Extra calorie intake may be obtained from additional healthy snacks such as fruits or nuts.

#### *Protein*

Breastfeeding women need about 25 g/day of extra protein to maintain adequate nutrition during lactation. These requirements can be met with an extra small meal each day (FAO, WHO and UNU, 2007).

#### *Vitamin A*

Infants are usually born with low body stores of vitamin A. Maternal dietary intake is an important determinant of breast milk vitamin A concentration and an infant's vitamin A status (Bahreynian, Saleki and Kelishadi, 2017; Gannon, Jones and Mehta, 2020). Mothers are, therefore, encouraged to exclusively breastfeed for the first six months postpartum. It is recommended that mothers who are breastfeeding should consume enough vitamin A to replace the amount lost through breastfeeding. Thus, the increments in basal and safe recommended intakes during lactation are 180 mg RE and 350 mg RE, respectively. This additional vitamin A intake is reduced after the infant reaches the age of six months or when solid foods are introduced (FAO and WHO, 2004).

#### *Iron*

In lactating women, the daily iron loss in milk is about 0.3 mg. Together with the basal iron loss of 0.8 mg, the total iron requirements during the lactation period amount to 1.1 mg/day (FAO and WHO, 2004). Lactating women should take iron and folic acid supplementation for at least three months after delivery (WHO, 2016a).

#### *Folic acid*

Folic acid is naturally found in the breast milk of people who are well-nourished. Milk folate content can be maintained at a level that prevents the development of folate inadequacy in exclusively breast-fed infants, but often at the expense of maternal folate stores (Smith, Picciano and Deering, 1983; O'Connor, Green and Picciano, 1997). Loss of folate in milk therefore increases the folate for breast feeding women. An increased intake of up to 25 percent (i.e. from 400 mcg per day for a normal person to 500 mcg) is recommended (FAO and WHO, 2004).

The folate concentration in breast milk increases progressively from colostrum to mature milk (O'Connor *et al*., 1997). Milk folate concentrations are generally higher in hind milk (at the end of feeding) than in foremilk (at the beginning of feeding) (Smith, 1983). It is therefore important to empty one breast first. Reported changes in milk folate concentrations with the progression of lactation are not consistent; some researchers found a gradual increase as lactation progresses (Tamura and Picciano, 2006).

### *Zinc*

An adequate supply of zinc is essential for the normal growth and development of the fetus and infant postpartum. Some studies show that zinc intake is associated with infant weight gain and achieved weight at 4 months of age. It was further indicated that there is a positive association of cumulative zinc intake from breast milk with the achieved infant weight at age 4 months and with weight gain from birth to the age of 4 months (Dumrongwongsiri *et al*., 2021).

Although women are encouraged to consume more zinc-rich food during lactation, studies have shown that zinc content in breast milk is sustained tightly and is not affected by maternal zinc status, dietary zinc intake, or ingestion of zinc-rich supplements (Amuistere *et al*., 2018; FAO and WHO, 2004). While zinc concentration in human milk is not high, it is enough to satisfy the needs of the child due to its high bioavailability. It is recommended that lactating women should increase their zinc intake by 50 percent (Segura, Ansótegui and Díaz-Gómez, 2016).

### *Iodine*

Iodine deficiency occurring during foetal and neonatal growth and development leads to irreversible damage of the brain and central nervous system and, consequently, to irreversible mental retardation (FAO and WHO, 2004). The iodine requirements of lactating women are nearly double those of healthy adult women to meet their own requirements and for the baby to receive sufficient iodine from the milk to synthesise thyroid hormones (FAO and WHO, 2004). The iodine content of human milk is variable and depends on maternal intake (Becker *et al*., 2006; Segura, Ansótegui and Díaz-Gómez, 2016). Iodised table salt (the source of iodine recommended for all individuals) only contributes half of the required intake during lactation (Segura, Ansótegui and Díaz-Gómez, 2016), so increased consumption of other sources of iodine like sea fish is recommended.

### *Vitamin C*

During lactation, 20 mg/day of vitamin C is secreted in milk. Vitamin C levels are higher in colostrum by 10 to 20 mg/L compared with mature milk. Levels are relatively stable until after 12 months postpartum when they begin to decrease slightly and reach 30 percent of previous levels by 18 to 24 months postpartum (FAO and WHO, 2004). For an assumed absorption efficiency of 85 percent, the mother will require an extra 25 mg per day. It is therefore recommended that the RNI should be set at 70 mg/day to fulfil the needs of both the mother and infant during lactation (FAO and WHO, 2004). The vitamin C concentration in milk is positive correlated with maternal intake of vitamin C from food (Hoppu *et al.*, 2005). The vitamin C concentration in milk is positive correlated with maternal intake of vitamin C from food (Hoppu *et al.,* 2005).

## MYTHBUSTER! MATERNAL DIET AND MILK QUALITY

Although the quality of milk is not affected by the mother's diet quality[1] (WHO, 1985; Prentice *et al.*, 1989; Hartmann *et al.*, 1985; Greiner, 1994) a healthy, varied diet with extra amounts of foods rich in these nutrients is important as the mother will have to replace the nutrients lost through breastfeeding.

If nutrient intake is lower than the total demand for both maternal maintenance needs and milk production, the mother's body will mobilize available nutrients from body tissues to maintain a constant breastmilk quality and quantity. Thus, additional nutrients are important for mothers' healthy weight, proper function of the body, body repair and protection against diseases.

[1] *Studies have found that there is no dose response relationship between diet and human lactation and that, in general, reductions in the quality and quantity of breast milk, and reductions in infant growth have been difficult to find even among malnourished women who breastfeed for long periods. Further, empirical evidence has not been able to demonstrate reduced energy or protein levels in breast milk of malnourished women. Some of the reasons for constant breast milk quality is that the woman's metabolic rate becomes more efficient during breastfeeding and at times the woman's body will mobilise available nutrients from her own body tissues to meet produce breastmilk in case of low dietary nutrient intakes (WHO, 1985; Prentice et al., 1988; Illingworth et al., 1986; Frigerio et al., 1991; Whitehead, 1979; Deem, 1931; Hartmann et al., 1985; Spring et al., 1985; Prentice et al., 1986; Greiner, 1994).*

### *12.2.4 Recommendations for lactating women*

- Lactating women should follow the dietary recommendations by eating a variety of foods from the six food groups described in the guidelines for the general population.
- Lactating women need an additional 505 kcal and 25 g of protein as well as additional folate, zinc, calcium, and vitamin A to support their health and wellbeing (FAO, 2004).
- Lactating woman should increase intake of foods rich in vitamin A, such as orange-coloured fruits and vegetables.
- Lactating women should continue to take iron and folic acid supplementation for at least three months after delivery (WHO, 2013).
- Eat eggs or thoroughly cooked beef, chicken, pork, fish, or lamb daily for B vitamins, vitamin D, iron and protein.

The diet modelling for lactating women aimed to maximize micronutrient intake and additional calorie requirements during breastfeeding. The serving sizes and nutrients supplied by the recommended diet model are shown in Table 14.

## Table 14 Recommended daily food intake amounts and nutrients for lactating women

| | Servings per day | Food weight | Energy | Protein | Fat | Carbohydrate | Fibre | Calcium | Iron | Magnesium | Zinc | Vitamin A-RAE | Thiamin | Riboflavin | Niacin | Vitamin B6 | Folate | Vitamin C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (g) | (kcal) | (g) | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mg) | (mcg) | (mg) | (mg) | (mg) | (mg) | (mcg) | (mg) |
| **Total nutrient intakes** | | 2066.0 | 2822.4 | 114.5 | 64.4 | 423.6 | 45.1 | 1159.7 | 27.5 | 550.4 | 14.0 | 1019.6 | 1.2 | 1.8 | 19.0 | 2.3 | 689.1 | 225.9 |
| **Cereals, starchy roots tubers, plantains and green bananas** | 5.5 | 797 | 1130.7 | 21.0 | 2.3 | 251.0 | 11.2 | 79.4 | 2.9 | 129.9 | 2.1 | 55.3 | 0.2 | 0.3 | 3.2 | 0.5 | 75.6 | 39.3 |
| **Vegetables** | 2.0 | 281 | 134.3 | 12.7 | 0.9 | 15.6 | 6.6 | 750.5 | 10.8 | 121.5 | 1.2 | 589.6 | 0.2 | 0.6 | 2.0 | 0.4 | 127.3 | 52.1 |
| **Fruits** | 3.0 | 413 | 308.9 | 3.9 | 6.9 | 53.4 | 8.7 | 70.3 | 1.8 | 79.5 | 0.7 | 320.3 | 0.1 | 0.2 | 2.2 | 0.7 | 102.0 | 130.7 |
| **Pulses, nuts and oily seeds** | 3.0 | 293 | 410.2 | 27.1 | 8.0 | 48.3 | 18.5 | 100.0 | 7.3 | 175.1 | 3.3 | 0.0 | 0.6 | 0.2 | 3.9 | 0.4 | 354.2 | 2.9 |
| **Animal-source foods** | 2.5 | 193 | 337.6 | 49.8 | 14.9 | 1.0 | 0.0 | 157.7 | 4.7 | 44.0 | 6.5 | 54.5 | 0.1 | 0.5 | 7.6 | 0.3 | 29.7 | 0.8 |
| **Fats and oils** | 2.3 | 32 | 283.5 | 0.0 | 31.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sugary foods and sweets** | 1.3 | 58 | 217.2 | 0.1 | 0.0 | 54.2 | 0.0 | 1.8 | 0.1 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.1 |

## 12.3 Foods and habits to avoid during pregnancy and lactation

- Excess intake of beverages containing caffeine, such as tea and coffee, adversely affects foetal growth, so should be avoided.
- Beverages such as tea bind dietary iron and make it unavailable, so they should be avoided.
- Consult a doctor when taking medication. Pregnant and lactating women should not take any medicine without medical advice, as some of them could be harmful to the foetus or baby.
- Smoking, using tobacco and consuming alcohol should be avoided.
- Food beliefs and taboos such as avoiding animal-source foods (e.g. eggs) or restricting consumption of citrus fruits (e.g. lemons) should be discouraged.
- Avoid harmful drugs.

## 12.4 Key messages for healthy eating during pregnancy and lactation

1. Eating a variety of foods from the six food groups is important for everyone in the family, but caring for and feeding a baby from your own body requires more food.

2. Eat more than usual from the variety of foods from all the six food groups to keep yourself and the baby healthy.

3. Eat more liver, eggs, meat, poultry, fish, leafy vegetables, fruits and pulses for baby growth and development.

4. When pregnant, eat extra half servings of whole grains (free of mycotoxins), roots, tubers, and pulses to support the weight gain needed during pregnancy.

5. When breastfeeding, add extra servings of whole grains, roots, tubers and pulses to replenish energy lost through breastfeeding.

6. Always use iodized salt.

7. Avoid smoking and alcohol consumption as it will harm your baby and yourself.

8. Take iron and folate supplements every day as given by the clinic to prevent birth defects and anaemia.

9. Drink plenty of water when pregnant and breastfeeding.

## 12.5 Tips for nutrition during pregnancy and lactation

1. Eat more leafy greens for folate and vitamin A.

2. Eat more citrus fruits, papayas, mangoes, and pineapples for vitamin C.

3. Eat more orange fruits and vegetables and orange fresh sweet potatoes for vitamin A.

4. Choose lentils, peas, groundnuts, and sunflower seeds for folate, selenium and zinc.

5. Use iodized salt when cooking, but in small amounts.

6. Eat more meat, poultry, fish, and fresh or fermented milk while pregnant and breastfeeding.

7. Eat an extra meal and two snacks in addition to regular meals to support pregnancy and breastfeeding.

8. Avoid tobacco, alcohol and unprescribed drugs or supplements.

9. Eat foods that are fortified with iron, such as wheat and corn flour.

# 13. RECOMMENDATION 2.2

## FEED YOUR BABY ONLY BREAST MILK FOR THE FIRST SIX MONTHS OF LIFE AND NO FOOD OR WATER BECAUSE MOTHER'S MILK CONTAINS ALL THE NUTRIENTS THE BABY NEEDS

### 13.1 Breast milk

Breast milk contains complete nutrition for infants. Infants from birth to six months get their entire nutrient and water requirements from the mother's breast milk, so they do not need additional liquid or food (UNICEF, 2016; Victora *et al.,* 2016). Giving water to the baby reduces breastfeeding and may cause diarrhoea.

### 13.2 Importance of colostrum in breast milk for the baby

Breastfeeding should start as early as within one hour after delivery. It is important for babies to be given "first milk" (colostrum) within the first hour of birth (WHO, 2019a; UNICEF, 2016).

Colostrum is rich in protective antibodies and white blood cells that help the baby's immune system fight harmful microorganisms. It is important that infants receive colostrum and no other foods because it helps protect them against infections and illness. The high levels of secretory immunoglobulin A (SIgA) found in colostrum helps protect the newborn's digestive tract and protects against viruses and bacteria (De Vries *et al*., 2018; Toscano *et al*., 2017).

Colostrum also helps babies make their first bowel movements and get rid of the meconium – the tar-like faeces that collect in the bowels before birth – thereby helping to prevent new-born jaundice (De Vries *et al*., 2018; Toscano *et al*., 2017).

Colostrum also contains nutrients like protein and vitamin A, and growth factors (UNICEF and WHO, 2018).

Colostrum comes in very small amounts and the flow is slow so that a baby can learn the skill of breastfeeding, which require a baby to suck, breathe and swallow at the same time.

## 13.3 The importance of exclusive breastfeeding for six months

Breastfeeding has benefits for the child as well as for the mother.

For the child:

- According to the WHO, healthy dietary practices start early in life. Breastfeeding fosters healthy growth and improves cognitive development. It makes babies develop better resistance to common childhood diseases or illnesses such as diarrhoea and other bowel diseases, respiratory and ear infections, and malaria.
- Exclusive breastfeeding may have longer-term health benefits, such as reducing the risk of becoming overweight or obese and developing NCDs later in life (UNICEF, 2016; Sankar *et al*, 2015, Horta *et al*., 2015a).
- Breast milk provides all the nutrients and fluids that the baby needs for growth and development in the first six months. It also has several special components such as growth factors, enzymes, hormones and anti-infective factors (Jackson and Nazar, 2006)
- The nutrients in breast milk, including protein, fat and calcium, are more easily digested by the baby than those from animal milk. The iron content in cow milk is insufficient for nourishing a baby.
- Breastfeeding is associated with better cognitive development and improved performance in intelligence tests (UNICEF, 2016; Horta *et al*., 2015a)
- Breast milk provides good quality proteins, fats, vitamins, calcium, iron and other minerals.
- The gut flora and the low pH of breastmilk inhibits the growth of pathogens.
- Breast milk has components which protect the infant from infections such as diarrhoea and upper respiratory tract infections. Babies who are exclusively breastfed are less likely to get diarrhoea and other illnesses because breast milk is clean and protects infants against infections (Sanker *et al*., 2015).
- Breastfeeding provides warmth, closeness and contact, which helps the physical and emotional development of the child (UNICEF, 2020).
- Breastfeeding also protects infants from vulnerability to allergic reactions (Lodge *et al*., 2015).
- Breastfeeding promotes proper jaw, teeth and speech development – the action of breastfeeding helps the child's jaw to develop as well as muscles such as the tongue. This assists with clear speech, protects against dental caries and reduces the risk of orthodontic problems (Karimi, 2019; Tham, R. *et al*., 2015; Victora *et al*., 2016; UNICEF, 2013; Agarwal *et al*., 2012; Abate, *et al*., 2020).

For the mothers:

- Breastfeeding is associated with lower cardiovascular disease risk, including high blood pressure and high cholesterol (Victora *et al*., 2016; Rameez, Sadana and Kaur, 2019).
- Breastfeeding delays a new pregnancy and helps the uterus to return to its previous size, which in turn helps to reduce bleeding and may help to prevent anaemia (Kramer and Kakuma, 2012; Chowdhury *et al*., 2015).
- Breastfeeding also reduces the risk of ovarian cancer, breast cancer, and type 2 diabetes mellitus (Chowdhury *et al*., 2015).
- Breast milk is readily available, does not require any special preparation, saves time and makes night feeding easier.

- Breastfeeding delays the return of fertility. Mothers who breastfeed exclusively and frequently have less than a 2 percent risk of becoming pregnant in the first six months postpartum, provided that they still have amenorrhoea (WHO, 2016; Kramer and Kakuma, 2012).

## 13.4 Signs that a baby is receiving enough breast milk

The mother can look for the following signs to make sure she is giving her baby enough milk:

- The baby will have at least six to eight very wet nappies/diapers in 24 hours from day five. (Babies' urine frequency increases from two wet nappies on day two to three to four wet diapers on day three and four).
- The baby's urine is clear as water a few days after birth.
- The baby will produce bright yellow stools from the fifth day. The first few days after birth the baby's stool is a dark green, almost black as the baby passes meconium during that time. Frequency of passing stools varies from baby to baby. A baby may also change the frequency as she or he grows older.
- The baby will have good skin colour and muscle tone.
- The baby will be alert, responsive and contented.
- The baby will gain weight and grow in length and head circumference starting with regaining their birth weight by 10 to 14 days old.

## 13.5 Breastfeeding practice in the United Republic of Tanzania

Almost all women (98 percent) in the United Republic of Tanzania breastfeed their children. About 51 percent of infants are breastfed within one hour and 93 percent are breastfed within 24 hours after delivery. About 59 percent of the women practised exclusive breastfeeding. At age 4–5 months, only 27 percent were on exclusive breastfeeding compared to 84 percent at 0–1 month and 59 percent at 2–3 months. In some instances, infants of below six months consume liquids (water 11 percent and other milk 4 percent) other than breast milk and about 22 percent of infants under six months are fed complementary foods in addition to breast milk. Trends of exclusive breastfeeding show an increasing pattern (MoHCDGEC *et al*., 2016):

- 1991–92: 26 percent
- 2004–05: 41 percent
- 2010: 50 percent
- 2015–6: 59 percent

This means that exclusive breastfeeding is partially practised.

### *MYTHBUSTER!*

**There is a myth that a baby feels thirsty in hot weather and should be given water.**

**This is not true, as breast milk contains enough water to quench a baby's thirst!**

## 13.6 Key messages for exclusive breastfeeding

1. Breastfeed babies exclusively on demand from immediately after birth to six months of age because breast milk contains all the food and water the baby needs. Breastfeeding responsively ensures that babies will receive all they need to grow well and remain healthy.
2. Do not give babies any water, tea, honey, sugar water, salt, juice or any other foods before six months to reduce the risk of diarrhoea, infections or death.
3. Breastfeed as soon as possible within the first hour of birth to boost the child's immunity from colostrum (first milk) and prevent newborn deaths (WHO, 2017b). The colostrum is the baby's first shot of natural immunization.

## 13.7 Tips for exclusive breastfeeding

1. Initiate breastfeeding immediately after birth or within the first hour to stimulate breast milk production and promote better milk flow.
2. Breastfeed your baby when it shows a sign of hunger without counting the hours after the last breastfeeding.
3. Breast milk can stay at room temperature for up to four hours. If you have to be away from the baby for a while, express breast milk into a clean container and leave it covered for the baby.
4. Breastfeed your baby until your breast is empty before shifting to another breast.
5. There are signs to let you know if the baby is getting enough breast milk. These signs have been explained in section 13.4.

Credit: Adapted from UNICEF & URC/CHS

# 14. RECOMMENDATION 2.3

## FROM SIX MONTHS, FEED YOUR BABY A VARIETY OF FOODS FROM ANIMAL SOURCES, PULSES, FRUITS AND VEGETABLES, AND CONTINUE BREASTFEEDING UP TO 2 YEARS OF AGE OR BEYOND FOR HEALTHY GROWTH AND DEVELOPMENT OF YOUR BABY

From birth until 6 months, breast milk provides all the nutrients and energy required for the growth and development of the infant.

As per table 15 and Figure 5, the nutritional needs of an infant increase significantly after 6 months of age and the child, therefore, needs other foods in addition to breast milk to supplement its energy, protein, vitamin and mineral requirements. Feeding the child with other foods in addition to breastfeeding is known as complementary feeding

.

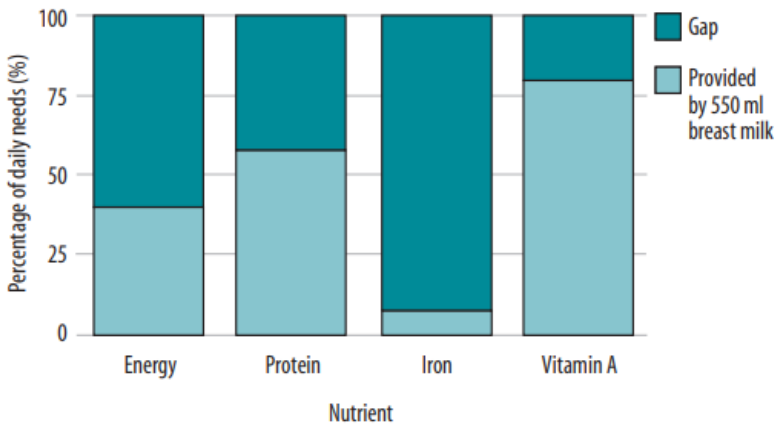



**Figure 5 Gaps to be filled by complementary foods for a breastfed child from 12 to 23 months**

Source: WHO. 2009b. *Infant and young child feeding: model chapter for textbooks for medical students and allied health professionals*. Geneva.

**Table 15 Estimate of daily energy and nutritional requirements compared to what is provided by breastmilk**

| Child age (months) | Energy needed (kcal) | Energy from breastmilk (kcal) | Energy gap (kcal) | Iron needed (mg/day) | Iron from breastmilk (mg/day) | Iron gap (mg/day) | Vitamin A needed (µg RE/day) | Vitamin A from breastmilk (µg RE/day) | Vitamin A gap (µg RE/day) |
|---|---|---|---|---|---|---|---|---|---|
| 0–2 | 405 | 405 | 0 | 1.18 | 0.05 | 0* | 400 | 365 | 0* |
| 3–5 | 500 | 500 | 0 | 0.9 | 0.05 | 0* | 400 | 390 | 0* |
| 6–8 | 600 | 400 | 200 | 0.79 | 0.04 | 0.75 | 400 | 340 | 60 |
| 9–11 | 700 | 400 | 300 | 0.65 | 0.04 | 0.61 | 400 | 310 | 90 |
| 12–23 | 900 | 350 | 550 | 0.5 | 0.04 | 0.46 | 400 | 280 | 120 |

*Although breast milk does not supply enough vitamin A and iron, the gap between iron and vitamin A is zero in the first six months because this gap is covered from the baby's birth stores.

Sources: 1) WHO. 2006b. *Food and nutrition policy for schools: a tool for the development of school nutrition programmes in the European region.* Geneva. 2) WHO. 2009b. *Infant and young child feeding: model chapter for textbooks for medical students and allied health professionals.* Geneva.

## 14.1 Complementary feeding

Complementary foods are foods given in addition to breast milk to infants and young children aged 6 to 24 months.

During the period of complementary feeding, the baby gradually becomes accustomed to eating family foods. It is important that mothers and caregivers start complementary feeding at six months.

Give the child foods from all six food groups to get all the nutrients required by the growing body with emphasis on iron rich foods.

Cow's milk should not be given to babies under 12 months, and adding honey, sugar, and salt to complementary foods is not recommended.

Complementary feeding should be:

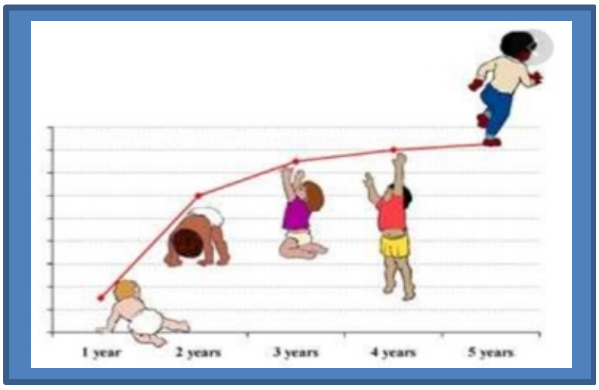
a) Timely – meaning that it is introduced at the age of 6 months when the need for energy and nutrients exceeds what is provided from exclusive breastfeeding.

b) Adequate in nutrient density – meaning that it is not bulky and that it is derived from all food groups providing sufficient energy, protein and micronutrients.

c) Safe – meaning that it is hygienically prepared and fed with clean hands using clean utensils and not bottles.

d) Properly fed – meaning that children are fed according to their age, appetite and satiety. Children should be actively encouraged, even during illness, to consume sufficient food, using fingers, spoons and self-feeding suitable for age.

Caregivers should interact with the child, respond to their hunger signals and select appropriate foods. Safe food preparation, storage and hygienic practices are also crucial to preventing the spread of disease and ensuring that good nutrition reaches and remains in children's bodies (UNICEF, 2016).




## 14.2 Benefits of adequate complementary foods

- From the age of 6 months, the baby needs breast milk and complementary foods to promote health, support growth and enhance development. Provision of adequate complementary foods prevents malnutrition.
- Complementary feeding is needed to provide energy and essential nutrients for continuing growth and development.

## 14.3 Recommendation on starting complementary foods after six months

Follow these guidelines recommended by UNICEF (2020):

- Continue frequent, on-demand breastfeeding until 2 years of age or beyond.
- After six months of exclusive breastfeeding, introduce safe, adequate, complementary foods.
- Children should eat a variety of foods from the six food groups in sufficient quantities.
    - Give children iron-rich foods such as pureed or mashed fish, meats and poultry, especially liver, pulses, and iron-fortified cereals to address the issue of iron-deficiency anaemia which is prevalent among infants and children in the United Republic of Tanzania.
    - Give foods rich in vitamin A, such as orange- and yellow-coloured fruits (mangoes, papaya), vegetables, grains, roots, and tubers (e.g. orange-flesh sweet potatoes, carrots). Liver and dark-green leafy vegetables are also rich in vitamin A. Vitamin A deficiency is prevalent among infants and children in the United Republic of Tanzania
- Give infants pureed foods at first. Make the food thicker as the child gets older and develops. Foods such as whole grapes, raw carrots, and nuts can cause choking and should not be given to children when they are still learning to chew food properly.
- Cow's milk should not be given to babies under 12 months of age. Adding honey, sugar and salt to complementary foods is not recommended.
- Start at six months with small amounts of food and increase gradually as the child gets older.
- Caregivers should interact with the child and respond to their hunger signals. Caregivers should feed the children slowly and patiently, encouraging them to eat but not forcing them. It is also recommended that the caregiver talks to the child and maintains eye contact during feeding times.
- When a child is ill, they should be offered more fluids, including breast milk and soft favourite foods for quicker recovery and prevention of weight loss.
- Clean hands with soap and clean water before, during and after food preparation and feeding the baby.
- Caregivers should also wash hands with soap and clean water after visiting the toilet or helping a child use the toilet as well as after changing

a baby's dirty nappy.

- All cooking and feeding utensils and containers should be clean.
- Food should be offered to children immediately after cooking while it's still warm. Feeding children food that has been sitting out at room temperature for more than two hours is not recommended.

## 14.4 Current infant and young child feeding practice in the United Republic of Tanzania

Inadequate feeding practices and limited dietary supply are known to contribute to chronic malnutrition in Tanzanian children. Early initiation of complementary feeding before a child is 6 months is a common practice. Reasons given by caregivers for early initiating complementary feeding include to stop frequent child crying, which is perceived by mothers as a sign that the infant is not satisfied with breast milk. Although the majority of the children aged 6–8 months received semisolid foods, meal frequencies, including snacks, were lower than the recommended values of 2–3 times for breastfed infants 6–8 months old and 3–4 times for breastfed infants 9–11 months old (MoHCDGEC *et al*., 2016).

## 14.5 Amounts of food to give to young children

The amount of food to give to young children after six months varies according to the age of the child (Table 16).

***MYTHBUSTER!***

*An exclusively breast-fed baby crying is a sign that the infant is not satisfied with breast milk.*

**This is not true!** Breast milk contains all the nutrients and water the baby requires from birth to 6 months.

Make sure to empty one breast before offering the other breast in order to quench the baby's thirst and get all the nutrients that come at different times from when breast in full until it is empty.

**Table 16 Guidance on the quality, frequency and amount of food to offer children aged 6–23 months**

| Child age | Texture | Frequency | Amount of food |
|---|---|---|---|
| **6–8 months** | Start with thick, well mashed, semi-solid, blended or pureed foods | • 2–3 meals per day | Start with 2–3 tablespoons per feed, increasing gradually to ½ cup (125 ml) per meal |
| **9–11 months** | Finely chopped or mashed foods and foods that baby can pick up | • 3–4 meals per day<br>• Depending on child's appetite, 1–2 snacks may be offered | ½ cup (125 ml) per meal |
| **12–23 months** | Family foods, chopped or mashed if necessary | • 3–4 meals per day<br>• Depending on child's appetite, 1–2 snacks may be offered | ¾ cup (190 ml) to 1 cup (250 ml) per meal |
| **2–5 years** | Family foods | • A variety of foods from all the six food groups | Three meals (at least 1 full cup per meal) plus healthy snacks in between meals |

Note: If a baby over 12 months is not breastfed, give an addition 1–2 cups of milk per day and one to two extra meals per day.
Source: UNICEF. 2020. *Improving young children's diets during the complementary feeding period. UNICEF programming guidance.* New York.

**Table 17 Recommended daily food intake amounts and the nutrients this eating pattern will provide children aged 6–8 months**

| 6–8 months | Servings per day | Food weight | Energy | Protein | Fat | Carbohydrate | Calcium | Iron | Zinc | Vitamin A | Folate | Fibre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (g) | kcal | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mcg) | (mcg) | (mg) |
| **Total nutrient intake** | | | 206.5 | 6.5 | 6.9 | 28.1 | 70.0 | 1.6 | 0.8 | 58.5 | 36.3 | 2.7 |
| **Animal and animal products** | 0.1 | 9.7 | 16.9 | 2.5 | 0.7 | 0.0 | 7.9 | 0.2 | 0.3 | 2.7 | 1.5 | 0.0 |
| **Cereals, tubers, roots and plantains** | 0.4 | 120.2 | 104.0 | 2.0 | 0.3 | 22.9 | 8.1 | 0.3 | 0.2 | 5.6 | 7.9 | 1.1 |
| **Fats and oil** | 0.4 | 5.3 | 47.3 | 0.0 | 5.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Fruits** | 0.1 | 17.2 | 12.9 | 0.2 | 0.3 | 2.2 | 2.9 | 0.1 | 0.0 | 13.3 | 4.2 | 0.4 |
| **Pulses, beans, nuts and seeds** | 0.1 | 12.2 | 17.1 | 1.1 | 0.3 | 2.0 | 4.2 | 0.3 | 0.1 | 0.0 | 14.8 | 0.8 |
| **Sugary foods and sweets** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Vegetables** | 0.1 | 17.6 | 8.4 | 0.8 | 0.1 | 1.0 | 46.9 | 0.7 | 0.1 | 36.9 | 8.0 | 0.4 |

**Table 18 Recommended daily food intake amounts and the nutrients this eating pattern will provide children aged 9–11 months**

| 9–11 months | Servings per day | Food weight | Energy | Protein | Fat | Carbohydrate | Calcium | Iron | Zinc | Vitamin A | Folate | Fibre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (g) | (kcal) | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mcg) | (mcg) | (mg) |
| **Total nutrient intake** | | | 327.9 | 11.8 | 11.9 | 41.0 | 134.6 | 3.0 | 1.4 | 113.3 | 67.4 | 4.6 |
| **Animal and animal products** | 0.3 | 19.3 | 33.8 | 5.0 | 1.5 | 0.1 | 15.8 | 0.5 | 0.7 | 5.4 | 3.0 | 0.0 |
| **Cereals, tubers, roots and plantains** | 0.5 | 160.3 | 138.7 | 2.6 | 0.3 | 30.5 | 10.8 | 0.4 | 0.2 | 7.4 | 10.5 | 1.5 |
| **Fats and oil** | 0.6 | 8.8 | 78.8 | 0.0 | 8.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Fruits** | 0.3 | 34.4 | 25.7 | 0.3 | 0.6 | 4.5 | 5.9 | 0.1 | 0.1 | 26.7 | 8.5 | 0.7 |
| **Pulses, beans, nuts and seeds** | 0.3 | 24.4 | 34.2 | 2.3 | 0.7 | 4.0 | 8.3 | 0.6 | 0.3 | 0.0 | 29.5 | 1.5 |
| **Sugary foods and sweets** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Vegetables** | 0.3 | 35.1 | 16.8 | 1.6 | 0.1 | 2.0 | 93.8 | 1.3 | 0.2 | 73.7 | 15.9 | 0.8 |

**Table 19 Recommended daily food intake amounts and the nutrients this eating pattern will provide children aged 12-23 months**

| 12–23 months | Servings per day | Food weight (g) | Energy (kcal) | Protein (g) | Fat (g) | Carbohydrate (g) | Calcium (mg) | Iron (mg) | Zinc (mg) | Vitamin A (mcg) | Folate (mcg) | Fibre (mg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total nutrient intake** | | | 521.2 | 17.3 | 18.7 | 66.7 | 248.0 | 5.3 | 2.0 | 217.3 | 126.6 | 8.5 |
| **Animal and animal products** | 0.25 | 19.3 | 33.8 | 5.0 | 1.5 | 0.1 | 15.8 | 0.5 | 0.7 | 5.4 | 3.0 | 0.0 |
| **Cereals, tubers, roots and plantains** | 0.75 | 240.4 | 208.0 | 3.9 | 0.5 | 45.8 | 16.2 | 0.6 | 0.4 | 11.1 | 15.8 | 2.3 |
| **Fats and oil** | 1 | 14.0 | 126.0 | 0.0 | 14.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Fruits** | 0.5 | 68.9 | 51.5 | 0.7 | 1.1 | 8.9 | 11.7 | 0.3 | 0.1 | 53.4 | 17.0 | 1.5 |
| **Pulses, beans, nuts and seeds** | 0.5 | 48.8 | 68.4 | 4.5 | 1.3 | 8.1 | 16.7 | 1.2 | 0.6 | 0.0 | 59.0 | 3.1 |
| **Sugary foods and sweets** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Vegetables** | 0.5 | 70.3 | 33.6 | 3.2 | 0.2 | 3.9 | 187.6 | 2.7 | 0.3 | 147.4 | 31.8 | 1.6 |

## 14.6 Key messages for feeding a baby

1. From six months, give children a variety of foods from the six different food groups and continue breastfeeding to support their growth and development.
2. Give beans, peas, lentils, nuts and seeds to infants and young children daily from 6 months of age.
3. Give green leafy vegetables and yellow- or orange-coloured vegetables and fruits daily to infants and young children. Add a little vegetable oil to vegetables. Oil helps with vitamin A absorption.
4. Give children clean and safe water to drink. Do not give infants and young children honey, tea, sugary drinks or salty foods.
5. Give prepared foods immediately after cooking and cooling.
6. Give food 2–3 times a day for infants 6–8 months old, while continuing to breastfeed.
7. Give food 3–4 times a day for infants and young children between 9–24 months, while continuing to breastfeed.
8. When a child is ill, offer them more fluid including breastmilk and favourite foods from 6 months of age.
9. Offer a variety of starchy foods such as orange-fleshed sweet potato, cassava, and provitamin A maize, in addition to rice to children over 6 months.
10. Prepare foods for infants and young children with clean and safe water.

## 14.7 Tips for for feeding a baby

1. Introduce only one new food at a time, then combine foods later.
2. Introduce iron-rich foods such as pureed meats, liver, kidney, egg yolk, fish, and chicken to babies after six months of exclusive breastfeeding daily.
3. Give fatty fish regularly, taking care to remove the bones.
4. Choose vegetable oils such as sunflower and peanut oils.
5. Give avocado for healthy fats.
6. Give prepared foods immediately after cooking.


Credit: Adapted from UNICEF & URC/CHS

# 15. RECOMMENDATION 2.4

## GIVE A VARIETY OF FOODS FROM THE SIX FOOD GROUPS TO CHILDREN BETWEEN THE AGES OF 2 AND 5 TO HELP THEM GROW TO THEIR FULL POTENTIAL

### 15.1 Importance of a variety of foods for this age group

From 2 years of age, children start to choose their own food and can feed themselves. They can eat family meals and some can start to eat outside the home (UNICEF, 2020; FAO, 2004a).

Good nutrition for children 2 to 5 years of age is important to meet the needs of rapid physical growth and development (UNICEF, 2020).

Children need a diversified diet from all six food groups to provide the energy and nutrients they need for continued growth and development. Inadequate nutrition at this stage is associated with high risks of illness and infections, which can have lifelong consequences on education attainment and health (UNICEF, 2020).

Encourage children to eat from all the food groups, especially during sickness (FAO, 2004a).

**Table 20 Recommended daily food intake amounts and the nutrients this eating pattern will provide children aged 2–5 years**

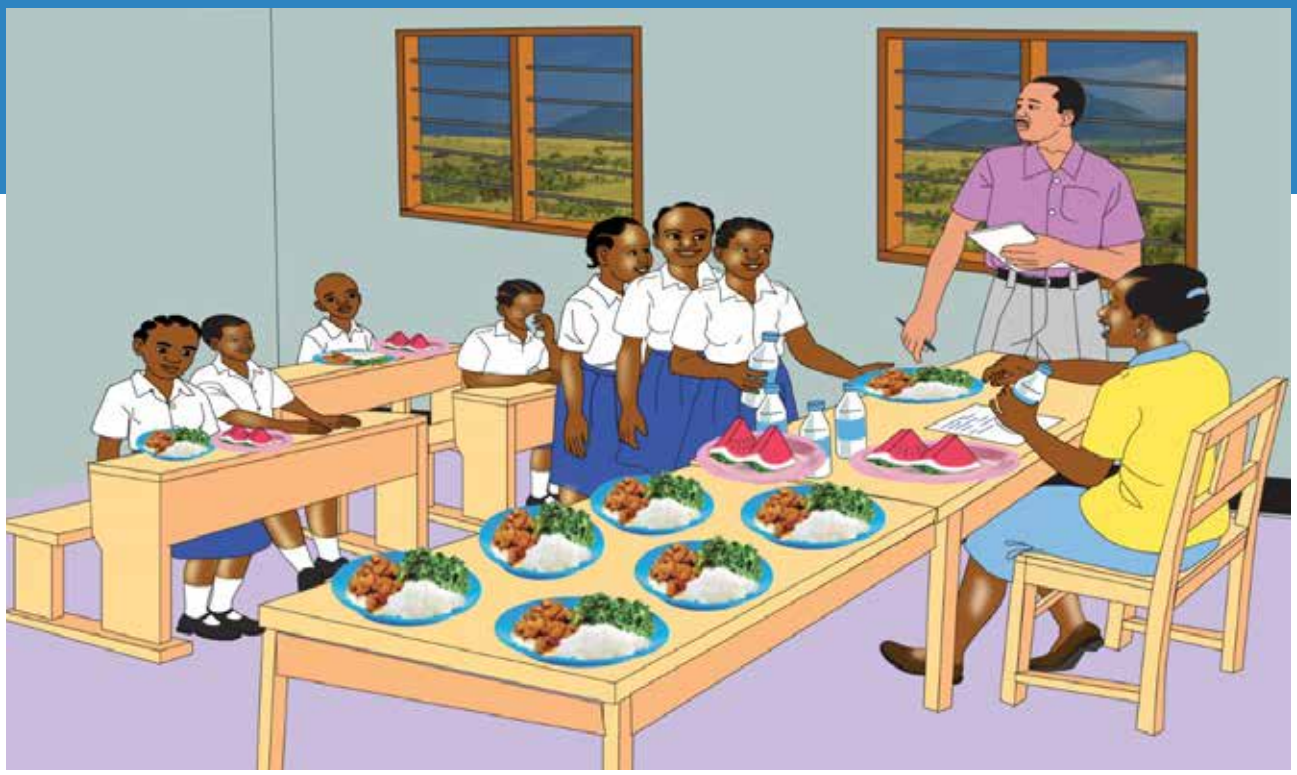
| Children 2–5 years | Servings per day | Food weight | Energy | Protein | Fat | Carbohydrate | Calcium | Iron | Zinc | Vitamin A | Folate | Fibre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (g) | (kcal) | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mcg) | (mcg) | (mg) |
| **Total nutrient intake** | | | 1193 | 44 | 41 | 154 | 493 | 11 | 5.4 | 460 | 252 | 17 |
| **Cereals, tubers, roots and plantains** | 2 | 289 | 411 | 7.6 | 0.8 | 91.2 | 28.8 | 1.0 | 0.8 | 20.1 | 27.4 | 4.1 |
| **Pulses, beans, nuts and seeds** | 1 | 98 | 137 | 9.0 | 2.7 | 16.1 | 33.3 | 2.4 | 1.1 | 0.0 | 118.1 | 6.2 |
| **Animal and animal products** | 1 | 77 | 135 | 20.0 | 6.0 | 0.4 | 63.2 | 1.9 | 2.6 | 21.8 | 11.9 | 0.0 |
| **Vegetables** | 1 | 140 | 67 | 6.3 | 0.4 | 7.9 | 347.2 | 5.2 | 0.6 | 307.8 | 62.9 | 3.3 |
| **Fruits** | 1 | 139 | 105 | 1.3 | 3.1 | 16.5 | 20.0 | 0.6 | 0.3 | 110.1 | 31.4 | 2.9 |
| **Fats and oil** | 2 | 28 | 252 | 0.0 | 28.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sugary foods and sweets** | 0.5 | 23 | 87 | 0.0 | 0.0 | 21.7 | 0.7 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |

## 15.2 Key messages for feeding children aged 2 to 5

1. Give family meals that contain a variety of foods from the six food groups to ensure a child gets all the nutrients they require.
2. Give a child three meals and one or two nutritious snacks a day.
3. Include fish or animal-source foods such as eggs, poultry, meat and milk products.
4. Give children orange-coloured vegetables, fruits and tubers such as papaya, ripe mango, pumpkin, pumpkin flowers, orange-fleshed sweet potatoes, whole grain yellow maize, and dark leafy vegetables.
5. Give children pulses, nuts and seeds. Adding pulses or nut powders is a great way to add nutrients to a child's meals.
6. Avoid adding too much spice, sugar and salt to a child's food.

## 15.3 Tips for quality, frequency and amount of food to offer children aged 2 to 5

1. Serve a child's food on his or her own plate or bowl to ensure children eat enough food.
2. Give fatty fish regularly, taking care to remove the bones.
3. Grow and use biofortified crops like orange-fleshed sweet potatoes, yellow maize and biofortified beans.
4. Add nutrient-rich food powders like bean, nut and fish powders and moringa powder to children's meals. Adding moringa is a great way to fortify and enrich a child's meals because the moringa leaf contains a much higher nutritional value of iron, calcium and complete protein, as well as vitamins A, C, B2, B6 and various minerals compared to other foods. The moringa tree grows easily and quickly.



# 16. RECOMMENDATION 2.5

## PROVIDE HEALTHY MEALS AND SNACKS FOR SCHOOL-AGED CHILDREN THROUGHOUT THE DAY

### 16.1 Dietary needs for children aged 6 to 9.

Like adults, children from 5 years of age need to eat a variety of foods in sufficient quantities. Since their brains and bodies are still developing, special attention should be given to nutrients that support their growth and development such as protein, iron, calcium, vitamin A, B vitamins and healthy fats.

In addition, children cannot do well in school if they do not get enough nutritious food. Children need nutritious meals and snacks throughout the day in order to stay focused and learn.

A healthy meal for school children reduces micronutrient deficiency, prevents overweight and obesity, improves school enrollment and attendance, increases cognitive and academic performance, and contributes to gender equity in access to education. Children need to drink milk and eat eggs often to support bone growth and health.

### 16.2 Importance of a diversified diet

Good nutrition during this age is essential as it provides a second window of opportunity for growth and development. Children in this age group require good nutrition to improve learning (UNICEF, 2021; FAO, 2004a) and help shape positive dietary practises that can continue into adulthood (UNICEF, 2021).

In addition, good nutrition at these ages impacts on current and future nutritional status, including breaking the intergenerational cycle of malnutrition (UNICEF, 2021). Good dietary practices during this stage reduce the risk of overweight and obesity and dental carries (WHO, 2006b). If maintained, positive dietary practices developed at this stage and continued into adulthood may reduce the risk of chronic diseases later in life (WHO, 2006b).

**Table 21 Recommended daily food intake amounts and the nutrients this eating pattern will provide children aged 6–9 years**

| Children 6–9 years | Servings per day | Food weight | Energy | Protein | Fat | Carbohydrate | Calcium | Iron | Zinc | Vitamin A | Folate | Fibre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (g) | (kcal) | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mcg) | (mcg) | (mg) |
| **Total nutrient intake** | | | 1661 | 65 | 46 | 232 | 971 | 20 | 8 | 855 | 485 | 31 |
| **Cereals, tubers, roots and plantains** | 3 | 435 | 617 | 11.4 | 1.2 | 136.9 | 43.3 | 1.6 | 1.1 | 30.1 | 41.2 | 6.1 |
| **Pulses, beans, nuts and seeds** | 2 | 195 | 273 | 18.0 | 5.3 | 32.2 | 66.7 | 4.9 | 2.2 | 0.0 | 236.2 | 12.4 |
| **Animal and animal products** | 1 | 77 | 135 | 19.9 | 6.0 | 0.4 | 63.1 | 1.9 | 2.6 | 21.8 | 11.9 | 0.0 |
| **Fruits** | 2 | 276 | 206 | 2.6 | 4.6 | 35.6 | 46.8 | 1.2 | 0.5 | 213.5 | 68.0 | 5.8 |
| **Vegetables** | 2 | 281 | 134 | 12.7 | 0.9 | 15.6 | 750.5 | 10.8 | 1.2 | 589.6 | 127.3 | 6.6 |
| **Fats and oil** | 2 | 28 | 252 | 0.0 | 28.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sugary foods and sweets** | 0.3 | 12 | 43 | 0.0 | 0.0 | 10.8 | 0.4 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |

## 16.3 Dietary needs for children and adolescents aged 10 to 18

Children between 10 to 18 years require additional nutrients due to the growth spurt both in height and weight during this period (FAO, 2004; WHO, 2006a).

Children aged 10 to 18 years need a healthy diet as this period is another window of opportunity for catch-up growth after stunting in early childhood (UNICEF, 2021; FAO, 2004; WHO, 2021c; WHO, 2006a). During these years, good nutrition is important for psychosocial development as it establishes dietary and lifestyle habits that continue into adulthood.

During puberty and adolescence, energy needs increase, especially for boys because of physical activity (FAO, 2004). Girls need additional iron (more than double) compared to boys and men when they start to menstruate and will continue to need it well into adulthood to prevent anaemia (FAO, 2004; WHO, 2006c).

**Table 22 Recommended daily food intake amounts and the nutrients this eating pattern will provide girls aged 10–18 years**

| Girls 10–18 | Servings per day | Food weight | Energy | Protein | Fat | Carbohydrate | Calcium | Iron | Zinc | Vitamin A | Folate | Fibre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (g) | (kcal) | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mcg) | (mcg) | (mg) |
| **Total nutrient intake** | | | 2387 | 101 | 55 | 350 | 1096 | 26 | 12 | 897 | 642 | 41 |
| **Cereals, tubers, roots and plantains** | 5 | 724 | 1028 | 19 | 2 | 228 | 72 | 3 | 2 | 50 | 69 | 10 |
| **Pulses, beans, nuts and seeds** | 3 | 293 | 410 | 27 | 8 | 48 | 100 | 7 | 3 | 0 | 354 | 19 |
| **Animal and animal products** | 2 | 155 | 270 | 40 | 12 | 1 | 126 | 4 | 5 | 44 | 24 | 0 |
| **Fruits** | 2 | 276 | 206 | 3 | 5 | 36 | 47 | 1 | 0 | 214 | 68 | 6 |
| **Vegetables** | 2 | 281 | 134 | 13 | 1 | 16 | 751 | 11 | 1 | 590 | 127 | 7 |
| **Fats and oil** | 2 | 28 | 252 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sugary foods and sweets** | 0.5 | 23 | 87 | 0 | 0 | 22 | 1 | 0 | 0 | 0 | 0 | 0 |

**Table 23 Recommended daily food intake amounts and the nutrients this eating pattern will provide boys aged 10–18 years**

| Boys 10–18 | Servings per day | Food weight | Energy | Protein | Fat | Carbohydrate | Calcium | Iron | Zinc | Vitamin A | Folate | Fibre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (g) | (kcal) | (g) | (g) | (g) | (mg) | (mg) | (mg) | (mcg) | (mcg) | (mg) |
| **Total nutrient intake** | | | 2846 | 106 | 65 | 435 | 1135 | 27 | 13 | 1014 | 690 | 46 |
| **Cereals, tubers, roots and plantains** | 6 | 869 | 1234 | 23 | 2 | 274 | 87 | 3 | 2 | 60 | 82 | 12 |
| **Pulses, beans, nuts and seeds** | 3 | 293 | 410 | 27 | 8 | 48 | 100 | 7 | 3 | 0 | 354 | 19 |
| **Animal and animal products** | 2 | 155 | 270 | 40 | 12 | 1 | 126 | 4 | 5 | 44 | 24 | 0 |
| **Fruits** | 3 | 413 | 309 | 4 | 7 | 53 | 70 | 2 | 1 | 320 | 102 | 9 |
| **Vegetables** | 2 | 281 | 134 | 13 | 1 | 16 | 751 | 11 | 1 | 590 | 127 | 7 |
| **Fats and oil** | 2.5 | 35 | 315 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sugary foods and sweets** | 1 | 46 | 174 | 0 | 0 | 43 | 1 | 0 | 0 | 0 | 0 | 0 |

## 16.4 The situation for school-aged children

There is limited national data on food consumption behaviour among schoolchildren in the United Republic of Tanzania. However, the study in urban and peri urban areas in Dar es Salaam reported that most Tanzanian schoolchildren leave home without eating breakfast. In addition, very few purchase any food until school recess at around 10 am.

Barriers to eating breakfast at home included long commuting times to get to school by public transport and the early commencement of school sessions. Some pupils were required to be at school at 7 am to participate in chores around the school grounds (FAO, 2007). In this guideline, it is recommended that children eat a healthy breakfast at home before going to school.

Increased consumption of deep-fried foods and sweetened beverages in the urban setting in Tanzania Mainland has fuelled the increased prevalence of overweight and obesity among schoolchildren. Snacks made primarily from fried potatoes, fried wheat- and rice-based buns, fried cassava and banana, sweetened and/or coloured beverages, and candies are commonly sold in school premises (FAO, 2007). This practice predisposes children to high consumption of fat and sugar. Similar types of snacks are also sold within the neighbourhoods of their homes.


# 16A. RECOMMENDATION 2.5A

## SCHOOL-AGED CHILDREN SHOULD EAT BREAKFAST BEFORE GOING TO SCHOOL TO ENABLE THEM TO BE PRODUCTIVE AND PERFORM WELL

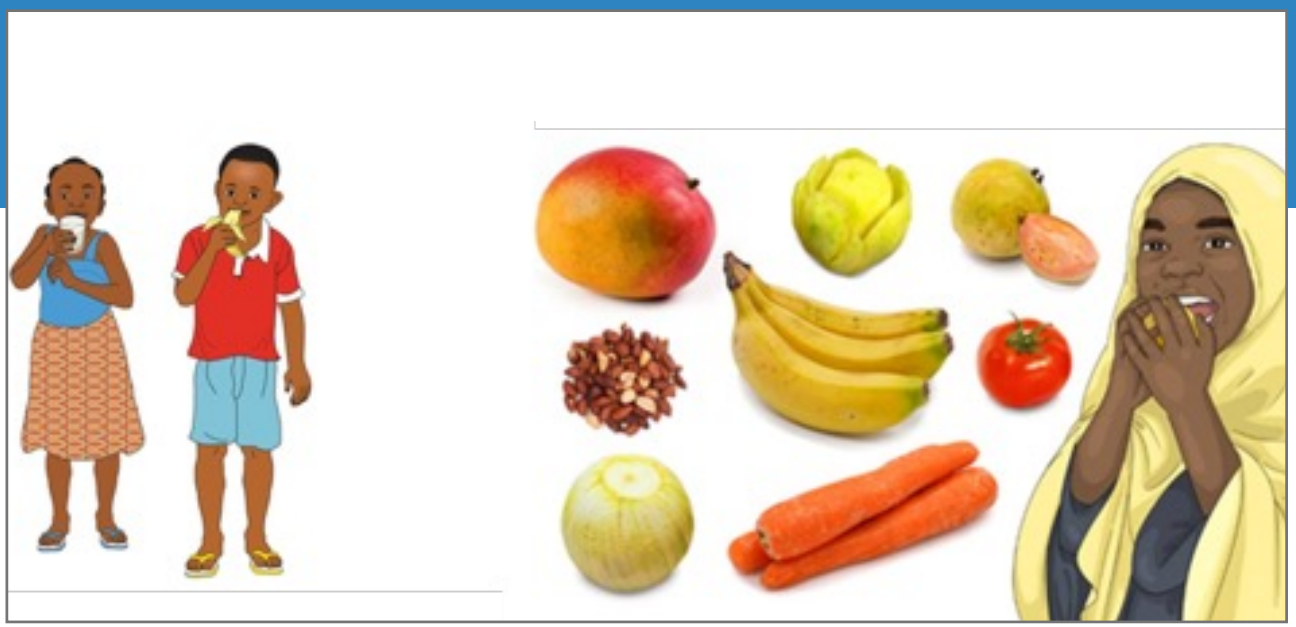
### 16A.1 The importance of eating breakfast

Breakfast is a very important meal for everyone, including school-aged children. It is required for energy in the morning and for good schoolwork. Eating breakfast is associated with a reduced risk of becoming overweight or obese and with a reduction in the body mass index of children and adolescents (De La Hunty, Gibson and Ashwell, 2013).

Breakfast is especially important if children have to walk a long distance to school or do not eat much at midday (FAO, 2004). If children do not eat breakfast, they will be hungry and will not be able to concentrate and learn at school (UNICEF, 2019).

Increased frequency of habitual breakfast was consistently positively associated with academic performance (Adolphus, Lawton and Dye, 2013).

Children who habitually consume breakfast are more likely to have adequate micronutrients and energy intake (Intiful and Lartey, 2014).



# 16B. RECOMMENDATION 2.5B

## ENCOURAGE SCHOOL-AGED CHILDREN TO EAT HEALTHY SNACKS SUCH AS FRESH FRUIT, VEGETABLES AND NUTS

### 16B.1 The importance of a healthy snack

In addition to balanced meals, school children should consume healthy snacks. Healthy snacks include fresh fruit (e.g. bananas, mangos, apples, oranges, guavas), vegetables (e.g. tomato, carrots), or nuts and seeds (e.g. peanuts, cashew nuts, sesame seeds, pumpkin seeds). Consumption of healthy snacks increases intake of essential nutrients required for growth and development.

Children do not need sweets, sugary drinks or ultraprocessed snacks. While these may be readily available and convenient to take to school, they only provide empty calories – meaning energy without valuable nutrients – and displace healthy foods that support growth and development.

# 16C. RECOMMENDATION 2.5C

## PROVIDE SCHOOL-AGED CHILDREN WITH FOOD WHEN THEY ARE AT SCHOOL TO INCREASE THEIR LEARNING ABILITY

### 16C.1 Importance of providing a lunch box for school children

Children between the ages of 5 and 18 spend most of the day at school. It is therefore important to provide a healthy meal for these children while they are in school in addition to a diversified breakfast before going to school and a wholesome meal when they get back from school. That way, the children stay nourished throughout the day.

In the United Republic of Tanzania, few schools provide school meals. When there are no school meals, children are given money to buy something to eat, in most cases a sweetened beverage or deep-fried snack. It is uncommon for parents to pack food for their children.

This guideline recommends that parents should provide a healthy packed lunch to school children for the following reasons:

- Healthy lunches or snacks for school help children stay alert and able to concentrate.
- Healthy lunches or snacks for school give children the nutrition they need during the day.
- Carrying food from home is less expensive, more convenient and more hygienic.
- When a parent/caregiver packs a child's lunch, they will always know what the child will be eating. If children are given money to buy food, parents and caregivers are not there to monitor what they buy or eat. The likelihood of children buying unhealthy snacks or food is very high.
- School lunches help set healthy eating habits for them in the future.

## 16C.2 Points to consider when packing school lunch for children

- Packed lunch should contain a variety of foods, such as vegetables (e.g. carrots, cucumbers), fruits, whole grains (e.g. chapatti, bread, popcorn) and plant proteins (e.g. nuts and seeds).
- Consider food safety. Since most of the packed foods may not be refrigerated, pack non-perisable foods that do not require refrigeration after two hours.
- Include water to stay hydrated and to avoid children buying or drinking sweetened beverages.

## 16.5 Key messages for providing healthy meals and snacks to school-aged children throughout the day

1. Provide children with a healthy breakfast, lunch, and snacks every day.
2. Add protein-rich foods like boiled eggs, nuts, and seeds to children's snacks.
3. Add liver, eggs, meat, poultry and fish to children's meals.
4. Add milk to children's meals every day.
5. Limit children's intake of salty snacks, fried foods and sweets.
6. Replace children's sugary drinks with safe and clean water.

## 16.6 Tips for providing healthy meals and snacks to school-aged children

1. Offer home-cooked meals and snacks instead of sweets or ultraprocessed foods.
2. Pack healthy snacks such as fruit, plain yoghurt and wholewheat bread with peanut butter and unsalted nuts instead of packaged ultraprocessed foods.
3. Encourage children to eat whole foods instead of ultraprocessed foods.
4. Replace sugary beverages with water or unsweetened milk.
5. Avoid giving foods that are high in fats such as pizza, deep-fried chips and doughnuts.
6. Instead of fruit juice, offer whole fruits.
7. Cook children's food with minimal salt to avoid excess intake.

# **GUIDELINE 3:** Limit intake of deep-fried foods, saturated and trans fats, sugar and salt

# 17. RECOMMENDATION 3.1

## LIMIT YOUR INTAKE OF DEEP-FRIED FOODS TO PREVENT HEART DISEASES, DIABETES AND OBESITY

Fried foods such as chips, samosas, kachoris and *maandazi* are popular, whether cooked at home or commercially prepared, because of their taste and ease of cooking. However, there are some serious health risks associated with over-consumption of these foods.

### 17.1 Why fried foods are unhealthy

There are four main reasons why eating a lot of fried foods negatively affects health:

***1. Frequent fried-food consumption is associated with a risk of type 2 diabetes and coronary artery disease***

Various studies have found an increased risk of eating fried foods with type 2 diabetes and cardiovascular events such as stroke and heart attack.

A recent meta-analysis of 17 different studies, involving more than 562,000 participants, found that people who ate the highest amount of fried food per week had a 28 percent increased risk of stroke and heart attack, a 22 percent heightened risk of coronary heart disease and a 37 percent heightened risk of heart failure when compared with people who ate the least amount of fried foods. These risks substantially increased by 3 percent, 2 percent, and 12 percent, respectively, in tandem with each additional 114 g (half cup) weekly serving (Qin *et al*., 2021).

Another study that looked at 70,842 women from the Nurses' Health Study (1984–2010) and 40,789 men from the Health Professionals Follow-Up Study (1986–2010) found a significant association of increased risk of type 2 diabetes and moderate association with coronary artery disease (Cahill *et al*., 2014). Similar findings were observed in other populations (Honerlaw *et al*., 2020)

***2. Deep-fried foods are high in fat and calories***

Fried foods, whether homemade or

commercially made, are higher in fat and calories than the same foods cooked with other methods such as boiling, steaming and grilling. When foods are deep fried in oil, they lose water and absorb fat, which increases their calorie content.

Eating fried foods easily adds calories to one's diet due to the higher energy density of fat. One gram of fat gives 9 kcal, whereas 1 g of carbohydrates and proteins provides only 4 kcal. Frying foods may add more calories than a person requires per day. High intake of calories leads to overweight and obesity.

Depending on the type of oils used, deep frying can increase the intake of saturated fats, which have negative health effects. Since frying replaces water in the food with fat, frying increases fat content in food. Fats and oils high in saturated fats include palm oil, coconut oil, ghee and butter (FAO and WHO, 2010).

***3. Frying causes the production of chemical by-products involved in the body's inflammatory response***

During frying, vegetable oils break down and change their composition due to high temperatures (Boskou *et al*., 2006; Choe and Min, 2007). The chemical by-products of this oil breakdown cause inflammatory responses in the body (Qin *et al*., 2021; Boskou *et al*., 2006). In addition, the high heat of frying causes hydrogenation of vegetable oils, creating trans-fatty acids, even in home cooking (Choe and Min, 2007).

It is therefore not recommended that people re-use oil used for frying to cook other foods. It is important to discard leftover oil after deep frying and avoid reusing used cooking oils.

***4. Commercially fried foods contain trans fats, which are harmful to health***

Fried foods in fast food restaurants, other commercially made fried foods and ultraprocessed foods use hydrogenated oils, which are high in trans fats. Fast food restaurants use hydrogenated oils as they are stable during long periods of frying and repeated frying without the need to change oils. Hydrogenated oils also give food a satisfying taste and crunch. Ultraprocessed food manufacturers use trans fats in foods because they are cheaper to produce, increase shelf life, and improve taste and texture.

Although widely used, trans fats are associated with an increased risk of heart diseases, type 2 diabetes and obesity and have no known health benefits (WHO and FAO, 2002; GBD, 2017; GBD 2019; WHO, 2021b).

## 17.2 Key messages for limiting intake of fried foods

1. Avoid buying or cooking fried foods. Choose alternatives such as baked, boiled or grilled products.
2. Avoid reusing oil because reheating oils creates trans-fatty acids.
3. Grill or stir-fry instead of deep frying.

## 17.3 Tips for reducing intake of fried foods

For those occasional times you have to fry foods:

1. Never let the food go brown or burn during frying.
2. Use vegetable oils when you fry.
3. Drain excess oil from food before eating or use a paper towel to remove excess fat.
4. Make consumption of home-fried foods an occasional treat just a few days a month.

# 18. RECOMMENDATION 3.2

## LIMIT INTAKE OF ULTRAPROCESSED FOODS TO REDUCE CARDIO-VASCULAR DISEASES, CANCER, OVERWEIGHT AND OBESITY, AND EARLY MORTALITY

### 18.1 The NOVA food groups

The degree to which a food is processed makes some foods unhealthy. The NOVA food classification system categorises foods into four groups according to the nature, purpose, and extent of the processing the food undergoes after it is separated from nature (Monteiro *et al*., 2016).

## Group 1: Unprocessed or minimally processed foods

**Unprocessed foods** are edible parts of plants and animals in their natural state without going through any alterations after removal from nature.

Examples of unprocessed foods include plants such as seeds, fruits, leaves, stems, roots and animal products such as meat, muscle, offal, eggs and fresh milk. Other foods include fungi, algae and water.

**Minimally processed** foods are natural foods that have gone through basic processes such as drying, crushing, filtering and packaging. Other such processes include removal of unwanted parts, grinding, fractioning, filtering, roasting, boiling, pasteurization, refrigeration, freezing, placing in containers, and non-alcoholic fermentation.

Examples of minimally processed foods include:

- milled and packaged grain flours;
- dried herbs, vegetables, fruits;
- frozen fresh meats, poultry, fish;
- frozen fruits and vegetables;
- boiled and fried meat or fish (without salt added); and
- pasteurised milk.

The purpose of processing is to increase shelf life and storability and enhance the edibility and digestibility of food. Minimally processed foods do not have sugar, salt, oil or other substances added. This food moves very quickly from the farm where it is harvested to the shop where it is sold or to the place where it is consumed.

Unprocessed or minimally processed foods are wholesome and nutrient dense. Make unprocessed or minimally processed foods a major part of your diet. Use unprocessed or minimally processed foods to make delicious, wholesome and healthy meals.

Sources: Educhange, 2018; Heart and Stroke Foundation, 2021; Monteiro *et al.*, 2019; Reardon, *et al.,* 2021

## Group 2: Processed culinary ingredients

**Processed culinary ingredients** are extracted and purified from natural foods (minimally processed food) through pressing, refining, grinding, crushing, pulverizing and refining.

They are typically not eaten on their own but are mainly used as condiments in homes and restaurants to season or add taste to natural foods when making freshly prepared dishes and drinks.

This group does not include ingredients that underwent further modifications, such as hydrogenated fats (margarine, other spreads or other trans fats) or modified starches as these are considered ultraprocessed foods (Monteiro *et al.*, 2019).

Examples of processed culinary ingredients include:

- salt;
- sugar;
- cooking oil;
- honey;
- apple cider vinegar; and
- maple syrup.

Processed culinary ingredients typically consist of only one macronutrient in highly purified form (mainly fat, sugar or carbohydrate) and therefore have low nutrient density. Thus, limit use and consumption of this group.

## Group 3: Processed foods

**Processed foods** are simple food products made by adding Group 2 foods like salt, sugar, and oil to natural or minimally processed foods (Group 1 foods).

Most processed foods have two or three ingredients. These foods are recognizable as modified versions of Group 1 foods and retain most constituents of the original food.

Processed foods can have some additives to preserve their original properties or prevent spoilage and increase food safety, for example, adding antioxidants to fruits in syrup or adding preservatives to dried salted meats.

Examples of processed foods include:

- canned or bottled vegetables, fruits and pulses in brine (salt water) or vinegar;
- canning of fish or bottling of fruits preserved in syrup;
- cured, dried or smoked fish or meat (with added salt and other ingredients);
- tinned fish preserved in oil;
- salted or sugared nuts and seeds;
- simple non-alcoholic fermentation like beer, sweet beer (*tongwa*), wine and cider;
- bakery freshly made bread;
- cheese; and
- fortified foods like flours with added nutrients such as vitamin A, calcium or vitamin D.


Large amounts of sugar, salt or oil can make processed foods nutritionally unbalanced. Therefore, just like processed culinary ingredients, they should be used sparingly and only occasionally. Make delicious dishes and meals from natural and minimally processed foods as a basis of the diet.

Sources: Educhange, 2018; Heart and Stroke Foundation, 2021; Monteiro *et al.*, 2016; Monteiro *et al.*, 2019

## Group 4: Ultraprocessed foods

**Ultraprocessed foods** are industrial formulations usually with five or more ingredients produced through a series of processes.

In addition to sugar, salt, oils and fats, they contain other substances that are not commonly used in home food preparation, such as non-sugar preservatives, sweeteners, colourants, flavourings and emulsifiers (Monteiro *et al.,* 2016).

The industrial formulation of these foods is made entirely or mostly from substances extracted from foods such as oils, fats, sugars, starches and protein, or derived from food constituents or synthesized in laboratories. Thus, ultraprocessed foods have little or no natural foods from Group 1.

These products are designed to be highly palatable and contain high amounts of sugar, salt, fat (mainly trans fats), and chemical additives.

Some examples include:

- beverages like sugary drinks;
- confectioneries like biscuits and cakes;
- snacks like crisps and sweets;
- Processed meats like corned beef;
- Baby food and milk formula; and
- Condiments like instant gravy and and stock cubes

(See Table 24 for a detailed list)

Due to high levels of trans fats, salt, sugar and chemical additives, ultraprocessed foods are linked to several non-communicable diseases and ill health. Because of their negative effects, ultraprocessed foods are discussed further below.

The processing and ingredients used to make ultraprocessed foods are nutritionally unbalanced (Moss, 2013; Brownell, 2012). However, it is important to note that added vitamins and minerals do not make highly processed foods healthy as they do not contain the numerous beneficial phytochemicals and nutrients that natural or unprocessed foods do.

## 18.2 How to recognise ultraprocessed foods

You can identify ultraprocessed foods by looking at factors such as their ingredients, preparation instructions, packaging and taste.

### *18.2.1 Contain substances or ingredients only found in ultraprocessed foods*

Ultraprocessed foods tend to contain substances or ingredients not found in shops or kitchens for ordinary cooking. These include dyes and other artificial colours, flavour or flavour enhancers, non-sugar sweeteners, sequestrants, humectants, PH regulators, emulsifiers, stabilizers and preservatives. Food additives also include gelling, thickening, firming, bulking, anti-bulking, anti-foaming, anti-caking, glazing, polishing, bleaching, colour retention, and carbonating agents (FAO and WHO, 2017a; FAO and WHO, 2022; Monteiro *et al.*, 2016). In some countries its not a requirement to include processing aids on food labels.

Since ultraprocessed foods have little or no natural foods, they use additives to imitate sensory qualities of natural foods or culinary preparations of these foods. Ultraprocessed foods also use these additives to disguise undesirable sensory qualities of the final product.

### *18.2.2 Contain ingredients extracted from nutrient components*

Ultraprocessed foods also contain ingredients extracted from nutrient components such as sugars, proteins and fats (Monteiro *et al*., 2016, 2019).

**Sugars:** fructose, high-fructose corn syrup, fruit juice concentrates, invert sugar, maltodextrin, dextrose, lactose.

**Proteins**: hydrolysed proteins, soya protein isolate, gluten, casein, whey protein and mechanically separated meat.

**Fats:** hydrogenated (trans fats) or interesterified oils derived from further processing of food constituents, such as natural oils.

### *18.2.3 Preparation*

Ultraprocessed foods are usually ready to eat or require little preparation. They are mostly ready-to-consume or to heat up, require very little preparation to be palatable, and are low in cost with a long shelf life (Monteiro *et al*., 2016). They are widely available through retail food vendors, grocery stores and supermarkets.

### *18.2.4 Packaging and taste*

Ultraprocessed foods are packed in attractive packaging with aggressive marketing and health claims. Various chemical additives are added to give them intense sensory properties that make the food especially attractive to see, taste, smell, and or touch (Monteiro *et al*., 2019).

### Table 24 Examples of ultraprocessed foods

**Beverages**

- Carbonated drinks, soft drinks, sodas beverages
- Sweetened drinks such as concentrates
- Juices, including fruit flavoured juices
- Energy drinks, fruit drinks, milk drinks, fruit yoghurts, cocoa drinks
- Ready to drink tea, coffee and hot chocolate mix

**Snacks**

- Crisps, chips* and other sweet, fatty or salty snacks
- packaged snacks
- Sweets, candy, chocolates
- Some energy bars

**Baby foods**

- Canned and bottled foods like purees
- Baby cereals
- Infant formulas, follow-on milk

**Meats**

- Reconstituted meats such as sausages, hotdogs, burgers, salami
- Corned beef or chicken

**Condiments**

- Stock cubes and gravy granules
- Salad dressings, mayonnaise
- Packaged soup powders or liquids
- Instant soups, sauces, gravy and gravy mixes
- Packages sauces such as tomato sauce, soy sauce, oyster sauce, instant sauces
- Soups
- Instant noodles, pasta and rice
- Yeast extracts

**Confectionaries**

- Long shelf-life packaged baked goods such as biscuits, cookies, cakes, pastries, pies
- Crackers
- Cake mixes, premixed pancakes
- Mass-produced packaged breads and buns (long life)
- Breakfast cereals

**Meals**

- Many fast-food restaurant foods*
- Ready-to-eat packaged meals and snack foods sold in shops (pizzas, pies, pastas), nuggets (fish/meat)

**Health and slimming products**

- Powdered or "fortified" meal and dish substitutes
- Ice cream, frozen desserts,
- Sugared and flavoured yoghurts and dairy drinks

*Continued on page 136*

*Most restaurant fast foods are ultraprocessed foods as they use hydrogenated oils. Although fast-food chips may look much the same as home-cooked chips, their formulations and the ingredients used in their pre-preparation and cooking render them ultraprocessed.

Monteiro *et al.,* (2016) note that Group 4 also includes foods from Groups 1 or 3 that have additives, such as plain yoghurt with added artificial sweeteners and bread with added emulsifiers. In addition, alcoholic drinks fermented and then distilled to make alcohol such as whisky, gin, rum and vodka are also considered Group 4 foods.

## 18.3 Limiting consumption of ultraprocessed foods

There are several compelling reasons why ultraprocessed foods should be avoided:

- Indulging in foods high in fat and sugar can add excessive calories to a person's diet, which can lead to overweight and obesity.
- Frequent consumption of unhealthy ultraprocessed food increases calorie intake without providing many nutrients, fibre, vitamins and minerals (Chen *et al*., 2020; Micha *et al*., 2017).
- Consuming more ultraprocessed foods is associated with higher overall cancer risk and breast cancer risk, thus reducing overall intake of ultraprocessed foods is recommended (Monteiro *et al*., 2019).
- It is known that consumption of sugar-sweetened beverages contributes to the prevalence of type 2 diabetes, partly due to weight gain. It can also be a result of high dietary glycaemic load, leading to inflammation, insulin resistance and impaired beta-cell function (Hu and Malik, 2010).
- Ultraprocessed foods also contain food additives, increasing the risk of exposure to various chemical additives (Chen *et al*., 2020).
- Heat treatment, food additives, food colouring, preservatives, and food packaging, in particular, can cause headaches, allergies, cancer and DNA damage (genotoxicity) (Schnabel *et al*., 2019; Chen *et al*., 2020).
- Eating less saturated fat, sugar, salt and highly processed foods can lower a person's risk of developing NCDs such as diabetes, stroke, and heart disease.

## 18.4 Key messages for avoiding the consumption of ultraprocessed foods

1. Limit intake of ultraprocessed foods.
2. Limit intake of sugar-sweetened beverages such as carbonated drinks and fruit-flavoured juice drinks.
3. Read food labels and avoid foods with ingredients such as emulsifiers, flavouring, flavour enhancers, colouring and texturisers.

## 18.5 Tips for avoiding the consumption of ultraprocessed foods

1. Avoid foods with long list of ingredients containing more than five ingredients, including salt, trans fats (hydrogenated oils) and sugar.
2. Avoid foods with ingredients not found in homes or used in cooking homemade food.
3. Avoid food labels with unrecognizable components or with very unfamiliar names.
4. Avoid foods with any ingredient extracted from nutrient components like sugar (e.g. lactose or fructose), protein (e.g. casein) or fat like hydrogenated oils (trans fats). These ingredients end with “ose” (lactose, fructose) or “ein” (casein).
5. Avoid foods with ingredients like nitrates, nitrites, benzoates, saccharin and sorbates.
6. “Fresh food” with a long shelf life may indicate the presence of preservatives. Check the label and avoid foods with preservatives such as sodium benzoate, nitrate, sulphite, BHA and BHT.
7. Watch out; ultraprocessed foods are often marketed as healthy, natural or organic. While these words may describe the original ingredients, they do not refer to the process of how the food was made. Remember, an organic, natural cookie is still an ultraprocessed food.
8. Do not get swayed by aggressive marketing and branding, attractive packaging and the low cost as you pay a high cost with your health.
9. Cook more often: make delicious meals with fresh ingredients. Heating up frozen pre-made foods does not count.
10. Make fresh, natural or minimally processed foods the basis of your diet.


# 19. RECOMMENDATION 3.3

## LIMIT INTAKE OF SATURATED FATS AND AVOID INTAKE OF TRANS FATS TO REDUCE THE RISK OF CARDIOVASCULAR DISEASES, INCREASED CHOLESTEROL AND TYPE 2 DIABETES

### 19.1 Unhealthy fats

#### *19.1.1 Saturated fats*

Saturated fats are made of carbon, hydrogen and oxygen atoms with no double bond in their structure, making them solid at room temperature with few exceptions.

The major sources of saturated fats are meats and meat products such as fatty beef or goat, poultry skin, butter, ghee, lard and cheese. Some plant-based oils, such as palm oil, palm kernel oil and coconut oil, also have saturated fats (WHO, 2020b).

#### *19.1.2 Trans fats*

The majority of trans-fatty acids (TFAs) are chemically altered vegetable oils (unsaturated fats) created through industrial processing of partial hydrogenation, where hydrogen atoms are added to the unsaturated vegetable oil. The trans configuration of unsaturated fats with added hydrogen causes the oils to become solid at room temperature. TFAs are also found naturally in very low amounts in ruminant fat in dairy and meat products (WHO, 2018d).

Ultraprocessed foods contain industrially made trans fats, which are sometimes called “partially hydrogenated oils” in the ingredients list.

Other major examples of artificial trans fats in addition to ultraprocessed foods include fried fast foods, commercially packaged snack foods, frozen pizzas, packaged frozen meals, pies and cookies (WHO, 2018d). Deep-fried foods at household level can convert natural unsaturated vegetable oil to trans fats.

Products brought from shops and used at home that contain industrial trans fats are margarine, fat spreads, mayonnaise and vegetable shortening. These vegetable-based fats are solid at room temperature because of partial hydrogenation.

As described earlier in Recommendation 1. 7, while unsaturated fats confer health benefits when taken in moderation, industrial trans fats increase coronary heart disease (CHD) risk factors and CHD events.

## 19.2 Health risks of eating more than 17 g of saturated fats

Multiple studies have found that limiting intake of saturated fats and replacing saturated fats with unsaturated fats decreases the risk of CHDs. Saturated fats, and especially palmitic acids (C16:0), have negative health effects as they increase LDL cholesterol (FAO and WHO, 2010; Willett *et al*., 2019).

The WHO recommends that saturated fat intake be less than 10 percent of total energy (WHO, 2018e). Less than 10 percent of total energy translates to less than 220 kcal, which is equivalent to 24 g or 2 tablespoons of fat.

The GBD (2019) defines exposure to high intakes of saturated fat as over 7 percent of total energy intake which is about 154 kcal for a 2200-kcal diet translating to 17 g of saturated fats (1.5 tablespoons) from all food sources. Taking in more than these amounts increases the risk of CHDs.

Given that the recommended intake of total added fats for Tanzania Mainland is 28 g, it is beneficial to use unsaturated fats like groundnut, sunflower and olive oils instead of saturated fats like ghee, butter, cream, palm and coconut oil.

## 19.3 Trans fats and non-communicable diseases

Eating products with artificially made trans fats, even in small quantities, is harmful to health:

- Trans fats increase cardiovascular heart disease risk factors, such as the risk of heart attacks and stroke. This is because trans fats increase LDL (so-called bad cholesterol) while decreasing HDL (good) cholesterol, thereby affecting the arteries through fatty deposits (WHO 2021b; GBD, 2017; GBD, 2019; FAO 2010a).
- TFAs are also associated with a higher risk of developing type 2 diabetes. Studies have shown that TFA could impair insulin sensitivity and affect glucose metabolism. (Wang *et al*., 2015).
- Trans fats have no known health benefits and there is no safe level of consumption (WHO 2021b; GBD 2019).

**Nutrition Facts**

Serv. Size 4 cookies (32g) Servings 9

**Calories** 150 Calories from fat 60

| Amount/Serving | | percentDV* | Amount/Serving | | percentDV* |
|---|---|---|---|---|---|
| **Total fat** | 7g | 11 percent | **Total Carb** | 20g | 7 percent |
| Sat Fat | 4.5g | 23 percent | Dietary Fiber | 1g | 4 percent |
| Trans Fat | 0g | | Sugars | 10g | |
| Cholesterol | 0mg | 0 percent | **Protein** | 2g | |
| **Sodium** | 115mg | 5 percent | | | |

Vitamin A 0 percent. Vitamin C 0 percent. Calcium 0 percent.Iron 4 percent

**INGREDIENTS**: Enriched flour, riboflavin, sugar, partially hydrogenated vegetable oil, cocoa, corn-starch, hydrogenated oils, soy, lecithin, salt, caramel color, artificial flavors

**Figure 6 Product ingredients list showing trans fats and hydrogenated oils**

In the Global Burden of Disease Study (GBD, 2019), exposure to a diet high in TFAs is defined as an average daily consumption greater than 0.5 percent of total energy from trans fat from all sources, mainly partially hydrogenated vegetable oils and ruminant products (Willet *et al*., 2019). Less than 0.5 percent of total energy is equivalent to 1 g of fat.

Given that 1 teaspoon of oil is about 5 g, consumption of trans fats of over one-fifth of a teaspoon will be harmful.

With the increased risks of heart attack and stroke caused by trans fats, adding partially hydrogenated oils (trans fats) to foods is no longer permitted in the United States of America, while in the United Kingdom of Great Britain and Northern Ireland, some supermarkets have voluntarily removed partially hydrogenated vegetable oil from all their shop-brand products. As similar laws have not been enacted in the United Republic of Tanzania, consumers are advised to avoid eating foods with trans fats. It is very important to be on the lookout for trans fats in manufactured food products.

The trans fats in ultraprocessed foods are sometimes called "partially hydrogenated oils" in the ingredients list. Ultraprocessed foods use trans fats because they are inexpensive to produce and give food products a desirable taste and texture.

A product may claim that it contains no trans fats as long as the content is less than 0.5 g per serving. However, if a packaged product contains two or more servings, a person could unknowingly consume more than 1 g of trans fat by eating the whole product. For example, if a serving is defined as 50 g and the product is 100 g or more, the total amount of trans fat a person would eat if they ate the whole product would be 1 g or more. One gram of trans fat is the threshold at which trans fats increase the risk of CHDs. Consumers need to refer to the ingredients list and check for partially hydrogenated oils. If the product has partially hydrogenated oils, then the product is not trans-fat free (GBD, 2017).

## 19.4 Key messages for limiting intake intake of unhealthy fats and avoiding trans fats

1. Replace saturated fats with unsaturated fats to decrease NCD risks.
2. Reduce intake of saturated fats to less than 10 percent of total energy.
3. Avoid trans fats as they increase the risk of NCDs.
4. There are no known health benefits of trans fats, while the risks are high.

## 19.5 Tips for replacing saturated fats with unsaturated fats and avoiding trans fats

1. Choose liquid vegetable oil like sunflower, groundnut, olive and canola oils instead of solid fats, palm oil, coconut oil, butter or ghee.
2. Read the ingredients list before buying packaged products.
3. Avoid products containing partially hydrogenated oils or trans fats.

# 20. RECOMMENDATION 3.4

## REDUCE INTAKE OF FREE SUGARS TO PREVENT WEIGHT GAIN AND DENTAL CARIES

### 20.1 What are sugars?

Sugar is one of the three principal dietary carbohydrates with three major sub-groups: monosaccharides, disaccharides and polyols. Monosaccharides include glucose, galactose and fructose. Disaccharides include sucrose, lactose and trehalose. Polyols are sugar alcohols with components such as sorbitol and mannitol (FAO, 1998).

Sugars, like other carbohydrates, provide the body with energy. Carbohydrates, including polysaccharides like starch, are digested and broken down into glucose. Human body cells prefer glucose as an energy source (Howarth, Gleeson and Attwell, 2012; Mergenthaler *et al*., 2013). Even though cells need glucose to survive, consuming too much can cause many health problems.

### 20.2 Sources of sugar

Sugars are found naturally in foods, mainly in intact fruit and vegetables, and in milk (lactose and galactose). These sugars are part of a healthy diet when consumed from fresh or unprocessed fruit, vegetables and milk. Although sugar cane, dried dates, honey and 100 percent fruit juice have naturally occurring sugars, they contain high amounts of sugars and should be consumed in moderation.

Other sugars are manufactured as sweeteners. Sweeteners include products used for sweetening foods or drinks and are derived from sources such as:

- sugar crops (sugar beets, sugar cane, sugar palm);
- cereals (maize);
- fruits;
- milk;
- insect activity (honey);
- the sap of certain species of maple trees; and
- sweet sorghum when cultivated explicitly for making syrup.

These sweeteners exist either in a crystallized state as sugar or in thick liquid form as syrups. They include a wide variety of monosaccharides (glucose and fructose) and disaccharides (sucrose and saccharose).

Typically, sweeteners are used to make food more palatable and to assist in food preservation. These sweeteners are also referred to as free sugars.

### *What are free sugars?*

Free sugars are sweeteners used for sweetening foods or drinks by a manufacturer, a cook or a consumer. They include sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates (WHO, 2015c).

Free sugars are typically found in:

- flour and sugar confections such as cakes, biscuits, pastries and doughnuts;
- candies, gum, jelly, jam and chocolate;
- sugar-sweetened carbonated beverages, soft drinks and fruit juices; and
- sugar cane, sugar cane juice and sweetened tea.




## 20.3 Health effects of consuming sugary foods

Sugary foods and drinks have minimal nutritional value and displace nutritious foods. Excessive amounts of sugar are harmful to health in several ways:

- Increased risk of obesity, type 2 diabetes, high blood cholesterol, high blood pressure, stroke, coronary heart disease, and cancer (Malik and Hu, 2019; Willett *et al*., 2019).
- Sugary drinks promote weight gain and obesity (WHO, 2016c, Ruanpeng *et al*., 2017).
- Sweets, sugary foods and drinks cause dental caries (cavities) (WHO; 2015a; Gibney, 2019.)
- There is an association between high consumption of sugar-sweetened beverages and increased risk of type 2 diabetes (WHO, 2016c). Sugar-sweetened beverages are directly linked to the increased risk of diabetes independent of obesity – meaning a person who drinks a lot of sugary drinks could develop type 2 diabetes even if that person is not overweight.

## 20.4 How much sugar is too much?

Consumption of more than 12 teaspoons (50 g) of sweeteners (free sugars) per day in the form of sugar-sweetened beverages, baked goods, confections and sweeteners added to food and drinks at home is considered too much sugar.

A diet high in sugar-sweetened beverages is defined as an average daily consumption greater than 2.5 g of beverages with ≥50 kcal per 226.8 g serving (GBD, 2019).

For example, one bottle or can (330 ml) of soft drink can contain 12 or more teaspoons of sugar, exceeding the recommended daily amount.

## DO YOU KNOW HOW MUCH SUGAR IS IN YOUR BEVERAGES?

Sodas and fruit-flavoured drinks in 250–330 ml cans or bottles have between 5 and 9 teaspoons (25–45 g) of sugar. Even drinks that taste sour rather than sweet can have very high sugar content.

### *20.4.1 Recommended amounts of added sugars per day*

- The WHO recommends that added sugar intake be less than 12 teaspoons (50 g), which is 10 percent of total daily caloric intake.
- For additional health benefits, sugar intake should be kept under 6 teaspoons (25 grams), which is 5 percent of total daily caloric intake based on a 2000-calorie diet (WHO, 2015c). Since sugar has no nutritional value and has adverse metabolic effects, a recent EAT Lancet Commission paper also suggests keeping intake of sugar to less than 5 percent of energy intake (Willett *et al.*, 2019).

## 20.5 Key messages for reducing consumption of free sugars

1. Limit intake of sugar-sweetened beverages, such as carbonated drinks and fruit-flavoured juice drinks.
2. Choose clean and safe water or unsweetened coffee or tea instead of sugary drinks.
3. Choose to eat fresh fruits or vegetables instead of sugary snacks or sweets

## 20.6 Tips for reducing consumption of free sugars

1. Choose more natural foods over processed foods as processed foods can contain a lot of sugar.
2. Avoid processed foods or condiments with added sugar, for example, tomato sauce.
3. Add less sugar to your tea, hot beverages and other foods.


# 21. RECOMMENDATION 3.5

## REDUCE SALT INTAKE TO REDUCE THE RISK OF INCIDENT STROKE, FATAL STROKE AND FATAL CORONARY HEART DISEASE

### 21.1 Salt and salty foods

Salt is composed mostly of the chemical compound sodium chloride. When you eat salt, the sodium and the chloride (chlorine) separate and the sodium becomes available for your body to use. Salt is the main source of sodium in the diets. Sodium is also a mineral naturally occurring in whole foods like fresh vegetables, pulses (legumes), and fruits.

In the body, it is necessary for absorption and transportation of nutrients and maintaining the right balance of fluids and blood pressure. However, intake of too much sodium or salt can lead to poor fluid balance and higher blood pressure, which can cause heart attack or stroke, and damage to the eyes and kidneys.

#### *21.1.1 Examples of foods high in salt*

Consuming highly processed foods that contain high amounts of salt can easily increase the intake of salt over the recommended daily limit.

Such foods include:

- Stock cubes and gravy granules.
- Salad dressings, mayonnaise.
- Packaged soup powders or mix and liquids, instant noodles, soups, sauces.
- Yeast extracts like Marmite and Bovril.
- Packaged baked goods, biscuits, cookies, cakes, and pastries, pies, crackers (sold on shelves and with a long shelf life).
- Mass-produced packaged breads and buns (long life).
- Other baby food products (canned and cereals).
- Prepared and ready-to-heat products including pre-prepared pies, pasta and pizza dishes; nuggets (fish/meat).
- Packaged sauces like tomato sauces, soya sauce, oyster sauce, instant sauces.
- Many fast-food restaurants foods.
- Ready-to-eat packaged meals and snack foods sold in shops.

***Health effects of high salt consumption***

- High salt intake is associated with an increased prevalence of hypertension and cardiovascular diseases (Hendriksen *et al*., 2014).
- Intake of too much salt is associated with higher risks of stroke, fatal stroke, and fatal coronary heart disease (WHO, 2012a).
- In addition, high-salt diets have been linked to an increase in oxidative stress and a reduction in the enzyme (ACE2 expression) responsible for regulating blood pressure in the kidneys (Bernardi, Toffoli and Zennaro, 2012).

***Recommended amount of salt intake***

The WHO strongly recommends a reduction of the total salt intake for adults to less than 5 g (1 teaspoon) per day to keep the sodium level lower than 2 g per day. This amount will reduce blood pressure and risk of cardiovascular disease, stroke and coronary heart disease in adults (WHO, 2012a). The WHO has a strong recommendation on reducing sodium intake for controlling blood pressure in children. The recommended maximum level of intake of 2 g per day of sodium in adults should be adjusted downward based on the energy requirements of children relative to those of adults (WHO, 2012a). The maximum amount of 5 g of salt per day includes all the salt that is added to foods that are purchased and the salt used in the foods cooked at home.

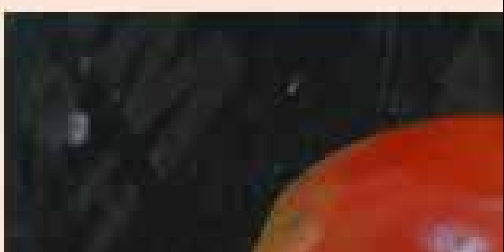
In sub-Saharan Africa, salt intake is above the WHO's recommended maximum intake (Hendriksen *et al*., 2014). Processed foods in general (e.g. bread and bakery products, processed meat products, and cheese) contribute significantly to salt intake. Ready-to-eat meals may also have high salt levels. People in urban areas also tend to eat more frequently outside the home (e.g. restaurants, fast-food outlets, and workplace canteens) where the salt content of meals may also be high.

## 21.2 Key messages for reducing consumption of salt

1. Use less salt when cooking and when eating.
2. Choose more natural foods over processed foods as processed foods contain a lot of salt,
3. Use iodized salt.
4. Pay attention to other food labels that mean salt, like monosodium glutamate, and any other name containing the word sodium.

## 21.3 Tips for reducing consumption of salt

1. Use more herbs and spices to bring out the flavour in food rather than salt.
2. Instead of salt, squeeze lime or lemon over fish and vegetables.
3. Avoid keeping extra salt on the dining table.
4. Limit intake of ultraprocessed food.
5. Choose packed foods labelled “No sodium” or “No salt added” when available.



# **GUIDELINE 4:** Ensure a clean home environment and safe food and water

# 22. RECOMMENDATION 4.1

## KEEP YOUR HOME ENVIRONMENT, FOOD AND WATER SAFE AND CLEAN TO PREVENT DISEASES

### 22.1 What is food safety?

Food safety refers to handling, preparing, and storing food in ways that prevent food-borne illnesses. Foodborne illnesses and food poisoning happen when a person gets sick by eating foods contaminated with germs or toxins.

Different kinds of bacteria can cause food poisoning, for example, *Salmonella*, *Staphylococcus*, *Clostridium*, *Shigella*, *Campylobacter* and *Bacillus*. Some viruses also cause food poisoning. Food poisoning can result from eating or drinking germ-contaminated food or water. Different types of germs take different lengths of time between being ingested and the onset of the disease.

Gastrointestinal diseases can cause all or a few of the following conditions:

- Frequent watery bowel movements, known as diarrhoea or runny tummy. This can be very serious. If it continues untreated for more than a day, the bowel movements remove too much water from the body and the person gets dehydrated. When this happens to babies, young children, the elderly or the sick, it is especially dangerous because they may lose so much water that they die.
- Vomiting.
- Nausea (person feels as though he/she wants to vomit).
- Stomach cramp or pains.
- Fever (high body temperature).
- Headache.
- General body weakness.

Though everyone can get sick, pregnant women, young children, older adults, and those who have weakened immune systems are at greater risk for developing foodborne illness.

### 22.2 The situation in the United Republic of Tanzania

The country has done well to achieve broad self-sufficiency in basic foodstuffs, but rapid urbanisation poses a severe future food security challenge, particularly for the poorer disadvantaged people in towns and cities in terms of food affordability, stability and food

safety. Unsafe water used for the cleaning and processing of food, poor food-production processes and food handling (including inappropriate use of agricultural chemicals), the absence of adequate food storage infrastructure, and inadequate or poorly enforced regulatory standards all contribute to a high-risk environment. Inadequate food safety and unhygienic practices can result in illness and sometimes lead to death (Wenban-Smith, Faße, and Grote, 2016).

Chronic diarrhoea among young children has been associated with the occurrence of stunting and other forms of undernutrition. Unsafe food creates a vicious cycle of disease and undernutrition, particularly affecting infants, young children, elderly, and the sick. Diarrhoea in infants and young children can lead to malnutrition and reduce immune resistance, which in turn increases the risk of prolonged and recurrent diarrhoea (Marino, 2007).

## 22.3 Five keys to safer food

Food safety relies heavily on good hygiene. Hygiene refers to the conditions or practices that are used to maintain health and prevent disease through cleanliness. There are five keys to keeping food safe:

- keep clean;
- cook thoroughly;
- keep food at safe temperatures;
- separate raw and cooked; and
- use safe water and raw materials.

### *22.3.1 Keep clean*

A clean environment is one that is free from dirt and its effects. It encompasses safe food and water supply, proper waste disposal, clean air, and few pests such as flies, cockroaches and mosquitoes. Maintaining a clean environment helps keep diseases away and fosters society's welfare. There are many reasons for cleaning, but the most important reason is to ensure that all surfaces and equipment that come into contact with food are not contaminated with microbes, their toxins or other contaminants. Another reason is to prevent pests such as rats, flies and cockroaches from being attracted to the kitchen.

It is important to keep the environment free of human, animal and food waste at all times. Improper disposal of faeces and waste and poor hygiene are risk factors for diarrheal diseases. Human faeces and urine carry harmful bacteria. Other types of solid waste that can be problematic include food waste, leftover food, meat and fish parts, and vegetable peelings. These can attract flies, roaches, rats, and other pests that could spread diseases.

Contamination can happen when food makes contact with unclean or dirty hands. Proper hand washing is an important step in preventing food poisoning. It is important to wash hands with soap and clean water before handling and preparing food, before eating, after using the toilet, after changing a nappy, and before and after caring for the sick. Washing hands properly and frequently can greatly reduce the spreading of germs that could cause diarrhoea, cholera, hepatitis, typhoid and polio.

### *22.3.2 Cook thoroughly*

Bacteria grow most rapidly in temperatures between 5 °C and 60 °C. To kill bacteria and pathogens naturally present in food, cook the food on high heat to reach the minimum recommended internal temperatures before removing the food from the heat source. Internal temperatures vary between foods from 63 °C to 74 °C (USDA, 2021).

Some animal-source foods such as meats, milk, fish and poultry carry harmful germs. When these foods are not cooked thoroughly, the germs survive and get ingested, leading to illness. Cook meat and poultry until the juices are clear. Ideally, use a thermometer and make sure they have reached an internal temperature of 70 °C.

Bring foods like soups and stews to boil for over five minutes to kill germs. Reheat cooked food thoroughly before eating.

### *22.3.3 Keep food at safe temperatures*

Germs thrive and multiply quickly in warm and humid conditions between 5 °C and 60 °C, with some doubling in number in as little as 20 minutes. Keeping foods below 5 °C can slow bacterial growth. Foods do not have to smell bad to have been contaminated with germs.

Cooked foods should not be left at room temperature for more than two hours. Do not keep perishable food outside the fridge for over an hour in warm weather (over 32 °C) (Ghamrawy, 2019; WHO, 2006e).

Keep cooked food piping hot (more than 60 °C) before serving or eating.

Serve food immediately while still hot. Cooked food should be eaten right away, and leftovers should be stored in a food-safe closed-lid container and put away in a refrigerator. Discard all refrigerated cooked foods or leftovers older than three days.

When leaving food out, always keep the food covered to keep it safe from bugs and rodents.

Refrigerate perishable foods immediately where a fridge is available:

- Refrigerate or freeze meat, poultry, eggs and other perishables as soon as you get them home from the store or farm.
- Refrigerate or freeze cooked foods within two hours or one hour in warm weather.
- Keep foods in the refrigerator between 1 °C and 5 °C or in the freezer below 0 °C. Freezing will keep food up to six months or more.

- Do not store foods for too long, even in the fridge. Refrigerate leftover food for up to three days and reheat thoroughly before consumption.
- Do not thaw frozen food at room temperature.

If there is no refrigerator:

- prepare food in smaller quantities that can be finished during the meal and avoid having excess leftovers.
- Do not keep cooked or perishable foods for more than two hours, and in warmer weather (32 °C and above) do not keep food for over an hour.
- Share leftovers with others within one or two hours of cooking to avoid wasting food.
- Cook raw meat, poultry and fresh fish as soon as it is bought or slaughtered. Do not let them stand for more than two hours before cooking. Once

cooked, apply the same rules as cooked foods (WHO, 2006e).

### *22.3.4 Separate raw and cooked foods*

Germs that are naturally present in raw meats, poultry and fish can be transferred to other foods upon contact. Keep raw meats, poultry and fish separated from fresh fruit and vegetables and other cooked foods.

Use a different cutting board or plate for fruits and vegetables and another one for raw meat, poultry and seafood. If not possible to have separate cutting boards, cut fruit and vegetables first before cutting raw animal source foods to prevent germs from touching fruit and vegetables.

Always wash knives and cutting boards or surfaces with soap and hot water after preparing raw animal foods.

Never place cooked food on a plate that previously held raw meat, poultry, seafood or eggs.

### *22.3.5 Use safe water and raw materials*

Raw materials (food ingredients), including water and ice, may be contaminated. Food contamination refers to the presence in food of harmful chemicals and microorganisms that can cause illness. Examples are biological, physical and chemical contaminants, including natural occurring toxins (e.g. aflatoxins) (Rather *et al*., 2017).

Food production, distribution, marketing, processing and preparation environments expose food to a number of microorganisms both useful and harmful. A large proportion of food-borne disease incidents are caused by foods improperly prepared or mishandled at home, in food service establishments or at markets (FAO, 2010b; FAO, 2017; FAO and WHO 2021).

Foods highly susceptible to contamination are vegetables, fruits, meat, dairy and fish due to high contents of micronutrients and phytochemicals much loved by microorganisms. Direct and indirect outcomes associated with consumption of contaminated foods include gastrointestinal diseases, cancer and metabolic/physiological disorders as well as spoilage leading to food and nutrient losses.

Aflatoxin contamination is also common in cereal grains such as maize, sorghum, millet and pulses (legumes). Aflatoxins are poisonous substances produced by naturally occurring moulds. It is common in foods such as groundnuts, tree nuts, spices, maize, and sorghum (WHO, 2018a; Kimanya *et al*., 2008). Aflatoxin contamination of food can occur both before and after harvesting. If food is not properly stored and is kept in warm and humid environments, moulds can grow.

Ways to keep raw materials safe include selecting fresh and wholesome foods, while avoiding damaged, mouldy or rotting foods and not using food past the expiry date.

## 22.4 Key messages for keeping food, water and the home environment safe

1. Wash your hands thoroughly with soap and clean running water:

- before preparing, serving and eating food;
- after visiting the toilet, changing a baby's nappy and caring for a sick person; and
- after completing household tasks such as cleaning toilets and rubbish pits.

2. Wash food containers, cutting boards, and utensils with soap and clean water before and after each use.
3. Keep fresh fruits and vegetables and prepared foods away from raw meats, poultry, and fish to avoid cross-contamination.
4. Cook meats, poultry, and fish thoroughly.
5. Boil raw milk before drinking.
6. Do not leave cooked food out at room temperature for more than two hours.
7. Prepare foods for infants and young children with clean and safe water.
8. Clean surfaces and knives with soap and safe water before cutting fruits and vegetables, especially if these are to be eaten raw or cooked at low heat.
9. Wash fruits and vegetables with clean and safe water before preparing or eating.
10. Prepared foods should be stored in food-safe containers.
11. Avoid using plastic bags to store prepared foods as it is likely that the bags are not sanitary. Plastics that are not food-safe tend to leach harmful chemicals into the food.

## 22.5 Tips for keeping food, water and the home environment safe

1. Eat food immediately after cooking. Don't let it sit around.
2. Read the labels of packed foods to know the expiry date.
3. Clean chopping boards with running water and soap before and after use.
4. Do not dry your hands on your clothes as this can easily transfer microbes.
5. Use clean towels to clean up during food preparation and serving.
6. Prepare and cook the amount of food that you intend to consume to avoid leftovers.
7. Do not taste foods with any utensil used to either mix or stir foods.
8. Store tableware away from dust.
9. Sort cereals and nuts to remove contaminated grains.
10. Ensure hygienic precautions during harvesting, storage and processing of agricultural crops and foodstuff.

# 23. RECOMMENDATION 4.2

## DRINK CLEAN, SAFE WATER INSTEAD OF SWEETENED DRINKS EVERY DAY FOR GOOD HEALTH

Water makes up the major portion of the human body (50 to 70 percent). It is a major constituent of blood and other vital body fluids.

Although it is not defined as a nutrient, it is as important as all other nutrients. It absorbs and transports nutrients around the body, removes waste products, regulates body temperature, helps in food digestion, and acts as a lubricant (spinal fluid, synovial fluid and mucous secretions).

The body is continuously losing water through sweat, urine and faeces, which must be replaced by drinking enough clean and safe water. Feeling thirsty is a signal that the body is already dehydrated. Therefore, it is important to form the habit of drinking sufficient water every day, instead of only when thirsty.

### 23.1 What is clean and safe water?

Clean and safe water is free from disease-causing agents like bacteria, parasites and viruses and harmful chemical substances such as industrial wastes, heavy metals, pesticides and excess fluoride. The most common use of this term applies to drinking water, but it could also apply to water for other uses.

There are several ways to make unsafe water clean and safe for human consumption, including:

- Boiling: Boiling is the surest method to kill disease-causing organisms, including viruses, bacteria, and parasites. Boiling water to a rolling boil is a satisfactory method of purifying water, though it does not remove chemical contaminants. In addition to killing all disease-causing organisms, it also removes temporary hardness. Store the boiled water

in sterilized containers with tight covers (WHO, 2015b; WHO, 2017).

- Disinfectants: If boiling is not possible, you can make small quantities of filtered and settled water safer to drink using a chemical disinfectant such as unscented household chlorine bleach (WHO, 2017). It is important to follow the instructions for disinfecting drinking water that are written on the label of the bleach.

The availability of clean, safe drinking water helps people avoid water-borne diseases such as cholera, diarrhoea, dysentery, typhoid and hepatitis. Clean and safe water is essential not only to remain safe but also to maintain good health.

## 23.2 The current water situation

The 2015 Tanzania Demographic and Health Survey (MoHCDGEC *et al*., 2016) reported that nearly 9 in 10 Tanzania Mainland urban households (86 percent) obtain their drinking water from improved sources such as piped water, public taps, standpipes, tube wells, protected dug wells and springs, rainwater and bottled water. Access to improved sources of water in the United Republic of Tanzania has improved substantially since the 2010 TDHS (from 57 percent to 61 percent). By contrast, more than half (52 percent) of Tanzania Mainland rural households obtain their drinking water from unimproved sources such as surface water and unprotected dug wells. About 6 in 10 households (62 percent) did not treat their water before drinking, but more than one-third (36 percent) used an appropriate treatment method (e.g. boiling, bleaching, filtering or solar disinfecting) (MoHCDGEC *et al*., 2016).

It is estimated that the United Republic of Tanzania spends 70 percent of its health budget on preventable diseases related to water, sanitation, and hygiene (WASH) as the majority (81 percent) of the population does not have access to improved sanitation and 51 percent and 14 percent of the population in rural areas and urban areas, respectively, do not have access to clean drinking water (UNICEF, 2017; MoHCDGEC *et al*., 2016, 2015/16).

## 23.3 Key messages for safe and clean water

1. Boil or treat water before drinking.
2. Allow water to settle then decant (pour) to another container or filter before boiling.
3. Store drinking water in a clean, covered container to avoid recontamination.
4. Drink an adequate amount of water (six to eight glasses or two litres per day).
5. Avoid soft drinks and sweetened drinks.

## 23.4 Tips for drinking safe and clean water

1. Choose plain water as your beverage as often as possible.
2. Carry water with you to get access to safe and clean water.
3. Drink water even when you are not thirsty.
4. Increase water intake in hot weather and with increased activity.

# **GUIDELINE 5:** Keep an active lifestyle for optimal health and weight

# 24. RECOMMENDATION 5

## BE PHYSICALLY ACTIVE EVERY DAY TO STAY STRONG AND KEEP A HEALTHY BODY WEIGHT

### 24.1 What are physical activities and exercise?

Physical activity refers to any voluntary bodily movement produced by skeletal muscles that require energy expenditure (WHO, 2018b). Some examples of physical activity include daily chores around the house, farming, fishing, walking, cycling, dancing, and exercise.

Physical activity undertaken throughout the life cycle reduces the risk of NCDs such as cardiovascular disease, diabetes and cancer and their risk factors such as raised blood pressure, raised blood sugar and overweight. In addition, physical activity is a key determinant of energy expenditure and thus is fundamental to energy balance and weight control.

Exercise is a type of physical activity that is planned, structured, repetitive and purposeful in order to maintain or improve one's physical fitness. Examples of exercise include:

- aerobic activity (walking, dancing, swimming, riding a bicycle);
- strength (anaerobic) exercises (push-ups, squats, pull-ups);
- flexibility exercises – range of motion (yoga, stretching, pilates); and
- functional balance exercises (standing with one leg, tai chi, muscle strength exercise).

### 24.2 Benefits of physical activities

Being active daily and exercising regularly can help maintain a healthy body weight when combined with a healthy diet. Physical activities use up energy and burn calories. When energy-rich food is consumed in excess of the body's requirements, it leads to weight gain. When less energy is consumed compared to body requirements, it leads to weight loss. One way to burn excess calories is through moving the body more. This can be through regular exercise or through other physical activities. It is important to

ensure that daily energy intake balances out daily energy expenditure to achieve a zero balance of energy, which enables maintenance of a healthy weight.

In addition to maintaining a healthy weight, engaging in at least 150 to 300 minutes of physical activity per week at moderate intensity, while keeping active daily, can help to reduce the risk of hypertension, stroke, heart attack, diabetes, depression, and certain cancers (WHO, 2020a). It also reduces stress, elevates mood, improves memory and learning, and strengthens the bones.

Other benefits of regular physical activities:

- Increases strength and stamina and elevates "good" cholesterol levels.
- Essential for maintaining ideal body weight and composition by burning excess calories.
- A major modifiable risk factor in reduction of non-communicable chronic diseases such as type 2 diabetes, high blood pressure, heart disease, osteoporosis, arthritis, and certain types of cancers.
- Improves flexibility and builds strong muscles, bones, and joints, thus reducing the risk of falls and injuries in the elderly.
- Improves mood, sense of well-being and self-esteem, thus warding off depression.

## 24.3 What is sedentary behaviour?

At the lower end of the physical activity range is sedentary behaviour, which is defined as any waking behaviour characterised by low energy expenditure (of 1.5 METS or lower) while sitting, reclining or lying. Examples include desk-based office work, watching television, working or playing on a computer or mobile device, sitting down chatting, reading a book, selling items, and driving a car.

### *Effects of sedentary behaviour*

Physical inactivity is estimated to be the main cause of approximately 21–25 percent of breast and colon cancers, 27 percent of diabetes and 30 percent of ischemic heart disease (WHO, 2009a). The evidence from developing countries confirms that physical activity positively influences other chronic disease risk factors such as blood pressure, lipid levels, and obesity. A systematic review on the role of physical activity in prevention of hypertension (Diaz and Shimbo, 2013) reported that elimination of physical inactivity would remove between 6 percent and 10 percent of the major NCDs of coronary heart diseases, type 2 diabetes, breast cancer and colon cancer while increasing life expectancy (Lee *et al*., 2012).

## 24.4 Recommendations for physical activities for different age groups

The WHO (2020) recommends the following physical activities for each age group:

### *24.4.1 During pregnancy and lactation*

Pregnant women are advised to do at least 150 minutes of moderate intensity in week while keeping active daily. Physical activity can include walking or performing daily household chores. However, they should avoid vigorously intense exercises and consult their medical attendants for confirmation to prevent unnecessary falls and traumas.

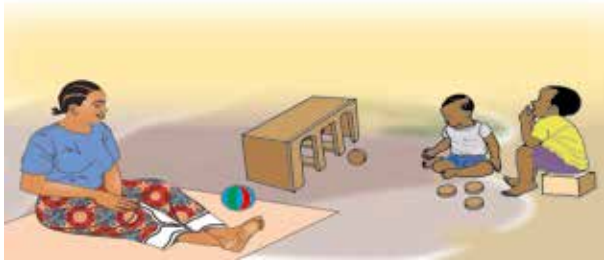
Pregnant and postpartum women should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.

Being physically active during pregnancy has been associated with preventing excessive gestational weight gain, gestational diabetes, gestational hypertension, and prenatal depression. It has also been shown to lower instrument delivery.

### *24.4.2 Infants 0–12 months*

Infants should be as active as possible under the supervision of parents or caretakers throughout the day when they are awake. Activities such as grasping, pushing, pulling, reaching out, crawling, and moving their heads, limbs and bodies can be ways to keep them active. Include at least 30 minutes of tummy time, which can be spread throughout the day (WHO, 2020a).

### *24.4.3 Toddlers (1–2 yrs)*



Toddlers should have at least 180 minutes (three hours) of physical activity spread throughout the day. Activities can include standing up, running and rolling, chasing-ball games, jumping, playing in water and riding a bike.

For 1-year-olds, sedentary screen time (such as watching TV or videos, playing computer games) is not recommended. For children of age 2 years, sedentary screen time should not be more than one hour; less than one hour is better. Engaging in reading and storytelling with a caregiver is encouraged when the child is not active or playing" (WHO, 2020a).

### *24.4.4 Preschoolers (3–4 yrs)*

Pre-schoolers should have at least 180 minutes (three hours) of physical activities spread throughout the day. Of this, at least 60 minutes should be exercise of moderate to vigorous intensity.

This particular age group should have limited on-screen time – an hour or less is better for a child's good health and development (WHO, 2019b).

### *24.4.5 Children 5–17 years*

Children and young people aged 5–17 years old should accumulate at least 60 minutes of moderate to vigorous physical activity daily.

Physical activity of amounts greater than 60 minutes daily will provide additional health benefits.

Most daily physical activity should be aerobic. Vigorous-intensity activities should be incorporated, including those that strengthen muscle and bone, at least three times per week.

Limit the amount of time spent being sedentary, in particular recreational screen time.

### *24.4.6 Young people and adults 18–64 years*

Adults aged 18–64 years should do at least 150 minutes of moderate-intensity aerobic physical activity spread throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week, or an equivalent combination of moderate and vigorous activity.

Aerobic activity should be performed in bouts of at least 10 minutes duration.

For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week or engage in 150 minutes of vigorous-intensity aerobic physical activity per week or an equivalent combination of moderate and vigorous activity.

Muscle-strengthening activities should be done involving major muscle groups at least twice a week.

### *24.4.7 Older people 65 years old and above*

Adults aged 65 years and above should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week, or an equivalent combination of moderate- and vigorous-intensity activity.

Aerobic activity should be performed in bouts of at least 10 minutes duration.

For additional health benefits, adults aged 65 years and above should increase their moderate-intensity aerobic physical activity to 300 minutes per week or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate and vigorous-intensity activity.

Adults of this age group with poor mobility should perform physical activity to enhance balance and prevent falls on three or more days per week.

Muscle-strengthening activities involving major muscle groups should be done on two or more days every week.

When adults of this age group cannot do the recommended amounts of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow.

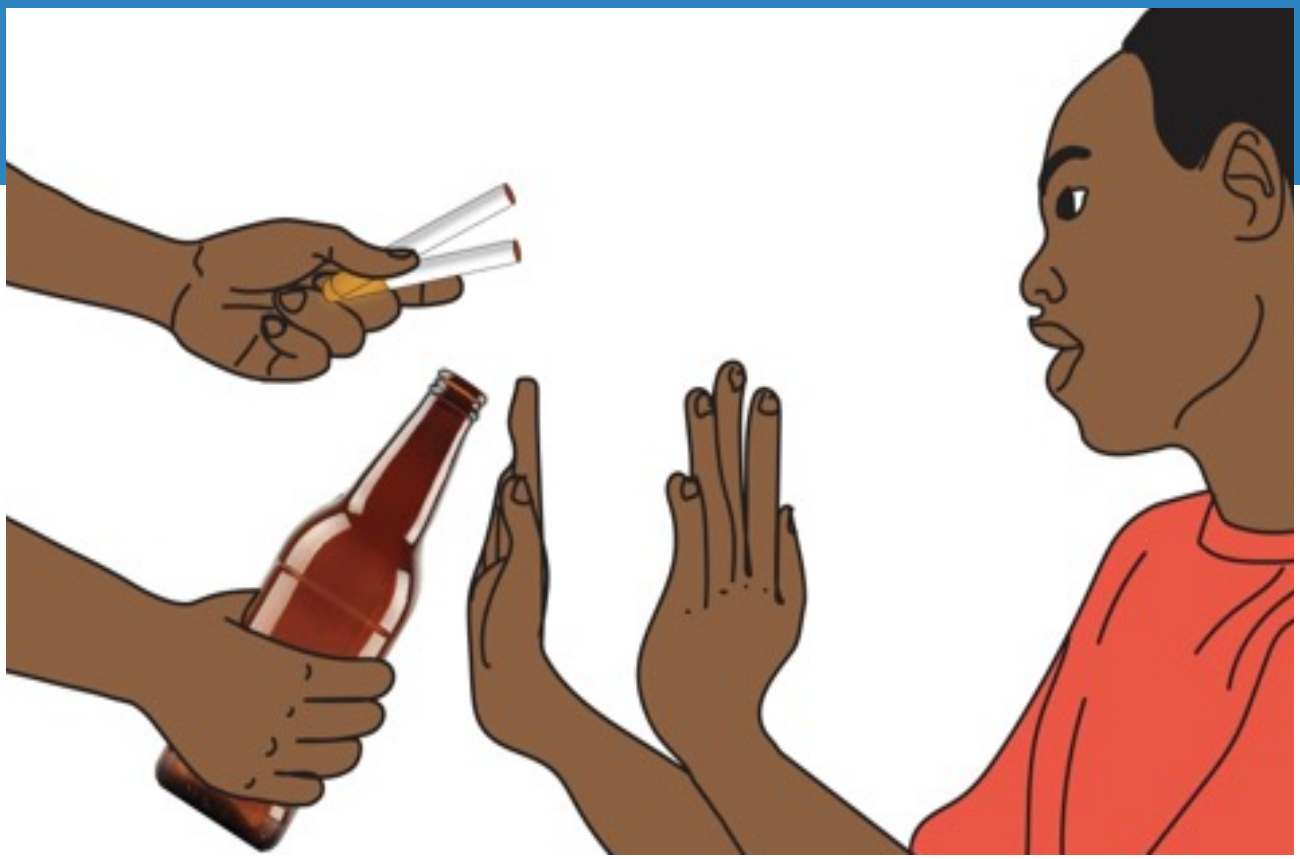
## 24.5 Key messages for increased physical activities

1. Adults from 18 years and older should do at least 150 to 300 minutes a week of moderate physical activity to keep the body healthy.
2. Pregnant women should do at least 150 to 300 minutes a week of moderate physical activity to keep their bodies healthy.
3. Keep babies and young children active daily under adult supervision.
4. Keep children aged 1 to 4 years active for at least 180 minutes a day.
5. Children aged 5 to 17 years should do at least 60 minutes a day of moderate to vigorous physical activity.
6. Limit recreational screen time (television, computer, video games, among others) to no more than two hours per day.
7. Do muscle-strengthening activities at least twice a week.
8. Choose to be active every day.

## 24.6 Tips for being physically active

1. Enjoy your favourite activities such as soccer, dancing, walking, and biking with your friends and family.
2. Perform activity in bouts of at least 10 minutes duration.
3. Walk or bike to your destination instead of taking motorized transportation.
4. Take the stairs instead of elevators.
5. Take a break from sitting and get up and move around.
6. Every bit helps. You can break up your physical activity into two or three parts each day to fit your schedule.
7. Be active together. Being active with someone else will keep you accountable and motivated.
8. If physically inactive, start gradually, increasing the duration and frequency of moderate-intensity activity before considering increasing the intensity to vigorous-intensity activity.

# **GUIDELINE 6:** Avoid risky behaviours such as using tobacco and drinking alcohol to reduce the risk of diseases



# 25. RECOMMENDATION 6

## AVOID DRINKING ALCOHOL AND USING TOBACCO TO REDUCE THE RISK OF DISEASES

### 25.1 What is alcohol?

Alcohol is a product of the fermentation of grains, fruits, or other sources of sugar with yeast and or bacteria. Fermentation is the anaerobic breakdown of sugar molecules into simpler compounds. For example, wine is made from the sugar in grapes, beer from the sugar in malted barley, cider from the sugar in apples, and vodka from the sugar in potatoes, beets or other plants. There are also locally made brews which include bamboo wine (*ulanzi*), banana wine (*mbege*), fermented cereals (*komoni*), coconut wine (*tembo*), and cashew nut wine (*uraka*).

### 25.2 Effects of alcohol consumption

#### *25.2.1 Alcohol is a risk factor for premature mortality and disability*

Drinking too much alcohol in one session can lead to drowsiness (sleepiness), respiratory depression (where breathing becomes slow, shallow or stops entirely), coma or even death.

According to the WHO (2018c), alcohol consumption contributes to three million deaths globally each year and results in poor health and disabilities for millions of people. Overall, the harmful use of alcohol is responsible for 5.1 percent of the global burden of disease. Alcohol is the leading risk factor for premature mortality and disability among those aged 15 to 49 years, accounting for 10 percent of all deaths in this age group (WHO, 2018c). Alcohol has effects on every organ in the

body and these effects depend on the blood-alcohol concentration over time. It may lead to several serious psychosocial problems and accidents (Traversy and Chaput, 2015). A systematic review reported that even a small amount of alcohol is harmful, so it is important to abstain (Iranpour and Nakhaee, 2019).

Similarly, the World Cancer Research Fund recommends that for the prevention of cancer, it is best to abstain (WCRF, 2018).

### *25.2.2 Alcohol and cancer risk*

Alcohol consumption has been identified as carcinogenic for the cancers of the colorectum, female breast, larynx, liver, oesophagus, oral cavity, and pharynx (WCRF, 2018). The higher the rate of consumption of alcohol, the greater the risk for these cancers. Increased risk is evident even among light to moderate drinkers (up to two drinks a day), who represented one in seven of all new cancers in 2020 and more than 100,000 cases worldwide (Rumgay *et al*., 2021, WCRF/AICR, 2018). Thus, the World Cancer Research Fund recommends that for the prevention of cancer, it is best to abstain (WCRF, 2018).

### *25.2.3 Alcohol and other NCDs*

Alcohol consumption has detrimental effects on hypertension, cardiac dysrhythmias, and haemorrhagic stroke, regardless of the drinking pattern (Rehm *et al*., 2011). People who regularly consume more than two alcoholic drinks (one drink contains about 30 ml of ethanol) are at a higher risk for hypertension and stroke. Excessive alcohol intake weakens the heart muscle and damages the liver, brain, and peripheral nerves.

### *25.2.4 Foetal alcohol syndrome and pre-term birth complications*

These are conditions caused by alcohol consumption during pregnancy. Alcohol use by the mother has been shown to be detrimental to the health and development of neonates (Iranpour and Nakhaee, 2019). Alcohol consumption also increases the risk of preterm delivery and low birth weight (Addila *et al*., 2021).

### *25.2.5 Alcohol and nutrition*

Consumption of alcohol promotes metabolic changes and weight gain, increasing the risk of cardiovascular diseases, altering the lipid profile, and promoting hypertension. Alcohol contains 7 kcal per gram, which is more than the 4 kcal contained in one gram of carbohydrates and protein. However, because alcohol consumption does not provide vitamins and minerals, its calories are considered empty (Tofollo, Aguiar-Nemer and Silva-Fonseca, 2013).

When large amounts of alcohol are consumed, the body perceives that its energy needs have been met, decreasing its demand for other foods (Tofollo, Aguiar-Nemer and Silva-Fonseca, 2013). This leads to multiple deficiencies of vitamins and minerals.

Alcohol contributes to malnutrition by replacing foods needed for essential nutrients and by interfering with the absorption, storage and metabolism of the essential nutrients (Bishehsari *et al*., 2017).

The energy content of alcohol represents extra calories. This effect seems to add to the overfeeding associated with a high-fat diet, increasing the chances of weight gain (Azevedo *et al.,* 2021; De Aguiar, 2013).

Alcohol also affects mucosal immunity by suppressing one of the intestine's main lines of defence against bacteria (Bishehsari *et al*., 2017).

#### *25.2.6 Other effects of alcohol*

Abuse of alcohol may lead to violence, increased incidence of psychological problems that lead to mental disorders, interpersonal violence and risk of accident (Iranpour and Nakhaee, 2019).

### 25.3 What is smoking?

Smoking is the act of inhaling and exhaling the fumes of burning plant material. A variety of plant materials are smoked, including marijuana and hashish, but the act is most commonly associated with tobacco as smoked in a cigarette, cigar, or pipe.

### 25.4 Effects of smoking

#### *25.4.1 Increased risk of NCDs*

Smoking causes cancer, heart disease, stroke, lung diseases, diabetes, and chronic obstructive pulmonary disease (COPD), which includes emphysema and chronic bronchitis (CDC, 2020; American Cancer Society, 2020). People who smoke and drink heavily have a much higher risk of developing oral cancer (mouth and lip) and the pharynx (Pelucchi *et al*., 2006). Smoking also increases the risk of tuberculosis, certain eye diseases, and problems of the immune system, including rheumatoid arthritis (CDC, 2020).

#### *25.4.2 Smoking may cause ADHD*

Smoking during pregnancy may cause attention deficit hyperactivity disorder (ADHD) in the child. ADHD is a mental health disorder that can cause above-normal levels of hyperactive and impulsive behaviours. People with ADHD may also have trouble focusing their attention on a single task or sitting still for long periods (Huang *et al.,* 2018).

### 25.5 Passive smoking

Passive smoking (which means inhalation of tobacco smoke from the surrounding air) is equally bad for children and non-smoking adults. It is responsible for causing excess cases of sudden infant death syndrome, lower respiratory infections in infancy, asthma, middle ear infections, meningitis and streptococcus pneumonia (Ferrence, 2010; Cao *et al*., 2015; WCRF, 2018).

### 25.6 Smoking and alcohol intake in the United Republic of Tanzania

In addition to genetic predispositions, unhealthy diets and sedentary lifestyles, other risk factors for NCDs in the United Republic of Tanzania included excessive alcohol consumption and smoking (Shayo and Mugusi, 2011; Njelekela *et al*., 2009). According to the STEPS survey (Mayige and Kagaruki, 2013), about 16 percent of the population use tobacco and 4.1 percent are smokers (men 26.0 percent and women 2.9 percent). Second-hand smoke exposure in at least one day in the past week in the home was reported by 17.5 percent of the population. Furthermore, alcohol drinking is also common, with about one in three men and one in four women drinking alcohol.

According to the Global Adults Tobacco Survey of 2018 (NBS, 2020), 8.7 percent of adults across the survey currently use tobacco. Of these current tobacco users, 74.2 percent smoked tobacco only, 21.7 percent used smokeless tobacco only, and 4.2 percent were dual users. Significant difference exists between male and female smokers, as about 14.6 percent of males were current tobacco users, while only 3.2 percent of females were current tobacco users.

It was observed in the same survey that about 5.2 percent smoked daily and about 50 percent initiated smoking before age 20. Although the current policy restricts smoking in public, there is also high exposure to tobacco smoke at workplaces (33 percent), restaurants (31 percent), bars (77 percent) and at home (14 percent) (NBS, 2020).

## 25.7 Key messages for avoiding alcohol and tobacco use

1. Avoid drinking alcohol and using tobacco to reduce the risk of diseases.
2. Avoid places where people drink alcohol or smoke.

## 25.8 Tips for avoiding drinking alcohol and using tobacco

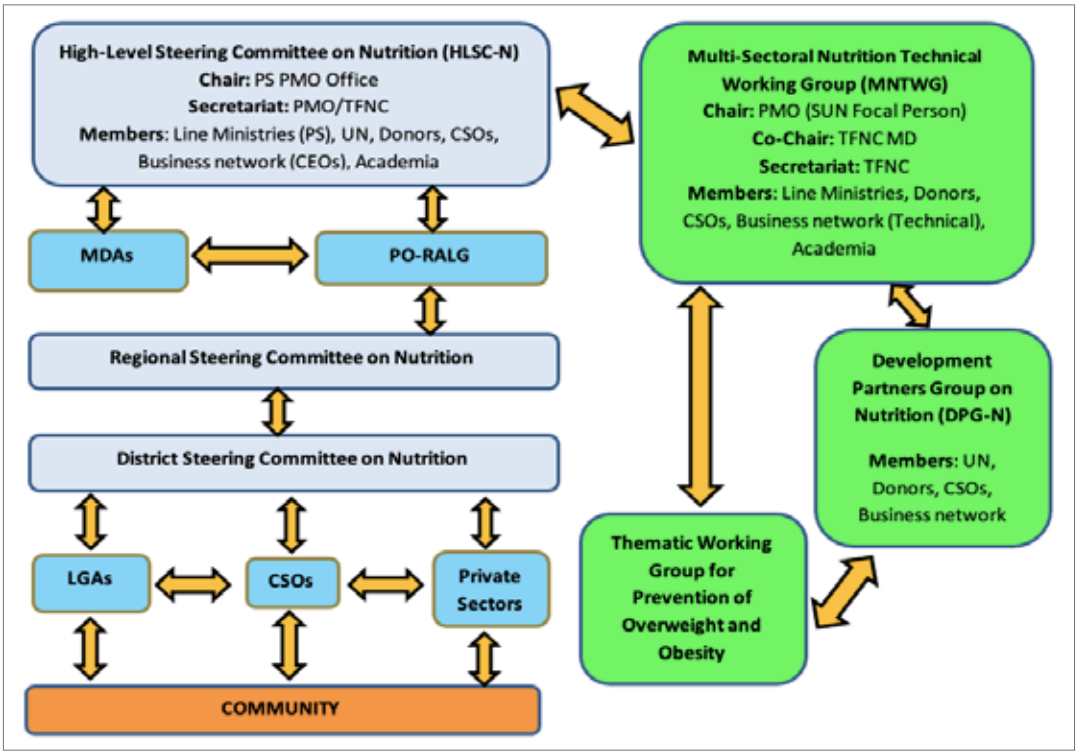
1. Choose to associate more with people who are non-drinkers and non-smokers.
2. Create new recreational activities to replace drinking alcohol or smoking.
3. Distract yourself from drinking alcohol or using tobacco by staying focused.
4. Do not allow friends or visitors to use tobacco in your home.

SECTION 3

# Implementing the FBDGs

# 26.IMPLEMENTATION PARTNERS

The implementation of the guidelines will follow a multisectoral approach as stipulated in the existing National Multisectoral Nutrition Action Plan (NMNAP), with the Tanzania Food and Nutrition Centre (TFNC) providing overall technical support and leadership. This arrangement is necessary to ensure effective and efficient implementation.




Source: Adapted from NMNAP II (Prime Minister's Office (2022).

**Figure 7 FBDGs coordination structure**

## 26.1 Key actors for implementation of the FBDGs

The key implementers of the FBDGs include:

- government ministries, departments and agencies (MDAs);
- regional administrations and local government authorities (LGAs);
- communities, development partners and civil society organizations (CSOs), including NGOs and faith-based organizations (FBOs);
- institutions of higher learning, training and research;
- private-sector institutions;
- the media; and
- political parties.

The specific mandates and functions of each of these implementing partners are described under three sections – the ministries, local government authorities, and other implementers.

## 26.2 Ministries, departments and agencies

Table 25 describes the mandates and functions of different ministries and departments in implementing FBDGs.

**Table 25 Mandates and functions of the FBDGs implementation partners**

| Ministries, departments and agencies | | Specific responsibilities for the ministries, departments, and agencies in line with their mandates |
|---|---|---|
| 1. | The Prime Minister's Office | • Coordinate the overall national response on implementation of FBDGs.<br>• Ensure effective contribution by ministries, departments and agencies to the implementation of FBDGs.<br>• Support the multisectoral response to improve utilisation of FBDGs and ensure that interventions to improve implementation of FBDGs are adequately mainstreamed in policies and strategies of the key line ministries.<br>• Provide oversight for governance and accountability of all sectors and actors in implementation of FBDGs. |
| 2. | President's Office: Ministry of Regional Administration and Local Government | • Guide and monitor the integration of interventions to improve implementation of the FBDGs in regional and local government authorities plans and bylaws.<br>• Coordinate and facilitate capacity development of regional and local government administrations to plan and implement programmes to improve consumption of adequate diets at the community level.<br>• Coordinate and monitor implementation of FBDGs by all actors in regional and local government authorities using the principle of the three ones: One plan, one coordinating mechanism and one monitoring and evaluation framework. |
| | President's Office: Ministry of Public Service and Good Governance | • Prioritize implementation of FBDGs to improve consumption of diverse foods and promote healthy lifestyles in the ongoing government structural/institutional reforms. |
| 3. | Ministry of Health | • Supervise, monitor and coordinate implementation of the FBDGs to improve diet diversity and nutrient intake to all individuals.<br>• Promote desirable and supportive behaviour-change strategies that promote consumption of healthier foods and a healthy lifestyle. |

*Continued on page 174*

| | | |
|---|---|---|
| 4. | Community development, women, special groups | • Promote consumption of diversified foods among women and special groups. |
| 5. | Ministry of Agriculture | • Ensure that national food security plans and programmes have explicit objectives to improve consumption of adequate diets based on the recommendations presented in the FBDGs.<br>• Promote and support increased production and consumption of diverse, nutritious and safe food to improve nutrition status.<br>• Promote production and dissemination of varieties of crops, including varieties of biofortified fruits and vegetables and promotion of home gardening to ensure consumption of nutrient-rich foods as suggested in the FBDGs. |
| 6. | Ministry of Livestock and Fisheries | • Promote and support increased production and consumption of livestock, fish and related products to improve the nutrition status of Tanzanians.<br>• Ensure mainstreaming of food and nutrition topics in livestock and fisheries training programmes.<br>• Facilitate good marketing of livestock and fisheries products across the country.<br>• Ensure storage, transportation and safety of animal and fisheries products. |
| 7. | Ministry of Human Settlement (Urban Planning Unit) | • Establish safe food environments in all areas to ensure easy accessibility to nutritious foods.<br>• Create safe environments for physical activity, such as footpaths, access to public transport, and parks with lighting.<br>• Promote and develop environments, including infrastructure, that support healthy eating and physical activity for infants, children and young people and their families, including older people.<br>• Develop bylaws to promote adequate production of fruits and vegetables in urban areas.<br>• Develop bylaws to protect consumer exposure (especially children) to ultraprocessed foods and unsafe drinks. |

*Continued on page 175*

| | | |
|---|---|---|
| 8. | Ministry of Water and Irrigation | • Ensure sustainable supply of adequate safe and clean water up to household level.<br>• Promote safe water, sanitation and hygiene practices for improved nutrition outcomes.<br>• Ensure sustainable water supply for irrigation, especially for home gardens. |
| 9. | Ministry of Education | • Integrate food and nutrition topics in school and college curricula to impart knowledge and skills on food choice, selection and consumption in line with the FBDGs.<br>• Promote implementation of the FBDGs in schools, colleges and other educational institutions to improve food services provided by these institutions.<br>• Promote physical activity, healthy lifestyles and appropriate food consumption at all levels of the education system. |
| 10. | Ministry of Energy and Minerals | • Promote better and cheaper energy in both rural and urban areas to reduce women's workload, prevent environmental degradation, and improve nutritional outcomes in households.<br>• Promote better and cheaper energy in both rural and urban areas to ensure best preparation practices of diversified foods.<br>• Protect consumers from risks associated with contamination of food and water sources with hazardous minerals. |
| 11. | Ministry of Natural Resource Management | • Ensure integration of interventions to improve healthy diets and nutritional rights of communities surrounding wildlife and forest reserves in their plans.<br>• Promote increased small-scale production and processing of quality honey, fruits and animal products to enhance diversity of diets and to ensure desirable nutritional outcomes at household level. |

*Continued on page 176*

| | | |
|---|---|---|
| 12. | Ministry of Industry and Trade | • Promote increased processing, storage and marketing of agricultural, livestock and fisheries products to ensure availability of nutritious foods throughout the year.<br>• Promote increased nutrition-relevant small and medium enterprise (SME) participation in the food industry subsector.<br>• Promote consumer protection against ultraprocessed foods and trans fats.<br>• Promote traceability of ultraprocessed foods.<br>• Ensure imported and exported food products meet the minimum food standards. |
| 13. | Ministry of Finance and Trade | • Mobilize and allocate funds to improve interventions geared to promoting implementation of the FBDGs.<br>• Expedite timely disbursement of allocated funds to the responsible sectors and institutions for implementation of the FBDGs.<br>• Monitor public expenditure on implementation of interventions to improve utilisation of the FBDGs, with specific reference to NMNAP-II. |
| 14. | The Ministry Responsible for Labour | • Sensitize employers and the national labour force to adhere to good nutrition practices and consumption of diversified diets as stipulated in the FBDGs.<br>• Monitor the status of nutrition of the labour force and take appropriate action to improve the situation based on the requirements and recommendations of the FBDGs.<br>• Promote workplace nutrition services, including the food environment and physical activities, to improve the wellbeing of the working population. |
| 15. | Ministry Responsible for Home Affairs | • Strengthen enforcement of laws and regulations that facilitate implementation of interventions that promoted good utilisation of food in the country based on the recommendations of the FBDGs.<br>• Ensure that the food and nutrition rights of people under confinement/custody, including prisoners, are met. These rights include adequate access to health services, healthy nutritious diets and safe water for drinking, hygiene, sanitation, and physical exercise. |

*Continued on page 177*

| | | |
|---|---|---|
| 16. | Ministry Responsible for Culture and Sports | • Increase media coverage of food and nutrition issues to promote awareness and adoption of the FBDGs.<br>• Promote traditions and customs that positively impact on good food and nutrition practices, including production and consumption of indigenous nutritious foods and engaging in physical activities, including sports.<br>• Promote sports for healthy lifestyle for the prevention of overweight, obesity and other DRNCDs at all levels in the country.<br>• Integrate dietary practices and other nutrition issues in sports development programmes. |
| 17. | Ministries Responsible for Infrastructure Development | • Infrastructure development, especially in urban settings, should facilitate physical exercises, such as walking, jogging and cycling.<br>• Ensure clean environment for fresh air and limited pollution.<br>• Create good market infrastructure for accessing diversified foods. |
| 18. | Tanzania Food and Nutrition Centre | • To provide technical advice and support to regions, local government authorities (LGAs), and the private sector on the implementation of the FBDGs.<br>• To monitor and evaluate implementation of FBDGs at various levels. |
| 19. | Tanzania Bureau of Standards | • Ensure nutritional concerns are addressed in the development and monitoring of quality and standards of food products as stipulated in the FBDGs. |

## 26.3 Local government authorities (region, district, ward, village and street)

Specific responsibilities for LGAs in line with their mandates are as follows:

### *26.3.1 Regional Nutrition Steering Committee*

- Provide knowledge to communities and other stakeholders on the implementation of the FBDGs.
- Supervise and monitor interventions to implement FBDGs.
- Provide technical advice and support to local government authorities in implementation of the FBDGs.
- In collaboration with other institutions, provide technical support and supportive supervision to districts in implementation of the FBDGs.
- Collect and compile data for monitoring and evaluating the implementation of the FBDGs.

### *26.3.2 Council Nutrition Steering Committee*

- Integrate interventions to implement FBDGs in local government authorities' development plans.
- Plan, coordinate, monitor, and evaluate implementation of interventions to improve dietary practices as stipulated in the FBDGs.
- Promote and support communities to participate in the implementation of FBDGs activities to improve health and wellbeing.
- Mobilize resources for the implementation of FBDGs.
- Integrate interventions to improve dietary practices and other lifestyle aspects in the Comprehensive Council Health Plans.
- Monitor and supervise the interventions to implement the FBDGs.
- Conduct training for members of the Council Nutrition Steering Committee to ensure a common understanding of the guidelines and impart skills for dissemination of the FBDGs to the communities.
- Support and ensure community involvement and participation in activities geared towards implementation of recommendations stipulated in the FBDGs.
- Allocate sufficient resources for the implementation of the FBDGs at the district level.

### *26.3.3 Ward and village/mtaa levels*

- Identify unique and context-specific opportunities and challenges at the respective level for the implementation of FBDGs.
- Empower members of the committee with knowledge and skills to understand the FBDGs. To ensure that activities related to the implementation of the FBDGs are integrated in ward/village/mtaa plans and strategies.
- Ensure adequate community sensitization to practise the recommendations of the FBDGs.
- Mobilize resources for the implementation of the FBDGs.
- Coordinate, monitor and evaluate interventions to improve implementation of the FBDGs recommendations.

## 26.4 Other implementers

### *26.4.1 Higher learning, training and specialized research institutions*

- Review and update curricula for pre-service, in-service and continuing education to ensure that FBDGs are adequately integrated.
- Mobilize funding for research of food-based approaches for addressing all forms of malnutrition.
- Conduct research to identify drivers/ enhancers and bottlenecks of adherence to recommendations stipulated in the FBDGs.
- Provide technical advice and consultancy services on implementation of the FBDGs.

### *26.4.2 Civil society organizations, NGOs, faith-based organizations, community-based organizations, and political parties*

- Provide financial and technical support.
- Advocate for the prioritization of implementation of the FBDGs in national, regional, LGA and community development plans.
- Mobilize communities and households to adhere to recommendations stipulated in the FBDGs.
- Support capacity development for dissemination and implementation of the FBDGs at all levels.
- Integrate activities targeting communities and households for the implementation of the FBDGs in programmes and projects.

### *26.4.3 Professional bodies and associations*

- Advocate for appropriate practices of the recommendations stipulated in the FBDGs.
- Provide professional guidance in dissemination and implementation of the FBDGs recommendations.
- Conduct research, set professional standards and participate in the development of appropriate food-based approaches in curricula for pre-service, in-service and continuing education.
- Support outreach activities on implementation of the FBDGs in communities.

### *26.4.4 Political parties*

Political parties are in a unique position to promote nutrition improvement, given their reach and influence in mobilizing for social goals. In implementing of the FBDGs, political parties will:

- incorporate implementation of the healthy lifestyle interventions issues in their election manifestos and campaigns;
- support mobilization for healthy lifestyle interventions;
- support initiatives for improvement of healthy lifestyles in the community; and
- advocate for the prioritization of implementation of the healthy lifestyle interventions in national, regional, LGA, and community development plans.

### *26.4.5 Private-sector institutions*

The private sector will partner with government in the implementation of healthy lifestyle interventions at all levels.

Specific contributions could include:

- increasing investments in production, processing, storage and marketing of high-value nutritious and healthy products and in the provision of essential basic social services (food, health, water, sanitation and hygiene) for improvement of healthy lifestyle;
- investing in production and marketing of appropriate low-cost labour-saving technologies that enhance healthy lifestyle improvement at community level;
- integrating healthy lifestyle interventions in corporate social responsibility plans and activities;
- initiating and improving workplace implementation of the healthy lifestyle intervention programmes for their labour force; and
- ensuring compliance with all national laws, regulations, guidelines and international protocols for protection of consumer rights, health and the environment.

#### *26.4.6 The media (print, radio, TV, social media, and online communications)*

The mass media will be responsible for:

- translating complicated FBDGs recommendations into simple language and disseminating it to a wider population using various channels; and
- advocating and creating awareness to influence positive practices in adopting recommendations of the FBDGs.

#### *26.4.7 Development partners*

Development partners, including the UN agencies and multilateral and bilateral organizations, will advocate for, promote and prioritise the implementation of the FBDGs in their global and national agendas. Their role will include:

- mobilizing for technical and financial resources for implementation, capacity development, monitoring and evaluating the implementation of the FBDGs; and
- contributing their international experience, norms and standards, and evidence-based guidance and insights to the implementation of the FBDGs.

### 26.5 The framework for the Implementation Plan

This Implementation Plan framework is outcomes focused and action oriented so that all the stakeholders can work towards a common set of results. Its development has begun the process of intersectoral and interagency action, including the private sector. This will continue during the implementation phase.

The framework for the Implementation Plan of the Tanzania FBDGs includes the following actions (as elaborated in Tables 26–33):

- Develop and implement a comprehensive communication plan to ensure consistent FBDGs messaging.
- Promote FBDGs issues into the school curriculum in the United Republic of Tanzania.
- Identify and develop activities for promoting FBDGs in health care settings.
- Initiate development and implementation of a range of social marketing strategies to facilitate behavioural changes supporting healthy eating, healthy action and healthy weight.
- Develop and expand community

action programmes for FBDGs advocacy.

- Develop and implement a strategy to increase the capacity and capability of trained health professionals and community health workers to disseminate FBDGs.
- Encourage the private sector and industries to implement the FBDGs strategy.
- Establish a database on the nutritional status of the population and their dietary practices, which will give adequate information to suggest suitable modifications.
- Develop an FBDGs Monitoring and Evaluating Plan.

The specific actions outlined in Tables 26–33 are based on the outcome results we are aiming for. This is where the implementation plan really comes alive. The tables detail the desired outcomes and the specific actions identified to reach these outcomes. Institutions and organizations have been identified to take part in the specified actions, as have milestones and measures of progress towards the outcomes. The final column identifies timelines and resources for the plan. The timelines use three one-year phases, giving the plan a three-year timeline. Phase one indicates that action will be initiated in the first year of implementation. Phase two actions will be initiated in the second year and phase three actions in the third year of the implementation.

An implementation steering group will be established to provide leadership and expert advice to the Ministry of Health during the implementation phase.

**Table 26 Implementation Plan: Objective 1**

| Objective 1: Public policy communication | | | | |
|---|---|---|---|---|
| **Outcome** | **Specific actions** | **Agencies** | **Progress milestones and measures** | **Time frame / resourcing** |
| Sectors work collaboratively and in a coordinated manner to incorporate key messages and recommendations of the FBDGs into country policies, programmes and plans for agriculture, food security, nutrition, health and social protection policies, prioritising those with high needs based on the wider determinants of health. | Document the stakeholder groups that could have an influence on FBDGs implementation in the United Republic of Tanzania. | TFNC, DPG | Database of stakeholders to be completed. | Phase 1 |
| | Form an interagency steering group for the cross-sectoral implementation of FBDGs, with members from the DRNCDs Technical Working Group. | TFNC, Ministry of Health (MoH), Presidents Office, Regional Administration and Local Government (PO-RALG), regional and district councils | Interagency groups (national, regional and local) to be established. | Phase 1 |
| | | | A staged approach to joint work programmes to be developed. | |
| | Engage the private sector and food industries to implement FBDGs. | TFNC, MoH, private sector and industry | Private sector and industry participation in implementation of the plan. | Phase 1 |
| Multi-way strategic alignment of policies and priorities between MoH, Ministry of Education (MoE) and TFNC in place to progress FBDGs implementation issues. | Undertake collaborative planning between MoH, MoE, TFNC for FBDGs implementation. | MoH, MoE, TFNC | Joint planning initiated. | Phase 1 |

*Continued on page 183*

| | | | | |
|---|---|---|---|---|
| Healthy public policy in the areas of nutrition and physical activity developed and supportive environments created. | Implement FBDGs in settings such as schools, preschools, churches, mosques, hospitals, health services, and tertiary institutions. | MoH,NGOs | Nutrition and physical activity policy implemented in range of settings. Systematic audit processes and specific policies developed and implemented. | Phase 1 |

**Table 27 Implementation Plan: Objective 2**

| Objective 2: Create supportive environments | | | | |
|---|---|---|---|---|
| **Outcome** | **Specific actions** | **Agencies** | **Progress milestones and measures** | **Time frame / resourcing** |
| Increased profile of healthy food and physical activity through media, advertising, and promotion. | Identify social influencers as change agents for healthier food choices and physical activity in media, advertising and promotions. | TFNC, MoH | Options to be considered and agreed actions to be implemented. | Phase 1 |
| Improved access to healthy food in preschools and schools. | Assess the accessibility of fruit, breakfast programmes and gardening in schools as a model to improve student access to healthy food. | TFNC, MoH, NGOs | Feasibility study completed and recommendations for rollout made based on evaluation. Rollout undertaken as recommended. | Phase 1 |
| Reduced salt, sugar, fat content of commercially prepared foods. | Food service industry adopts best practice preparation, cooking and serving techniques consistent with the FBDGs. | TFNC, MoH, industry | Best practice adopted. | Phase 1 |

*Continued on page 185*

| | | | | |
|---|---|---|---|---|
| choices are affordable, available, and accessible. Increased consumption of vegetables and fruits in the Tanzanian population. | Undertake regional ecological scans regarding access to healthy food opportunities (mapping access to food in a deprived area). Action taken to improve access. | TFNC,MoH | Scans completed at the regional level. Access improved. | Phase 1 |
| | Promote consumption of vegetables and fruits in a variety of settings, for example, schools, workplaces, and community settings. | TFNC, MoH, NGOs | Consumption monitored in National Nutrition Survey and Tanzania Demographic Health Survey. | |
| Environments promote and support physical activity and/or healthy eating. | Develop and implement a Walking and Cycling Strategy. Final plan addresses needs of priority groups, and messages are consistent with FBDGs. | TFNC, MoH | Walking and Cycling Strategy developed and implemented. | Phase 2 |
| | Develop regional physical activity plans. | TFNC | Number and coverage of plans. | Phase 2 |
| | Develop district-level alliances and networks between health agencies and LGAs to inform and influence district planning. | TFNC, MoH, PORALG, LGAs, NGOs<br><br>Regional councils | Networks developed. | Phase 2 |

*Continued on page 186*

| | | | | |
|---|---|---|---|---|
| | Run forums to foster identification of nutrition, physical activity, and obesity as priorities for LGAs. | TFNC, MoH, PORALG, LGAs, NGOs Regional councils | Several forums held. Participant evaluation indicates increased awareness of nutrition and physical activity as priority issues for LGAs. | Phase 2 |
| | Develop and expand existing settings-based programmes promoting healthy food and physical activity. Settings include early childhood centres, schools, workplaces, health care facilities, shopping centres, and markets. | TFNC, MoH, NGOs | Successful programmes expanded (number and coverage) and new programmes developed. | Phase 1–3 |
| | Promote nutrition, physical activity and obesity issues to preschools and schools, prioritising those with high-need populations. | TFNC, MoH | The monitoring process indicates success of promotion. | Phase 2 |
| | Work with schools to become Health Promoting Schools and to include nutrition, physical activity and obesity issues as a priority. | TFNC, MoH, MOE | Number of Health Promoting Schools identifying nutrition, physical activity and obesity as priorities. | Phase 1 |

**Table 28 Implementation Plan: Objective 3**

| Objective 3: Strengthen community action | | | | |
|---|---|---|---|---|
| **Outcome** | **Specific actions** | **Agencies** | **Progress milestones and measures** | **Time frame / resourcing** |
| Communities are actively involved and successful in supporting, promoting and influencing the availability of healthy food and physical activity in their communities. | Support community action by resourcing key community people to promote healthy food and physical activity, prioritising high-need communities. | TFNC, MoH | Investment increased for high-need groups (number and coverage). | Phase 1 |
| | Support communities to develop nutrition and physical activity programmes in key settings of significance and high-need communities. | TFNC, MoH, NGOs | Research collated and disseminated about successful initiatives (number and coverage). | Phase 1 |
| | Disseminate information about evaluated, successful community action initiatives, especially those effective in achieving health gain in high-need groups. | TFNC, MoH | Mechanism to share information established within and between agencies. | Phase 1 |
| | Support community initiatives that promote healthy eating and physical activity (e.g. community gardens). | TFNC, NGOs | Number and coverage of programmes. | Phase 2 |

**Table 29 Implementation Plan: Objective 4**

| Objective 4: Develop personal skills (including industry, education and wider workforce involved in promoting nutrition and physical activity) | | | | |
|---|---|---|---|---|
| **Outcome** | **Specific actions** | **Agencies** | **Progress milestones and measures** | **Time frame / resourcing** |
| Increased knowledge and skills in families and communities about improving nutrition, increasing physical activity and reducing obesity. | Stocktake existing community-based education opportunities. | TFNC, MoH | Stocktake to be done. | Phase 1 |
| | Develop community-based education programmes aimed at increasing knowledge and skills of community members about nutrition and physical activities. | TFNC, MoH | Number and coverage of education programmes. | Phase 1 |
| Increased knowledge of employers and other key stakeholders in settings such as workplaces about improving nutrition and increasing physical activity. | Train employers and other key stakeholders in workplaces to promote the key messages of food and nutrition guidelines and physical activity guidelines. | TFNC, MoH | Number and coverage of training programmes. | Phase 1 |

*Continued on page 189*

| | | | | |
|---|---|---|---|---|
| Increased knowledge and skills of teachers to deliver nutrition and physical activity in the curriculum. | Establish nutrition and physical activity training course content. | TFNC, MoH, education sector | Nutrition and physical activity guidelines included in tertiary instruction course content. | Phase 1 |
| | Make training available to early childhood centres and schoolteachers on the key messages of the FBDGs. | TFNC, MoH, NGOs Education sector | Number and coverage of professional development sessions conducted. | Phase 1 |
| Increase the knowledge and skills of workers in the food and physical activity industries about improving nutrition and increasing physical activity. | Train food vendors in best practice food preparation, cooking and serving techniques consistent with the FBDGs. | TFNC, MoH, food industry, NGOs | Number and coverage of training opportunities. | Phase 1 |
| | Train physical activity industry (gym/fitness clubs) employees in the key FBDGs messages. | NGOs, MoH | Number and coverage of training opportunities. | Phase 2 |

**Table 30 Implementation Plan: Objective 5**

| Objective 5: Reorient health services | | | | |
|---|---|---|---|---|
| **Outcome** | **Specific actions** | **Agencies** | **Progress milestones and measures** | **Time frame / resourcing** |
| Improved availability and access by high-need groups to affordable and appropriate programmes and services for weight loss (including maintenance). | Create a list of all evidence-based weight loss programmes and services to develop new programmes and services to meet consumer need. | TFNC, MoH | List of evidence-based programmes to be developed. | Phase 2 |
| | Collaborate with NCDs department of the MoH to develop service guidelines and training packages for providers on the treatment of overweight and obesity. Ensure guidelines are effective for high-need groups including children and link to existing nutrition and physical activity guidelines. | TFNC, MoH | Guidelines developed. Treatment guidelines consistent with food and nutrition guidelines. | Phase 2 |
| FBDGs models of health are integrated into health sector planning to improve nutrition, increase physical activity and reduce obesity. | Build nutrition and physical activity indicators into Multisectoral Nutrition Information Systems (MNIS). | TFNC, MoH, PO-RALG | Changes in practice signalled in annual reports. | Phase 1 |

*Continued on page 191*

| | | | | |
|---|---|---|---|---|
| | Use FBDGs models of health to prioritise and plan services and programmes to improve nutrition, increase physical activity, and reduce obesity. | TFNC, MoH, PO-RALG | Changes in practice signalled in annual reports. | Phase 1–3 |

**Table 31 Implementation Plan: Objective 6**

| Objective 6: Monitor, research and evaluate | | | | |
|---|---|---|---|---|
| **Outcome** | **Specific actions** | **Agencies** | **Progress milestones and measures** | **Time frame / resourcing** |
| Improved availability of research and information to support evidence-based approaches and interventions to improve nutrition, increase physical activity and reduce obesity. | Develop Tanzanian Healthy Eating Index (TAHEI) based on the FBDGs using the food consumption data. | TFNC | TAHEI developed. | Phase 1–2 |
| | Develop a brief food quality screening tool scoring for the important TAHEI components to enable evaluation for counselling. | TFNC | A brief food quality screening tool scoring developed. | Phase 1–2 |
| | Update key tools, including the National Nutrition Survey. | TFNC, MoH | Updated Tanzania Health Monitor includes relevant information. | Phase 2–3 |
| | Investigate other sources of monitoring information, such as the National Bureau of Statistics (NBS). | TFNC, MoH, NBS | Other sources of data identified. | Phase 2–3 |
| | Independently evaluate implementation of FBDGs. | TFNC, MoH | Evaluation framework developed and evaluation completed. Results published and promoted widely. | Phase 3 |

**Table 32 Implementation Plan: Objective 7**

| Objective 7: Communication | | | | |
|---|---|---|---|---|
| **Outcome** | **Specific actions** | **Agencies** | **Progress milestones and measures** | **Time frame / resourcing** |
| Tanzanians aware of key messages of FBDGs. | Develop and implement a communication plan to deliver clear, consistent messages about nutrition, physical activity and healthy weight for a variety of audiences and settings. | TFNC, MoH | Communication plan developed and implemented. | Phase 1 |
| | Develop media guidelines for promotion of key messages from FBDGs. | TFNC, MoH | Guidelines developed. | Phase 1 |
| | Evaluate effectiveness of communication plan and modify if necessary according to results (pre- and post-evaluation required). | TFNC, MoH | Communication plan evaluated. | Phase 1–3 |

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| | | | | |
|---|---|---|---|---|
| | Initiate the development and implementation of a range of social marketing strategies to facilitate behavioural changes supporting healthy eating, healthy action and healthy weight. | TFNC, MoH | Social marketing plan developed and implemented. | Phase 1 |
| | Tracking survey to monitor reach, knowledge and awareness, uptake of messages, and change of behaviour. | | | |

**Table 33 Implementation Plan: Objective 8**

| Objective 8: Workforce (health and physical activity) | | | | |
|---|---|---|---|---|
| **Outcome** | **Specific actions** | **Agencies** | **Progress milestones and measures** | **Time frame / resourcing** |
| The United Republic of Tanzania has a healthy and physically active workforce with an understanding of nutrition and physical activity issues and guidelines and is able to implement effective approaches to support health gain. | Undertake needs assessment to identify training needs of healthy and physically active workforce. | TFNC, MoH | Needs assessment completed and existing training opportunities identified. Database of workforce training opportunities developed and distributed. | Phase 1 |
| | Work with tertiary institutions to include nutrition and physical activity in relevant health training curricula, e.g., medical, nursing. Include physical activity components within nutrition training and nutrition components within physical activity training. | TFNC, MoH, Education sector | Consideration given to nutrition and physical activity training being included in relevant curricula. | Phase 3 |
| | Increase support of existing evaluated community training programmes that provide nutrition and physical activity training and support to community workers working with high-need groups. | TFNC, MoH, NGOs | Number and coverage of training programmes supported. | Phase 2 |

# APPENDICES

## **APPENDIX 1:** TECHNICAL RECOMMENDATIONS SELECTED TO GUIDE FORMULATION OF MESSAGES

| No. | Technical Recommendation to Solve the Problem |
|---|---|
| 1 | Increase food diversity / Increase consumption of varieties of foods / Increase consumption of varieties of locally available foods |
| 2 | Reduce intake of high processed foods / Limit consumption of high fat, salty and sugary convenience foods |
| 3 | Increase physical activity / Maintain normal weight |
| 4 | Increase intake of fruits and vegetables / Increase intake of fruits vegetables and fibres / Increase consumption of fruits and vegetables (fresh and dried) / Eat whole fruit instead of fruit juice |
| 5 | Practising good food hygiene and sanitation during food preparation / Use safe food handling and sanitation practices (clean and safe water) / Wash hands properly using soap/ash at all critical times (before and after meals, before meal preparations, after use of latrines, after cleaning/changing diaper) / Wash hands using running water / Separate cooked and uncooked foods |
| 6 | Improve methods of cooking to preserve micronutrients / Use cooking methods that preserve nutrients / Use appropriate cooking time for vegetables and other foods |
| 7 | Increase consumption of meat by children / Give diversified complementary food after 6 months up to 23 months |
| 8 | Pack healthy food for school children / Prepare healthy school meals (school feeding programmes) |

## **APPENDIX 2:** NUTRIENT REQUIREMENTS FOR PREGNANT, LACTATING AND NON-PREGNANT, NON-LACTATING WOMEN (18–49 YEARS)

| | | Recommended intake per day | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Nutrients** | | **19-50 years (not pregnant)** | **PREGNANT** | | | **LACTATING** | | |
| | | | **1st trimester** | **2nd trimester** | **3rd trimester** | **0-3 months** | **4-6 months** | **7-12 months** |
| **Energy (kcal/day)** | | 2300 | - | 2660 | 2775 | 2805 | 2805 | 2760 |
| **Protein (g/day)** | | 41 | 66 | | | 61 | | |
| **Vitamin A (ug RE/day)** | | 270 | 370 + s** | | | 450 + s* | | 450 |
| **Iron (mg/day)** | **15% bio-availability** | 20 | n, s, d | | | 10 | | |
| | **12% bio-availability** | 25 | n, s, d | | | 12 | | |
| | **10% bio-availability** | 29 | n, s, d | | | 15 | | |
| | **5% bio-availability** | 59 | n, s, d | | | 30 | | |
| **Folate (µg/day)** | | 400 | 600 + s*** | | | 500 | | |
| **Zinc (mg/day)** | **High bio-availability** | 3 | 3.4 | 4.2 | 6 | 5.8 | 5.3 | 4.3 |
| | **Moderate bio-availability** | 4.9 | 5.5 | 7 | 10 | 9.5 | 8.8 | 7.2 |
| | **Low availability** | 9.8 | 11 | 14 | 20 | 19 | 17.5 | 14.4 |
| **Selenium (µg/day)** | | 26 | 26 | 28 | 30 | 35 | 35 | 42 |
| **Calcium (mg/day)** | | 1000 | 1000 | 1000 | 1200 | 1000 | | |
| **Vitamin C (mg/day)** | | 45 | 55 | | | 70 | | |
| **Magnesium (mg/day)** | | 220 | 220 | | | 270 | | |
| **Iodine (µg/day)** | | 150 | 200 | | | 200 | | |
| **Thiamine (mg/day)** | | 1.1 | 1.4 | | | 1.5 | | |
| **Riboflavin (mg/day)** | | 1.1 | 1.4 | | | 1.6 | | |
| **Niacin (mg NE/day)** | | 14 | 18 | | | 17 | | |

*Continued on page 199*

| | | | |
|---|---|---|---|
| **Vitamin B6** | 1.3 | 1.9 | 2.0 |
| n: No figures are given for dietary iron requirements in pregnant women because the iron balance in pregnancy depends not only on the properties of the diet but also on the amounts of stored iron. | | | |
| s: The increased iron requirement cannot be obtained from the diet and thus daily supplemental iron and folic is recommended during pregnancy and for at least three months after delivery (WHO, 2012b). | | | |
| s**: Pregnant women should take Vitamin A supplementation in addition to diet. | | | |
| s*: A single dose of 200,000 IU should be taken no later than eight weeks after delivery in addition to diet. | | | |
| s*** Pregnant women take daily oral folic acid supplementation and, where possible, women should take folic acid supplements before conception. | | | |
| Energy and all other nutrients listed above can be met by eating a variety of foods. | | | |
| NB: Calcium: No calcium levels for first and second trimester given, hence pre-pregnancy levels are assumed.<br>NB: Selenium: No selenium levels for first trimester given, hence pre-pregnancy levels are assumed. | | | |
| Sources: FAO and WHO, 2004; FAO, WHO and UNU, 2001; FAO, WHO and UNU, 2007 | | | |

# REFERENCES


1. Abate, A., Cavagnetto, D., Fama, A., Maspero, C. & Farronato, G. 2020. Relationship between breastfeeding and malocclusion: a systematic review of the literature. *Nutrients*, 12 (3688): 1–15.

2. Abete, I., Romaguera, D., Vieira, A.R., Lopez de Munain, A., Norat, T. 2014. Association between total, processed, red and white meat consumption and all-cause, CVD and IHD mortality: a meta-analysis of cohort studies. *British Journal of Nutrition*, 14; 112(5): 762–75.

3. Addila, A.E., Azale, T., Gete, Y.K., Yitayal, M. 2021. The effects of maternal alcohol consumption during pregnancy on adverse fetal outcomes among pregnant women attending antenatal care at public health facilities in Gondar town, Northwest Ethiopia: A prospective cohort study. *Substance Abuse, Treatment, Prevention and Policy,* 16: **(**64)14.

4. Adjepong, M., Yakaha, W., Harris, W.S., Annan R.A., Pontifex, M.B., Fenton, J.I. 2018. Whole blood n-3 fatty acids are associated with executive function in 2–6-year-old Northern Ghanaian children. *Journal of Nutritional Biochemistry,* 57: 287–293.

5. Adolphus, K., Lawton, C.L. & Dye, L. 2013. The effects of breakfast on behavior and academic performance in children and adolescents. *Frontiers in Human Neuroscience*, 7, 425.

6. Agarwal, M., Ghousia, S., Konde, S. & Raj, S. 2012. Breastfeeding: nature's safety net. *International Journal of Clinical Pediatric Dentistry,* 5(1): 49–53.

7. Alexander, D.D., Miller, P.E., Vargas, A.J., Weed, D.L. & Cohen, S.S. 2016. Meta-analysis of egg consumption and risk of coronary heart disease and stroke. *Journal of the American College of Nutrition*, 35:8, 704–716.

8. Alwan, N.A., Cade, J.E., McArdle, H.J., Greenwood, D.C., Hayes, H.E. & Simpson, N.A. 2015. Maternal iron status in early pregnancy and birth outcomes: insights from the Baby's Vascular Health and Iron in Pregnancy study. *British Journal of Nutrition,* 113(12):1985–1992.

9. American Cancer Society. 2020. *Health risks of smoking tobacco*. Cited 3 September 2022. www.cancer.org/healthy/stay-away-from-tobacco/health-risks-of-tobacco/health-risks-of-smoking-tobacco.html

10. Anitha, S., Muzanila, Y., Tsusaka, T.W., Kachulu, L., Kumwenda, N., Musoke, M., Swai, E., Shija, J., Siambi, M., Monyo, E.S., Bekunda, M. & Okori, P. 2020. Reducing child undernutrition through dietary diversification, reduced aflatoxin exposure, and improved hygiene practices: the immediate impacts in central Tanzania. *Ecology of Food and Nutrition*, 59(3), 243–262.

11. ANSAF (Agriculture Non-State Actors Forum). 2017. *Agriculture Non-State Actors Forum on livestock sector development in Tanzania*. Cited 20 September 2022. https://ansaf.or.tz/wp-content/uploads/2019/07/Livestock-Strategy.pdf

12. Arimond, M. & Ruel, M.T. 2004. Dietary diversity is associated with child nutritional status: evidence from 11 demographic and health surveys. *The Journal of Nutrition,* 134(10): 2579–2585.

13. Aumeistere, L., Ciprovičа, I., Zavadska, D., Bavrins, K. & Borisova, A. 2018. Zinc content in breast milk and its association with maternal diet. *Nutrients*, 10(10): 1438. https://doi.org/10.3390/nu10101438

14. Asghari, G., Mirmiran, P., Yuzbashian, E., Azizi, F. 2017. A systematic review of diet quality indices in relation to obesity. *British Journal of Nutrition,* 117(8):1055–1065.

15. Ayalew, A., Kimanya, M., Matumba, L., Bandyopadhyay, R., Menkir, A., & Cotty, P.J. 2017. Controlling aflatoxins in maize in Africa: strategies, challenges and opportunities for improvement. In: *Burleigh Dodds Series in Agricultural Science*, pp. 371–394. Burleigh Dodds Science Publishing. https://doi.org/10.19103/as.2016.0002.23

16. Azevedo, L.D.S., de Souza, A.P.L., Ferreira, I.M.S., Lima, D.W.D.C., Pessa, R.P. 2021. Binge eating and alcohol consumption: an integrative review. *Eating and Weight Disorders,* 26(3):759–769.

17. Bahreynian, M., Saleki, M. & Kelishadi, R. 2017. Macro- and micronutrients of human milk composition: are they related to maternal diet? A comprehensive systematic review. *Breastfeeding Medicine*, 12(9): 517–527. https://doi.org/10.1089/bfm.2017.0048

18. Ballard, O. & Morrow, A.L. 2013. Human milk composition: nutrients and bioactive factors. *Pediatric Clinics of North America*, 60(1): 49–74.

19. Becker, D.V., Braverman, L.E., Delange, F., Dunn, J.T., Franklyn, J.A., Hollowell, J.G., *et al*. 2006. Iodine supplementation for pregnancy and lactation – United States and Canada: recommendations of the American Thyroid Association. *Thyroid*, 16(10):949–51.

20. Bernardi, S., Toffoli, B., Zennaro, C., Tikellis, C., Monticone, S., Losurdo, P., Bellini, G., Thomas, M.C., Fallo, F., Veglio, F., Johnston, C.I. & Fabris, B. 2012. High-salt diet increases glomerular ACE/ACE2 ratio leading to oxidative stress and kidney damage. *Nephrology Dialysis Transplantation*, 27(5), 1793–1800.

21. Bhardwaj, S., Passi, S.J., Misra, A., Pant, K.K., Anwar, K., Pandey, R.M. & Kardam, V. 2016. Effect of heating/reheating of fats/oils, as used by Asian Indians, on trans fatty acid formation. *Food Chemistry*, 212: 663–670.

22. Bishehsari, F., Magno, E., Swanson, G., Desai, V., Voigt, R.M., Forsyth, C.B., & Keshavarzian, A. 2017. Alcohol and gut-derived inflammation. *Alcohol Research: Current Reviews*. 38(2): 163–171.

23. Boskou G., Salta F.N., Chiou A., Troullidou E., Andrikopoulos, N.K. 2006. Content of trans,trans-2,4-decadienal in deep-fried and pan-fried potatoes. *European Journal of Lipid Science and Technology,*108:109–115. doi: 10.1002/ejlt.200500236x

24. Brownell, K.D. & Gold, M.S. 2012. *Food and addiction*. New York, Oxford University Press.

25. Bukkens, S.G.F. 1997. The nutritional value of edible insects. *Ecology of Food and Nutrition*, 36:2-4, 287-319. doi: 10.1080/03670244.1997.9991521

26. Cahill, L.E., Pan, A., Chiuve, S.E., Sun, Q., Willett, W.C., Hu, F.B., Rimm, E.B. 2014. Fried-food consumption and risk of type 2 diabetes and coronary artery disease: a prospective study in 2 cohorts of US women and men. *American Journal of Clinical Nutrition*, 100(2):667–675. doi:10.3945/ajcn.114.084129

27. Cao, S., Yang, C., Gan, Y. & Lu, Z. 2015. The health effects of passive smoking: an overview of systematic reviews based on observational epidemiological evidence. *PloS One*, 10(10), e0139907.

28. CDC (Centers for Disease Control and Prevention). 2020. *Health effects of cigarette smoking*. Cited 3 September 2022. www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/index.htm

29. Chaffee B.W., King J.C. 2012. Effect of zinc supplementation on pregnancy and infant outcomes: a systematic review. *Paediatric and Perinatal Epidemiology*, Suppl 1(0 1):118–37.

30. Chen, X., Zhang, Z., Yang, H., Qiu, P., Wang, H., Wang, F., Zhao, Q., Fang, J. & Nie, J. 2020. Consumption of ultra-processed foods and health outcomes: a systematic review of epidemiological studies. *Nutrition Journal,* 19(1): 86.

31. Choe, E. & Min, D.B. Chemistry of deep-fat frying oils. 2007. *Journal of Food Science*, 72: R77–86. https://doi.org/10.1111/j.1750-3841.2007.00352.x

32. Chowdhury, R., Sinha, B., Sankar, M.J., Taneja, S., Bhandari, N., Rollins, N., Bahl, R. & Martines, J. 2015, Breastfeeding and maternal health outcomes: a systematic review and meta-analysis. *Acta Paediatrica*, 104: 96–113.

33. Clifton, P. & Keogh, J. 2017. A systematic review of the effect of dietary saturated and polyunsaturated fat on heart disease. Nutrtion, Metabolism & Cardiovascular Diseases, 27(12):1060–1080.

34. Cochrane, N. & D'Souza, A. 2015. *Measuring access to food in Tanzania: a food basket approach*. EIB-135, U.S. Department of Agriculture, Economic Research Service.

35. Czeizel, A.E., Dudás, I., Vereczkey, A., & Bánhidy, F. 2013. Folate deficiency and folic acid supplementation: the prevention of neural-tube defects and congenital heart defects. *Nutrients*. 21;5(11):4760–75.

36. De Aguiar, A. 2013. Alcohol: effects on nutritional status, lipid profile and blood pressure. *Journal of Endocrinology and Metabolism*. 2:205–211.

37. De la Hunty, A., Gibson, S., Ashwell, M. 2013. Does regular breakfast cereal consumption help children and adolescents stay slimmer? A systematic review and meta-analysis. *Obesity Facts,* 6(1):70–85.

38. De Vries, Y.J., Pundir, S., Mckenzie, E., Keijer, J. & Kussmann, M. 2018. Maternal circulating vitamin status and colostrum vitamin composition in healthy lactating women: a systematic approach. *Nutrients*, 10(6): 687.

39. Deem, H.E. 1931. Observations on the milk of New Zealand women. *Archives of Disease in Childhood*, 6(31): 53–70.

40. Deen, A., Visvanathan, R., Wickramarachchi, D., Marikkar, N., Nammi, S., Jayawardana, BC., Liyanage, R. 2021. Chemical composition and health benefits of coconut oil: an overview. *Journal of the Science of Food and Agriculture*, *101*(6), 2182–2193.

41. Dewey, K.G. 1997. Energy and protein requirements during lactation. *Annual Review of Technology,* 17:19–36.

42. Diaz, K.M. & Shimbo, D. 2013. Physical activity and the prevention of hypertension. *Current Hypertension Reports*, 5(6):659-68. doi: 10.1007/s11906-013-0386-8

43. Dominik, D., Alexander, P.E., Miller, A.J., Vargas, D.L. & Cohen, S.S. 2016. Meta-analysis of egg consumption and risk of coronary heart disease and stroke. *Journal of the American College of Nutrition*, 35:8, 704–716.

44. Duley, L. 2009. The global impact of pre-eclampsia and eclampsia. *Seminars in Perinatology*. 33(3):130–7.

45. Dumrongwongsiri, O., Winichagoon, P., Chongviriyaphan, N., Suthutvoravut, U., Grote, V. & Koletzko, B. 2022. Zinc and iron adequacy and relative importance of zinc/iron storage and intakes among breastfed infants. *Maternal & Child Nutrition*, 18(1), e13268. https://doi.org/10.1111/mcn.13268

46. EduChange. 2018. *Food, nutrition & fitness 1: the digestion journey begins with food choices.* Classfication reference sheet prepared with guidance from NUPENS, Sao Paulo. Cited 15 September 2022. https://educhange.com/wp-content/uploads/2018/09/NOVA-Classification-Reference-Sheet.pdf.

47. El-Hajj Fuleihan, G., Bouillon, R., Clarke, B., Chakhtoura, M., Cooper, C., McClung, M., & Singh, R.J. 2015. Serum 25-hydroxyvitamin D levels: variability, knowledge gaps, and the concept of a desirable range. *Journal of Bone and Mineral research*, *30*(7), 1119–1133.

48. Eyres, L., Eyres, M.F., Chisholm, A., Brown, R.C. 2016. Coconut oil consumption and cardiovascular risk factors in humans. *Nutrition Reviews,* 74:(4): 267–280.

49. Fall, C.H. 2013. Fetal programming and the risk of noncommunicable disease. *Indian journal of pediatrics*. 80 Suppl 1(0 1):S13-S20.

50. Fanzo, J. 2013. *The nutrition challenge in Sub-Saharan Africa.* UNDP Working Paper 2012–012, January 2012. New York, UNDP Regional Bureau for Africa. Cited 14 September 2022. www.africa.undp.org/content/rba/en/home/library/working-papers/nutrition-challenge.html

51. FAO (Food and Agriculture Organization of the United Nations). 1994. *Definition and classification of commodities.* Chapter 3: Sugar crops and sweeteners and derived products. Rome. Cited 9 December 2021. https://www.fao.org/es/faodef/fdef03e.htm

52. FAO. 1998. *Carbohydrates in human nutrition: Report of a joint FAO/WHO expert consultation*. Paper No. 66. Rome, FAO.

53. FAO. 2004a. *Family nutrition guide*. Rome. Cited 3 September 2022. www.fao.org/3/y5740e/y5740e.pdf

54. FAO. 2004b. *Human energy requirements: report of a joint FAO/ WHO/UNU Expert Consultation*. Food And Nutrition Technical Report Series 1. Cited 3 September 2022. www.fao.org/3/y5686e/y5686e.pdf

55. FAO. 2004c. *Worldwide regulations for mycotoxins in food and feed in 2003*. Rome. Cited 3 September 2022. www.fao.org/3/y5499e/y5499e00.htm

56. FAO. 2007. *Improving the nutritional quality of street foods to better meet the micronutrient needs of schoolchildren in urban areas*. Rome.

57. FAO. 2010a. *Fats and fatty acids in human nutrition: report of an expert consultation*. FAO Food and Nutrition Paper 91. Rome.

58. FAO. 2010b. *Science for safe food: FAO's strategy for the prevision of scientific advice for food safety 2010–2013*. Cited 22 September 2022. www.fao.org/3/i1677e/i1677e.pdf

59. FAO. 2017. *Do good: save food! Nine easy tips to reduce food waste*. Global Initiative on Food Loss and Waste Reduction. Rome. Cited 3 September 2022. www.fao.org/3/i7059e/i7059e.pdf

60. FAO. 2019. *FAO/INFOODS Food Composition Table for Western Africa. 2019: User Guide & Condensed Food Composition Table*. Rome. Cited 5 September 2022. www.fao.org/3/ca7779b/CA7779B.PDF

61. FAO & WHO. 1998. *Preparation and use of food-based dietary guidelines: report of a joint FAO/WHO consultation*. WHO Technical Report Series No. 880. Geneva, World Health Organization. Cited 3 September 2022. https://apps.who.int/iris/handle/10665/42051

62. FAO & WHO. 2004. *Vitamin and mineral requirements in human nutrition, second edition*: *report of a joint FAO/WHO expert consultation, Bangkok, Thailand, 21–30 September 1998*, p. 362. Geneva, World Health Organization. Cited 3 September 2022. https://apps.who.

int/iris/bitstream/handle/10665/42716/9241546123.pdf

63. FAO & WHO. 2010. *Interim summary of conclusions and dietary recommendations on total fat & fatty acids*. From the Joint FAO/WHO Expert Consultation on Fats and Fatty Acids.

64. FAO & WHO. 2021. World food safety day: Safe food now for a healthy tomorrow. In: *World Health Organization*. Cited 20 September 2022. www.who.int/campaigns/world-food-safety-day/2021

65. FAO & WHO. 2022. *Codex alimentarius: food additive functional classes*. Cited 15 September 2022. www.fao.org/gsfaonline/reference/techfuncs.html

66. FAO, WHO & UNU (United Nations University). 1981. *Joint FAO/WHO/UNU expert consultation on energy and protein requirements: diet and the pregnant and lactating woman*. Information Paper No. 4. Rome, FAO. Cited 4 September 2022. www.fao.org/3/M2998E/M2998E00.htm

67. FAO, WHO & UNU. 2001. *Human energy requirements: report of a joint FAO/WHO/UNU expert consultation, 17–24 October, 2001,* p. 103. Rome, FAO. Cited 3 September 2022. www.fao.org/3/y5686e/y5686e.pdf

68. FAO, WHO & UNU. 2007. *Protein and amino acid requirements in human nutrition: report of a joint FAO/WHO/UNU expert consultation*. WHO Technical Report Series: 935. Geneva, World Health Organization. Cited 3 September 2022. https://apps.who.int/iris/handle/10665/43411

69. Ferrence, R. 2010. Passive smoking and children. *BMJ*, 340:c1680. doi:10.1136/bmj.c1680

70. Ferreira-Borges, C., Parry, C.D.H. & Babor, T.F. 2017. Harmful use of alcohol: a shadow over Sub-Saharan Africa in need of workable solutions. *International Journal of Environmental Research and Public Health*, 14(4): 346.

71. Galasso, E., & Wagstaff, A. 2018. *The aggregate income losses from childhood stunting and the returns to a nutrition intervention aimed at reducing stunting.* Policy Research Working Paper No. 8536. Washington, DC, World Bank. Cited 3 September 2022. https://openknowledge.worldbank.org/handle/10986/30108

72. Gannon, B.M., Jones, C., & Mehta, S. 2020. Vitamin A requirements in pregnancy and lactation. *Current Developments in Nutrition*, 4(10), nzaa142. Cited 4 September 2022. https://doi.org/10.1093/cdn/nzaa142

73. GBD (Global Burden of Disease). 2017. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet,* 390: 1345–422. https://doi.org/10.1016/S0140-6736(17)32366-8

74. GBD. 2019. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet,* 393(10184): 1958–1972. https://doi.org/10.1016/S0140-6736(19)30041-8

75. Gernand A.D., Schulze, K.J., Stewart, C.P., West, K.P. & Christian, P. 2016. Micronutrient deficiencies in pregnancy worldwide: health effects and prevention. *Nature Reviews Endocrinology*, 12(5):274–89.

76. Ghamarzad Shishavan, N., Masoudi, S., Mohamadkhani, A., Sepanlou, S.G., Sharafkhah, M., Poustchi, H., Mohamadnejad, M., Hekmatdoost, A., Pourshams, A. 2021. Dietary intake of fatty acids and risk of pancreatic cancer: Golestan cohort study. *Nutrition Journal,* 20(69).

77. Ghamrawy, M. 2019. *Say no to food waste. A guide to reduce household food waste –Trainers Guide*. Cairo, FAO

78. Gibney, M.J. 2019. Ultra-processed foods: definitions and policy issues. *Current Developments in Nutrition,* 3(2).

79. Gil, Á., Martinez de Victoria, E., Olza, J. 2015. Indicators for the evaluation of diet quality. *Nutricion Hospitalaria,* 31 Suppl 3: 128–144.

80. Gowele, V.F., Kinabo, J., Jumbe, T., Rybak, C., Stuetz, W. 2021. High prevalence of stunting and anaemia is associated with multiple micronutrient deficiencies in school children of small-scale farmers from Chamwino and Kilosa Districts, Tanzania. *Nutrients*. 13(5):1576.

81. Greiner T. 1994. Maternal protein-energy malnutrition and breastfeeding. *Sub-Committee on Nutrition News*, (11): 28–30.

82. Gutierrez-Mazariegos, J., Theodosiou, M., Campo-Paysaa, F., and Schubert, M. 2011. Vitamin A: a multifunctional tool for development. *Seminars in cell & developmental biology*, *22*(6), 603–610. https://doi.org/10.1016/j.semcdb.2011.06.001

83. Hahn, S., Jumbe, T., Harris, W., Kinabo, J. & Fenton, J. 2015. Association of blood fatty acids and growth in Tanzanian children 2–6 years of age. *The Federation of American Societies for Experimental Biology,* 39(Suppl. 1).

84. Hailu, S., Wubshet, M., Woldie, H. & Tariku, A. 2016. Iodine deficiency and associated factors among school children: a cross-sectional study in Ethiopia. *Archives of Public Health*, 74, 46. https://doi.org/10.1186/s13690-016-0158-4

85. Hamajima, N., Hirose, K., Tajima, K., Rohan, T., Calle, E.E., Heath, C.W., Coates, R.J., Liff, J.M., Talamini, R., Chantarakul, N., *et al*. 2002. Alcohol, tobacco and breast cancer—collaborative reanalysis of individual data from 53 epidemiological studies, including 58,515 women with breast cancer and 95,067 women without the disease. *British Journal of Cancer*. 87:1234-1245.

86. Hartley L., Igbinedion E., Holmes J., Flowers N., Thorogood M., Clarke A., Stranges S., Hooper L. & Rees K. 2013. Increased consumption of fruit and vegetables for the primary prevention of cardiovascular diseases. *Cochrane Database of Systematic Reviews*, issue 6, Art. No.: CD009874.

87. Hartmann, P.E., Rattigan, S., Saint, L., & Supriyana, O. 1985. Variation in the yield and composition of human milk. *Oxford Reviews of Reproductive Biology*, 7: 118–167.

88. Heart and Stroke Foundation. 2021. What is ultra-processed food and how can you eat less of it. In: *The Heart and Stroke Foundation* [online]. Ottawa. Cited 15 July 2021. www.heartandstroke.ca/articles/what-is-ultra-processed-food

89. Hendriksen, M.A., Hoogenveen, R.T., Hoekstra, J., Geleijnse, J.M., Boshuizen, H.C., and van Raaij, J.M. 2014. Potential effect of salt reduction in processed foods on health. The *American Journal of Clinical Nutrition*, 99(3), 446–453.

90. Hlongwane, Z.T., Slotow, R. & Munyai, T.C. 2020. Nutritional composition of edible insects consumed in Africa: a systematic review. *Nutrients*,12(9): 2786. doi: 10.3390/nu12092786. PMID: 32933038; PMCID: PMC7551454

91. Honerlaw, J.P., Ho, Y.L., Nguyen, X.T., Cho, K., Vassy, J.L., Gagnon, D.R., O'Donnell, C.J., Gaziano, J.M., Wilson, P.W.F., Djousse, L. 2020. Fried food consumption and risk of coronary artery disease: the Million Veteran Program. *Clinical Nutrition*, 39(4):1203–1208. doi:10.1016/j.clnu.2019.05.008

92. Hooper, L., Abdelhamid, A., Bunn, D., Brown, T., Summerbell, CD., and Skeaff, CM. 2015. Effects of total fat intake on body weight. *The Cochrane database of Systematic Reviews*, 8, CD011834.

93. Hoppu U, Rinne M, Salo-Väänänen P, Lampi AM, Piironen V, Isolauri E. Vitamin C in breast milk may reduce the risk of atopy in the infant. *Eur J Clin Nutr*. 2005 Jan;59(1):123-8. doi: 10.1038/sj.ejcn.1602048. PMID: 15340369.

94. Horta, B.L., De Mola, L.C. & Victoria, C.G. (2015a). Breastfeeding and intelligence: a systematic review and meta-analysis. *Acta Paediatrica*. 104(467):14–19.

95. Horta, B.L., De Mola, C. & Victoria, C.G. 2015b. Long-term consequences of breastfeeding on cholesterol, obesity, systolic blood pressure and type 2 diabetes: a systematic review and meta-analysis. *Acta Paediatr*. 104:30-37. https://doi.org/10.1111/apa.13133

96. Hosseini, B., Berthon, B.S., Saedisomeolia, A., Starkey, M.R., Collison, A., Wark, P.A.B., Wood, L.G. 2018. Effects of fruit and vegetable consumption on inflammatory biomarkers and immune cell populations: a systematic literature review and meta-analysis. *American Journal of Clinical Nutrition*, 1;108(1):136–155.

97. Howarth, C., Gleeson, P., & Attwell, D. 2012. Updated energy budgets for neural computation in the neocortex and cerebellum. *Journal of Cerebral Blood Flow and Metabolism*, 32(7): 1222–1232.

98. Hu, F.B. & Malik, V.S. 2010. Sugar-sweetened beverages and risk of obesity and type 2 diabetes: epidemiologic evidence. *Physiology & Behaviour*. 100(1):47–54.

99. Huang, L., Wang, Y., Zhang, L., Zheng, Z., Zhu, T., Qu, Y., & Mu, D. (2018). Maternal smoking and attention-deficit/hyperactivity disorder in offspring: A Meta-analysis. *Pediatrics*, *141*(1), e20172465.

100. Iannotti, L.L., Lutter, C.K., Stewart, C.P., Gallegos Riofrío, C.A., Malo, C., Reinhart, G., Palacios, A., Karp, C., Chapnick, M., Cox, K., Waters, W.F. 2017. Eggs in early complementary feeding and child growth: a randomized controlled trial. *Pediatrics*, 140(1): e20163459.

101. Illingworth, P.J., Jung, R.T., Howie, P.W., Leslie, P. & Isles, T.E. 1986. Diminution in energy expenditure during lactation. *BMJ* (Clinical research ed.), 292(6518): 437–441.

102. Imdad A., Herzer K., Mayo-Wilson E., Yakoob M.Y., & Bhutta Z.A. 2010. Vitamin A supplementation for preventing morbidity and mortality in children from 6 months to 5 years of age. *Cochrane Database Syst Rev*. 8;(12):CD008524.

103. Institute of Medicine (US) Committee on Nutritional Status During Pregnancy and Lactation. 1990. Energy requirements, energy intake, and associated weight gain during pregnancy. In: *Nutrition During Pregnancy: Part I Weight Gain: Part II Nutrient Supplements*, pp. 137–175. Washington, DC, National Academies Press. Cited 3 September 2022. www.ncbi.nlm.nih.gov/books/NBK235247

104. Intiful, F.D. and Lartey, A. 2014. Breakfast habits among school children in selected communities in the eastern region of Ghana. *Ghana Medical Journal*. 48(2):71–77.

105. Iranpour, A., and Nakhaee, N. 2019. A review of alcohol-related harms: a recent update. *Addiction & Health.* 11(2):129–137.

106. Islam, M.A., Amin, M.N., Siddiqui, S.A., Hossain, M.P., Sultana, F., Kabir, M.R. 2019. Trans fatty acids and lipid profile: a serious risk factor to cardiovascular disease, cancer and diabetes. *Diabetes and Metabolic Syndrome,* 13(2):1643–1647.

107. Jackson, K. & Nazar, A. 2006. Breastfeeding, the immune response, and long-term health. *Journal of Osteopathic Medicine,* 106(4): 203–207.

108. Jáuregui-Lobera, I. 2014. Iron deficiency and cognitive functions. *Neuropsychiatric Disease and Treatment*, 10:2087–95.

109. Jéquier, E. & Constant, F. 2010. Water as an essential nutrient: the physiological basis of hydration. *European Journal of Clinical Nutrition*, 64, 115–123. https://doi.org/10.1038/ejcn.2009.111https://www.nature.com/articles/ejcn2009111

110. Jouanne, M., Oddoux, S., Noël, A., Voisin-Chiret, A.S. 2021. Nutrient requirements during pregnancy and lactation. *Nutrients*, 13(2): 692.

111. Jumbe, T., Comstock, S.S., Hahn, S. L., Harris, W.S., Kinabo, J. & Fenton, J.I. 2016. Whole blood levels of the n-6 essential fatty acid linoleic acid are inversely associated with stunting in 2-to-6 year old Tanzanian children: a cross-sectional study. *PloS ONE*. 11(5):537–1545.

112. Kamala, A., Shirima, C., Jani, B., Bakari, M., Sillo, H., Rusibamayila, N. & Simba, A. 2018. Outbreak of an acute aflatoxicosis in Tanzania during 2016. *World Mycotoxin Journal*, 11(3), 311–320.

113. Karimi, M. 2019. The effects of breastfeeding on the process of tooth and jaw's development. *Interventions in Pediatric Dentistry Open Access Journal,* 3(3): 236–237.

114. Keding, G.B., Msuya, J.M., Maass, B.L., Krawinkel, M.B. 2011. Dietary patterns and nutritional health of women: the nutrition transition in rural Tanzania. *Food and Nutrition Bulletin,* 32(3):218–26.

115. Keding, G.B., Msuya, J.M., Maass, B.L. & Krawinkel, M.B. 2013. Obesity as a public health problem among adult women in rural Tanzania. *Global Health: Science and Practice*. 1(3):359-371.

116. Kefiyalew, F., Zemene, E., Asres, Y., Gedefaw, L. 2014. Anemia among pregnant women in Southeast Ethiopia: prevalence, severity and associated risk factors. *BMC Research Notes*. 7(1):771.

117. Khamis, A.G., Mwanri, A.W., Kreppel, K. & Kwesigabo, G. 2020. The burden and correlates of childhood undernutrition in Tanzania according to composite index of anthropometric failure. *BMC Nutrition,* 6(39).

118. Kihupi, C.S.M., Yohana, L., Saria, J.A. & Malebo, H.M. 2016. Fecal contamination of drinking-water in Tanzania's commercial capital, Dar es Salaam: implication on health of the consumers. *SM Journal of Public Health & Epidemiology,* 2(1):1025.

119. Kimanya, M.E., De Meulenaer, B., Tiisekwa, B., Ndomondo-Sigonda, M., & Kolsteren, P. 2008. Human exposure to fumonisins from home grown maize in Tanzania. *World Mycotoxin Journal*, 1(3): 307-313. https://doi.org/10.3920/WMJ2008.x032

120. Kimanya, M.E., Routledge, M.N., Mpolya, E., Ezekiel, C.N., Shirima, C.P. & Gong, Y.Y. 2021. Estimating the risk of aflatoxin-induced liver cancer in Tanzania based on biomarker data. *PLoS ONE,* 16(3): e0247281.

121. Kinabo, J., Mamiro, P., Dawkins, N., Bundala, N., Mwanri, A., Majili, Z., Jumbe, T., Kulwa, K., Mamiro, D., Amuri, N., Ngowi, M., Msuya, J. 2016. Food intake and dietary diversity of farming households in Morogoro region, Tanzania. *African Journal of Food, Agriculture, Nutrition and Development,* 16 (4):11295–11309.

122. Kjøllesdal, M., Htet, A.S., Stigum, H., Hla, N.Y., Hlaing, H.H., Khaine, E.K., Khaing, W., Khant, A.K., Khin, N.O., Mauk, K.K., *et al*. 2016. Consumption of fruits and vegetables and associations with risk factors for non-communicable diseases in the Yangon region of Myanmar: a cross-sectional study. *BMJ Open*, 26;6(8):e011649.

123. Kramer, M.S. & Kakuma, R. 2012. Optimal duration of exclusive breastfeeding. *Cochrane Database of Systematic Reviews*. Issue 8. Art. No.: CD003517.

124. Krasevec, J., An, X., Kumapley, R., Begin, F. & Frongillo, E. 2017. Diet quality and risk of stunting among infants and young children in low- and middle-income countries. *Maternal & Child Nutrition,* 13. e12430.

125. Kulwa, K.B.M., Mamiro, P.S., Kimanya, M.E., Mziray, R. & Kolsteren, P.W. 2015. Feeding practices and nutrient content of complementary meals in rural central Tanzania: implications for dietary adequacy and nutritional status. *BMC Pediatrics,* 15, article 171. https://doi.org/10.1186/s12887-015-0489-2

126. Kunzmann, A.T., Coleman, H.G., Huang, W., Kitahara, C.M., Cantwell, M.M. & Berndt, S.I. 2015. Dietary fiber intake and risk of colorectal cancer and incident and recurrent adenoma in the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial. *The American Journal of Clinical Nutrition,* Volume 102(4): 881–890. https://doi.org/10.3945/ajcn.115.113282

127. Kwok, A., Dordevic, A., Paton, G., Page, M., & Truby, H. 2019. Effect of alcohol consumption on food energy intake: a systematic review and meta-analysis. *British Journal of Nutrition*, 121(5):481–495.

128. Lee, I.M., Shiroma, E.J., Lobelo, F., Puska, P., Blair, S.N., Katzmarzyk, P.T. & Lancet Physical Activity Series Working Group. 2012. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet*, 380(9838): 219–229.

129. Lodge, C.J., Tan, D.J., Lau, M.X., Dai, X., Tham, R., Lowe, A.J., Bowatte, G., Allen, K.J., Dharmage, S.C. 2015. Breastfeeding and asthma and allergies: a systematic review and meta-analysis. *Acta Paediatrica*, 104(467):38-53. doi: 10.1111/apa.13132. PMID: 26192405.

130. Lukmanji, Z., Hertzmark, E., Mlingi, N., Assey, V., Ndossi G., Fawzi W. 2008. *Tanzania food composition tables*. Dar es Salaam Tanzania, MUHAS, TFNC, HSPH.

131. Lukwago, F.B., Ivan, M., Mukisa, A.A., Archileo, N., Kaaya, A.N. & Tumwebaze, S. 2019. Mycotoxins contamination in foods consumed in Uganda: a 12-year review (2006–2018). *Scientific African,* Volume 3, e00054.

132. Lyana A.Z. & Manimbulu, N. 2014. Culture and food habits in Tanzania and Democratic Republic of Congo. *Journal of Human Ecology*, 48(1): 9–21.

133. Lykstad J. & Sharma S. 2022. *Biochemistry, water soluble vitamins*. Treasure Island, Florida, StatPearls Publishing.

134. Maddatu, J., Anderson-Baucum, E., & Evans-Molina, C. 2017. Smoking and the risk of type 2 diabetes. *Translational Research: The Journal of Laboratory and Clinical Medicine*. 184:101-107. https://doi.org/10.1016/j.trsl.2017.02.004

135. Malik, V.S. & Hu, F.B. 2019. Sugar-sweetened beverages and cardiometabolic health: an update of the evidence. *Nutrients*, 11(8): 1840. https://doi.org/10.3390/nu11081840

136. Mann, J., Cummings, J.H., Englyst, H.N., Key, T., Liu, S., Riccardi, G., Summerbell, C., Uauy, R., Van Dam, R.M., Venn, B., Vorster, H.H. & Wiseman, M. 2007. FAO/WHO scientific update on carbohydrates in human nutrition: conclusions. *European Journal of Clinical Nutrition*, 61(S1): S132–S137.

137. Marino, D.D. 2007. Perspectives in practice water and food safety in the developing world. *Journal of the American Dietetic Association*, 107(11): 1930–1934.

138. Marventano, S., Izquierdo Pulido, M., Sánchez-González, C., Godos, J., Speciani, A.,

Galvano, F., Grosso, G. 2017. Legume consumption and CVD risk: a systematic review and meta-analysis. *Public Health Nutrition*, 20(2):245–254.

139. Massomo, S. 2020. Aspergillus flavus and aflatoxin contamination in the maize value chain and what needs to be done in Tanzania. *Scientific African*, volume 10.

140. Mayige, M. and Kagaruki, G. 2013. *Tanzania STEPS survey report*. Dar es Salaam, Tanzania, National Institute of Medical Research.

141. Mayor, S. 2019. Eating more fibre linked to reduced risk of non-communicable diseases and death, review finds. *BMJ*. 364: l159.

142. McKeown, N.M., Meigs, J.B., Liu, S., Saltzman, E., Wilson, P.W. & Jacques, P.F. 2004. Carbohydrate nutrition, insulin resistance, and the prevalence of the metabolic syndrome in the Framingham Offspring Cohort. *Diabetes Care*. 27(2):538-46.

143. Mdoe, M.B., Kibusi, S.M., Munyogwa, M.J. & Ibolinga, A.E. 2021. Prevalence and predictors of gestational diabetes mellitus among pregnant women attending antenatal clinic in Dodoma region, Tanzania: an analytical cross-sectional study. *BMJ Nutrition, Prevention & Health*. 4:e000149.

144. Mergenthaler, P., Lindauer, U., Dienel, G.A., & Meisel, A. 2013. Sugar for the brain: the role of glucose in physiological and pathological brain function. *Trends in Neurosciences*, 36(10): 587–597.

145. Mghanga, F.P., Elia, A., Maduhu, E.A. & Nyawale, H.A. 2020. Prevalence and associated factors of gestational diabetes mellitus among rural pregnant women in southern Tanzania. *Med J.* 54(2): 82-87.

146. Micha, R., Penalvo, J.L., Cudhea, F., Imamura, F., Rehm C.D., Mozaffarian, D. 2017. Association between dietary factors and mortality from heart disease, stroke, and type 2 diabetes in the United States. *JAMA*. 317(9):912–24.

147. Ministry of Agriculture. 2017. *Comprehensive Food Security and Nutrition Assessment Report.* Coordinated by the Disaster Management Department in the Prime Minister's Office and the National Food Security Division of the Ministry of Agriculture, Livestock and Fisheries, United Republic of Tanzania. Dar es Salaam, Tanzania.

148. Ministry of Finance and Planning. 2016. *National five-year development plan 2016/17–2020/21*. Dar es Salaam, Tanzania, Ministry of Finance and Planning of the United Republic of Tanzania.

149. Ministry of Finance and Planning. 2021. *National five-year development plan 2021/22–2025/26: realising competitiveness and industrialisation for human development*. Dodoma, Tanzania Ministry of Finance and Planning.

150. Mohammed, S., Munissi, J.J.E., Nyandoro, S.S. 2018. Aflatoxins in sunflower seeds and unrefined sunflower oils from Singida, Tanzania. *Food Additives & Contaminants: Part B Surveill*, 11(3):161–166.

151. MoHCDGEC (Ministry of Health, Community Development, Gender, Elderly and Children, Tanzania Mainland), MoH (Ministry of Health, Zanzibar), NBS (National Bureau of Statistics), OCGS (Office of the Chief Government Statistician) & ICF. 2016. *Tanzania demographic and health survey and malaria indicator survey (TDHS-MIS) 2015–16*. Dar es Salaam and Rockville, Maryland, USA.

152. MoHCDGEC. 2017. *Tanzania mainland global school-based student health survey (GSHS)*. Dar es Salaam, Tanzania.

153. MoHCDGEC, MoH (Ministry of Health, Zanzibar), TFNC (Tanzania Food and Nutrition Centre), NBS (National Bureau of Statistics), OCGS (Office of the Chief Government Statistician, Zanzibar) & UNICEF. 2019. *Tanzania national nutrition survey (TNNS) using SMART methodology 2018*. Dar es Salaam: MoHCDGEC, MoH, TFNC, NBS, OCGS, and UNICEF.

154. Mollay, C., Kassim, N., Stoltzfus, R. & Kimanya, M. 2020. Childhood dietary exposure of aflatoxins and fumonisins in Tanzania: a review. *Cogent Food & Agriculture*, 6. 1859047. https://doi.org/10.1080/23311932.2020.1859047

155. Monnet, A., Laleg, K., Michon, C. & Micard, V. 2019. Legume enriched cereal products: a generic approach derived from material science to predict their structuring by the process and their final properties. *Trends in Food Science & Technology,* (86): 131–143.

156. Monteiro, C.A., Cannon, G., Levy, R.B., Moubarac, J.C., Louzada, M.L., Rauber, F., Khandpur, N., Cediel, G., Neri, D., Martinez-Steele, E., Baraldi, L.G., & Jaime, P.C. 2019. Ultra-processed foods: what they are and how to identify them. *Public Health Nutrition*. 22(5):936–941.

157. Monteiro, C., Cannon, G., Levy, R., Moubarac, J., Jaime, P., Martins, A.P., Canella, D., Louzada, M. & Parra, D. 2016. NOVA: the star shines bright. *World Nutrition Journal*, 7(1–3): 23–38.

158. Monteiro, C.A., Cannon, G., Levy, R. B., Moubarac, J. C., Louzada, M. L., Rauber, F., Khandpur, N., Cediel, G., Neri, D., Martinez-Steele, E., Baraldi, L. G., & Jaime, P.C. 2019. Ultra-processed foods: what they are and how to identify them. *Public Health Nutrition*, *22*(5): 936–941.

159. Mosha, D., Paulo, H.A., Mwanyika-Sando, M., Mboya, I.B., Madzorera, I., Leyna, G.H., Msuya, S.E., Bärnighausen, T.W., Killewo, J. & Fawzi, W.W. 2021. Risk factors for overweight and obesity among women of reproductive age in Dar es Salaam, Tanzania. *BMC Nutrition*. 7:37.

160. Moss, M. 2013. *Salt, sugar, fat: how the giants hooked us*. New York, Random House Publishing Group.

161. Mozaffarian, D., Aro, A. & Willett, W.C. 2009. Health effects of trans-fatty acids: experimental and observational evidence. *European Journal of Clinical Nutrition*, 63, S5–21. doi: 10.1038/sj.ejcn.1602973.

162. Muhimbula, H., Kinabo, J. & O'Sullivan, A. 2019. Determinants of infant nutrition status in rural farming households before and after harvest. *Maternal and Child Nutrition*. 15(3): e12811.

163. Muktar, M., Roba, K.T., Mengistie, B. & Gebremichael, B. 2018. Iodine deficiency and its associated factors among primary school children in Anchar district, Eastern Ethiopia. *Pediatric Health, Medicine and Therapeutics*, 9: 89–95.

164. Nadeeshani, R, Wijayaratna, U.N., Prasadani CW, Ekanayake, S. Seneviratne, K.N., Jayathilaka, N. 2015. Comparison of the basic nutritional characteristics of the first extract and second extract of coconut milk. *International Journal of Innovative Research in Science, Engineering and Technology,* 4(10).

165. Nakavuma, J.L., Kirabo, A., Bogere, P., Margaret, M., Nabulime, A., Kaaya, B. 2020. Awareness of mycotoxins and occurrence of aflatoxins in poultry feeds and feed ingredients in selected regions of Uganda. *Food Contamination*, 7, 1.

166. National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. 2014. *The health consequences of smoking – 50 years of progress: a*

*report of the surgeon general*. Atlanta (GA): Centers for Disease Control and Prevention (US). PMID: 24455788.

167. National Research Council. 1989. *Recommended Dietary Allowances: 10th Edition*. Chapter 6, Protein and Amino Acids. Washington, DC, The National Academies Press. https://doi.org/10.17226/1349.

168. NBS (National Bureau of Statistics, Tanzania). 2020. *2018 Tanzania Global Adult Tobacco Survey Country Report*. Ministry of Health, Community Development, Gender, Elderly and Children, Dodoma; Ministry of Health, Zanzibar; National Bureau of Statistics, Dodoma; Office of Chief Government Statistician, Zanzibar. Cited 20 September 2022. www.nbs.go.tz/nbs/takwimu/tobacco/2018TanzaniaGATSReport.pdf

169. NBS and ICF Macro. 2011. *Tanzania Demographic and Health Survey 2010*. Dar es Salaam, Tanzania.

170. Neelakantan, N., Seah, J.Y.H., van Dam, R.M. 2020. The effect of coconut oil consumption on cardiovascular risk factors: a systematic review and meta-analysis of clinical trials. *Circulation*, 141(10): 803–814.

171. Neme, K. and Mohammed, A. 2017. Mycotoxin occurrence in grains and the role of postharvest management as a mitigation strategy: a review. *Food Control*, 78: 412–425.

172. Njelekela, M.A., Mpembeni, R., Muhihi, A., Mligiliche, N.L., Spiegelman, D., Hertzmark, E., Liu, E., Finkelstein, J.L., Fawzi, W.W., Willett, W.C. & Mtabaji, J. 2009. Gender-related differences in the prevalence of cardiovascular disease risk factors and their correlates in urban Tanzania. *BMC cardiovascular disorders*, 9, 30. https://doi.org/10.1186/1471-2261-9-30

173. Nour, M., Lutze, S.A., Grech, A., Allman-Farinelli, M. 2018. The relationship between vegetable intake and weight outcomes: a systematic review of cohort studies. *Nutrients*, 2;10(11):1626.

174. Ntwenya, J.E., Kinabo, J., Msuya, J., Mamiro, P., Majili, Z.S. 2015. Dietary patterns and household food insecurity in rural populations of Kilosa district, Tanzania. *PLoS ONE*. 10(5): e0126038. https://doi.org/10.1371/journal.pone.0126038.

175. Nyamete, F. A., Bennink, M., & Mugula, J.K. 2016. Potential of lactic acid fermentation in reducing aflatoxin B1 in Tanzania maize-based gruel. *African Journal of Food, Agriculture, Nutrition and Development*, 16(3), 11139–11151.

176. Ochieng, J., Afari-Sefa, V., Lukumay, P.J., Dubois, T. 2017. Determinants of dietary diversity and the potential role of men in improving household nutrition in Tanzania. *PLoS ONE* 12(12): e0189022.

177. O'Connor, D.L., Green, T. & Picciano, M.F. 1997. Maternal folate status and lactation. *Journal of Mammary Gland Biology and Neoplasia*, 2(3), 279–289. https://doi.org/10.1023/a:1026388522182

178. Oibiokpa, F.I., Akanya, H.O., Jigam, A.A., Saidu, A.N. & Egwim, E.C. 2018. Protein quality of four indigenous edible insect species in Nigeria. *Food Science and Human Wellness*, 7(2): 175–183.

179. Oken, E., Radesky, J.S., Wright, R.O., Bellinger, D.C., Amarasiriwardena, C. J., Kleinman, K.P., Hu, H. & Gillman, M.W. 2008. Maternal fish intake during pregnancy, blood mercury levels, and child cognition at age 3 years in a US cohort. *American Journal of Epidemiology*, 167(10), 1171–1181. https://doi.org/10.1093/aje/kwn034

180. Orsavova, J., Misurcova, L., Ambrozova, J.V., Vicha, R. & Mlcek, J. 2015. Fatty acids composition of vegetable oils and its contribution to dietary energy intake and

dependence of cardiovascular mortality on dietary intake of fatty acids. *International Journal of Molecular Sciences*, 16(6): 12871–12890.

181. PAHO (Pan American Health Organization). 2015. *Ultra-processed food and drink products in Latin America: trends, impact on obesity, policy implications*. Washington, DC, Pan American Health Organization.

182. Pearce, E.N. 2017. Iodine supplementation during pregnancy. *WHO e-Library of Evidence for Nutrition Actions (eLENA)*. Cited 21 November 2022. https://www.who.int/elena/titles/commentary/iodine_pregnancy/en

183. Pelucchi, C., Gallus, S., Garavello, W., Bosetti, C., La Vecchia, C. 2006. Cancer risk associated with alcohol and tobacco use: focus on upper aero-digestive tract and liver. *Alcohol Research & Health: the Journal of the National Institute on Alcohol Abuse and Alcoholism*, *29*(3), 193–198.

184. Pena, M. & Molina, V. 1999. *Food based dietary guidelines and health promotion in Latin America*. Washington, DC, PAHO and Insitute of Nutrition of Central America and Panama.

185. Pereira, M.A., O'Reilly, E., Augustsson, K., Fraser, G.E., Goldbourt, U., Heitmann, B.L., Hallmans, G., Knekt, P., Liu, S., Pietinen, P., Spiegelman, D., Stevens, J., Virtamo, J, Willett, W.C., Ascherio, A. 2004. Dietary fibre and risk of coronary heart disease: a pooled analysis of cohort studies. *Archives of Internal Medicine,* 164(4): 370–6.

186. Prentice, A.M., Jarjou, L.M., Drury, P.J., Dewit, O., & Crawford, M.A. 1989. Breast-milk fatty acids of rural Gambian mothers: effects of diet and maternal parity. *Journal of Pediatric Gastroenterology and Nutrition*, 8(4): 486–490.

187. Prime Minister's Office. 2021. *National Multisectoral Nutrition Action Plan (NMNAP II) July 2021 - June 2026*. Prime Minister's Office and Ministry of Health. Dodoma, Tanzania.

188. Qin, P., Zhang, M., Han, M., Liu, D., Luo, X., Xu, L., Zeng, Y., Chen, Q., Wang, T., *et al*. 2021. Fried-food consumption and risk of cardiovascular disease and all-cause mortality: a meta-analysis of observational studies. *Heart*, 107(19): 1567–1575.

189. Raimi, O.G., Falade, O.A., Folorunso, O.S. & Lawal, A.K. 2012. Zinc and iron levels in pregnancy: A review. *Pakistan Journal of Food Sciences*, 22(2), 53–60.

190. Rameez, R.M., Sadana, D., Kaur, S., Ahmed, T., Patel, J., Khan, M.S., Misbah, S., Simonson, M.T., Riaz, H. & Ahmed, H.M. 2019. Association of maternal lactation with diabetes and hypertension: a systematic review and meta-analysis. *JAMA Netw Open,* 2(10).

191. Ramos-Elorduy, J., Moreno, J.M.P., Prado, E.E., Perez, M.A., Otero, J. L. & De Guevara, O.L. 1997. Nutritional value of edible insects from the state of Oaxaca, Mexico. *Journal of Food Composition and Analysis*, 10(2): 142–157.

192. Rather, I.A., Koh, W.Y., Paek, W.K. & Lim, J. 2017. The sources of chemical contaminants in food and their health implications. *Frontiers in Pharmacology*, 8, 830. https://doi.org/10.3389/fphar.2017.00830

193. Reardon, T., Tschirley, D., Liverpool-Tasie, L., Awokuse, T., Fanzo, J., Minten, B., Vos, R., *et al*. 2021. The processed food revolution in African food systems and the double burden of malnutrition. *Global Food Security*, 28: 100466.

194. Rehm, J. 2011. The risks associated with alcohol use and alcoholism. *Alcohol Research & Health: The Journal of the National Institute on Alcohol Abuse and Alcoholism*. 34(2), 135–143.

195. Rong, Y., Chen, L., Zhu, T., Song, Y., Yu, M., Shan, Z., Sands, A., Hu, F.B., Liu, L. 2013. Egg consumption and risk of coronary heart disease and stroke: dose-response meta-analysis of prospective cohort studies. *BMJ,* 346:e8539.

196. Ruanpeng, D., Thongprayoon, C., Cheungpasitporn, W. & Harindhanavudhi, T. 2017. Sugar and artificially sweetened beverages linked to obesity: a systematic review and meta-analysis. *QJM: An International Journal of Medicine*, 110(8): 513–520. https://doi.org/10.1093/qjmed/hcx068

197. Ruel, M.T. 2003. Operationalizing dietary diversity: a review of measurement issues and research priorities. *Journal of Nutrition*, 2003;133(suppl 2): 3911S–3926S.

198. Rumgay, H., Shield, K., Charvat, H., Ferrari, P., Sornpaisarn, B., Obot, I., Islami, F.,

199. Rumpold, B.A. & Schlüter, O.K. 2013. Nutritional composition and safety aspects of edible insects. *Molecular Nutrition and Food Research*, 57(5): 802–823.

200. Safari, J.G., Timothy, S.K, & Masanyiwa, Z.S. 2020. Food consumption patterns and predictors of dietary diversity in pastoral communities of Ngorongoro district, Tanzania. *Current Research Journal of Social Sciences*. 11(1):1–12.

201. Sankar, M.J., Sinha, B., Chowdhury, R., Bhandari, N., Taneja, S., Martines, J., Bahl, R. 2015. Optimal breastfeeding practices and infant and child mortality: a systematic review and meta-analysis. *Acta Paediatrica*. 104(467):3–13.

202. Schnabel, L., Kesse-Guyot, E., Alles, B., Touvier, M., Srour, B., Hercberg, S., Buscail, C. & Julia, C. 2019. Association between ultra-processed food consumption and risk of mortality among middle-aged adults in France. *JAMA Intern Med*, 179(4):490–8.

203. Seetha, A., Munthali, W., Msere, H., Elirehma, S., Muzanila, Y., Sichone, E., Tsusaka, T. W., Rathore, A., & Okori, P. 2017. Occurrence of aflatoxins and its management in diverse cropping system of central Tanzania. *Mycotoxin Research*, 33(4), 323–331.

204. Segura, S.A, Ansótegui, J.A. & Díaz-Gómez, N.M. 2016. The importance of maternal nutrition during breastfeeding: do breastfeeding mothers need nutritional supplements? *Anales de Pediatría* (English Edition), 84(6), 347.e341-347.e347. doi: 10.1016/j.anpede.2015.07.035

205. Shayo, G.A. and Mugusi, F.M. 2011. Prevalence of obesity and associated risk factors among adults in Kinondoni municipal district, Dar es Salaam Tanzania. *BMC Public Health*, 11, 365. https://doi.org/10.1186/1471-2458-11-365

206. Siwela, A.H., Siwela, M., Matindi, G., Dube, S. & Nziramasanga, N. 2005. Decontamination of aflatoxin-contaminated maize by dehulling. *Journal of the Science of Food and Agriculture*, 85(15), 2535–2538.

207. Slavin, J.L. & Lloyd, B. 2012. Health benefits of fruits and vegetables. *Advances in Nutrition,* 3(4): 506–16.

208. Smith, A.M., Picciano, M.F. & Deering, R.H. 1983. Folate supplementation during lactation: maternal folate status, human milk folate content, and their relationship to infant folate status. *Journal of Pediatric Gastroenterology and Nutrition*, 2(4): 622–628.

209. Spring, M.P.C., Amancio, O.M., Nobriga, F., Araujo, G., Koppel, S.M. & Dodge, J.A. 1985. Fat and energy content of breast milk of malnourished and well nourished women, Brazil 1982. *Annals of Tropical Paediatrics*, 5(2): 83–87.

210. Steiner-Asiedu, M., Lied, E., Lie, Ø., Nilsen, R., & Julshamn, K. 1993. The nutritive value of sun-dried pelagic fish from the rift valley in Africa. *Journal of the Science of Food and Agriculture*, 63(4): 439–443.

211. Stuetz, W., Gowele, V., Kinabo, K., Bundala, N., Mbwana, H., Rybak, C., Eleraky, L., Lambert, C. & Biesalski, H.K. 2019. Consumption of dark green leafy vegetables predicts vitamin A and iron intake and status among female small-scale farmers in Tanzania. *Nutrients*.11(5):1025.

212. Suleiman, R.A., Rosentrater, K.A., & Chove, B. 2017. Understanding postharvest practices, knowledge, and actual mycotoxin levels in maize in three agro- ecological zones in Tanzania. *Journal of Stored Products and Postharvest Research*, 8(7), 73–84.

213. Sun, Y., Neelakantan, N., Wu, Y., Lote-Oke, R., Pan, A. & van Dam, R.M. 2015. Palm oil consumption increases LDL cholesterol compared with vegetable oils low in saturated fat in a meta-analysis of clinical trials. *The Journal of Nutrition*, 145(7): 1549–1558.

214. Sunguya, B.F., Ge, Y., Mlunde, L., Mpembeni, R., Leyna, G. & Huang, J. 2021. High burden of anemia among pregnant women in Tanzania: a call to address its determinants. *Nutrition Journal,* 20(1): 65.

215. Tamura, T. & Picciano, M.F. 2006. Folate and human reproduction. *American Journal of Clinical Nutrition*, 83(5): 993–1016.

216. Tian, J., Chen, J., Lv, F., Chen, S., Chen, J., Liu, D. & Ye, X. 2016. Domestic cooking methods affect the phytochemical composition and antioxidant activity of purple-fleshed potatoes. *Food chemistry*, 197 Pt B, 1264–1270.

217. TFNC (Tanzania Food and Nutrition Centre). 2013. Ulishaji wa watoto wachanga na Wadogo kaatika Jamii. Wizara ya Afya na Ustawi wa Jamii. Dar es Salaam, Tanzania.

218. TFNC. 2016. *National guideline for nutrition care and support of people with HIV*. Dar es Salaam, Tanzania.

219. Tham, R., Bowatte, G., Dharmage, S.C., Tan, D.J., Lau, M.X., Dai, X., Allen, K.J. & Lodge, C.J. 2015. Breastfeeding and the risk of dental caries: a systematic review andmeta-analysis. *Acta Paediatrica,* 104 (S467): 62–84.

220. Thomaz, E.B.A.F., Alves, C.M.C., Gomes, E., Silva, L.F., Ribeiro de Almeida, C.C.C., Soares de Britto, E., Alves, M.T.S., Hilgert, J.B. & Wendland, E.M. 2018. Breastfeeding versus bottle feeding on malocclusion in children: a meta-analysis study. *Journal of Human Lactation*, 34 (4): 768–788.

221. Toffolo, M., Aguiar-Nemer, A. & Silva-Fonseca, V. 2013. Alcohol: effects on nutritional status, lipid profile and blood pressure. *Journal Of Endocrinology and Metabolism, 2*(6), 205–211.

222. Tola, M., & Kebede, B. 2016. Occurrence, importance and control of mycotoxins: a review. *Cogent Food & Agriculture,* 2:1.

223. Toscano, M., de Grandi, R., Grossi, E., & Drago, L. 2017. Role of the human breast milk-associated microbiota on the newborns' immune system: a mini review. *Frontiers in Microbiology*, 8: 2100.

224. Traversy, G., Chaput, J.P. 2015. Alcohol consumption and obesity: an update. *Current Obesity Reports,* 4: 122–130. https://doi.org/10.1007/s13679-014-0129-4

225. UNICEF (United Nations Children's Fund). 2013. *The community infant and child feeding counselling package*. New York.

226. UNICEF. 2016. *From the first hour of life: making the case for improved infant and young child feeding everywhere*. New York.

227. UNICEF. 2017. *Water, sanitation and hygiene*. New York. Cited 1 September 2022. www.unicef.org/tanzania/media/856/file/UNICEF-Tanzania-2017-WASH-fact-sheet.pdf

228. UNICEF. 2019. *The State of the World's Children 2019. Children, Food and Nutrition: Growing well in a changing world*. New York.

229. UNICEF. 2020. *Improving young children's diets during the complementary feeding period. UNICEF programming guidance*. New York.

230. UNICEF. 2021. *Nutrition in middle childhood and adolescence*. *UNICEF programming guidance.* New York. Cited 13 September 2022. www.unicef.org/media/106406/file

231. UNICEF and WHO. 2018. *Capture the moment – early initiation of breastfeeding: the best start for every newborn*. New York. Cited 9 December 2021. www.unicef.org/eca/media/4256/file/Capture-the-moment-EIBF-report.pdf

232. USDA (United States Department of Agriculture). 2021. Safe minimum internal temperature chart. In: *USDA Food Safety and Inspection Service* [online]. Washington, DC. Cited 17 July 2021. www.fsis.usda.gov/food-safety/safe-food-handling-and-preparation/food-safety-basics/safe-temperature-chart

233. Van Huis, A., Van Itterbeeck, J., Klunder, H., Mertens, E., Halloran, A., Muir, G., & Vantomme, P. 2013. *Edible insects: future prospects for food and feed security*. FAO Forestry Paper No. 171. Rome, FAO. Cited 15 September 2022. www.fao.org/3/i3253e/i3253e.pdf.

234. Victora, C. G., Bahl, R., Barros, A. J., França, G. V., Horton, S., Krasevec, J., Murch, S., Sankar, M. J., Walker, N., Rollins, N.C. & Lancet Breastfeeding Series Group. 2016. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *Lancet*, *387*(10017), 475–490.

235. Vitta, B.S., Benjamin, M., Pries, A.M., Champeny, M., Zehner, E., &Huffman, S.L. 2016. Infant and young child feeding practices among children under 2 years of age and maternal exposure to infant and young child feeding messages and promotions in Dar es Salaam, Tanzania. *Journal of Maternal and Child Nutrition*. 12(2):77–90.

236. Wallace, T.C., Bailey, R.L., Blumberg, J.B., Burton-Freeman, B., Chen, C.O., Crowe-White, K.M., Drewnowski A., Hooshmand, S., Johnson E., Lewis, R., Murray, R., Shapses, S.A., Wang, D.D. 2019. Fruits, vegetables, and health: A comprehensive narrative, umbrella review of the science and recommendations for enhanced public policy to improve intake. *Critical Reviews in Food Science and Nutrition*, 60(13): 2174–2211. doi: 10.1080/10408398.2019.1632258.

237. Wang, Q., Imamura, F., Ma, W., Wang, M., Lemaitre, R.N., King, I.B., Song, X., Biggs, M.L., Delaney, J.A., Mukamal, K.J., *et al*. 2015. Circulating and dietary trans fatty acids and incident type 2 diabetes in older adults: the Cardiovascular Health Study. *Diabetes Care*. 38(6): 1099–1107.

238. WCRF (World Cancer Research Fund). 2018. *Diet, nutrition physical activity and cancer: a global perspective*. Continuous Update Project Expert Report. Cited 1 September 2022. www.wcrf.org/diet-activity-and-cancer/global-cancer-update-programme/resources-and-toolkits

239. Wenban-Smith, H., Faße, A. & Grote, U. 2016. Food security in Tanzania: the challenge of rapid urbanisation. *Food Security*. 8, 973–984. https://doi.org/10.1007/s12571-016-0612-8

240. West Jr., K.P. 2003. Vitamin A Deficiency Disorders in Children and Women. *Food and Nutrition Bulletin*, 24, S78-S90.

241. Whitehead, R.G. 1979. Infant feeding practices and the development of malnutrition in rural Gambia. *Food and Nutrition Bulletin*, 1(4): 1–6.

242. WHO (World Health Organization). 1985. *The quantity and quality of breast milk: report on the WHO collaborative study on breast-feeding*. Geneva. Cited 3 September 2022. https://apps.who.int/iris/handle/10665/39047

243. WHO. 2003. *Joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases*. WHO Technical Report Series: 916. Geneva.

244. WHO. 2005. *Vitamin and mineral requirements in human nutrition.* 2nd edn. Cited 3 September 2022. https://apps.who.int/iris/handle/10665/42716

245. WHO. 2006a. *Adolescent nutrition: a review of the situation in selected South-East Asian countries*. Geneva. Cited 18 September 2022. https://apps.who.int/iris/handle/10665/204764

246. WHO. 2006e. *Five keys to safer food manual*. Geneva. Cited 20 September 2022. www.who.int/foodsafety/publications/consumer/manual_keys.pdf.

247. WHO. 2006b. *Food and nutrition policy for schools: a tool for the development of school nutrition programmes in the European region*. Geneva. Cited 19 September 2022. https://apps.who.int/iris/handle/10665/107797)

248. WHO. 2006c. *Global database on anaemia: United Republic of Tanzania*. Geneva.

249. WHO. 2006d. *Infant and young child feeding counselling: an integrated course*. Geneva. Cited 10 September 2022. www.who.int/publications/i/item/infant-young-child-feeding-counselling-an-integrated-course

250. WHO. 2007. *Protein and amino acid requirements in human nutrition: report of a joint FAO/WHO/UNU expert consultation*. WHO technical report series; no. 935. Lemmens, V., Rehm, J., Soerjomatarum, I. 2021. Global burden of cancer in 2020 attributable to alcohol consumption: a population-based study. *Lancet Oncology,* 22:1071–80.

251. WHO. 2009a. *Global health risks: mortality and burden of disease attributable to selected major risks*. Geneva.

252. WHO. 2009b. *Infant and young child feeding: model chapter for textbooks for medical students and allied health professionals*. Geneva. Cited 3 September 2022. https://apps.who.int/iris/handle/10665/44117

253. WHO. 2011a. *Global status report on alcohol and health*. Geneva. Cited 3 September 2022. https://apps.who.int/iris/bitstream/handle/10665/44499/9789241564151_eng.pdf

254. WHO. 2011b. *Guideline: vitamin A supplementation in infants and children 6–59 months of age*. Geneva.

255. WHO. 2012b. *Guideline: daily iron and folic acid supplementation in pregnant women*. Geneva.

256. WHO. 2012a. *Guideline: sodium intake for adults and children*. Geneva.

257. WHO. 2013. *Guideline: calcium supplementation in pregnant women*. Geneva. Cited 10 September 2022. http://apps.who.int/iris/bitstream/handle/10665/85120/9789241505376_eng.pdf

258. WHO. 2014a. *Global status report on alcohol and health*. Geneva. Cited 3 September 2022. www.iccp-portal.org/system/files/resources/9789240692763_eng.pdf

259. WHO. 2014b. *Guideline: fortification of food-grade salt with iodine for the prevention and control of iodine deficiency disorders*. Geneva. Cited 3 September 2022. https://apps.who.int/iris/handle/10665/136908

260. WHO. 2015c.*Guideline: sugars intake for adults and children*. Reference: WHO/NMH/NHD/15.2. Geneva.

261. WHO. 2015a. *Healthy diet*. WHO Fact Sheet.

262. WHO. 2015b. *Technical brief: boil water*. Brief: WHO/FWC/WSH/15.02. Cited 1 September 2022. https://www.who.int/publications/i/item/WHO-FWC-WSH-15.02

263. WHO. 2016a. *Global maternal nutrition: the best start in life.* Geneva. Cited 4 September 2022. https://apps.who.int/iris/handle/10665/329459

264. WHO. 2016c. *Global report on diabetes*. Geneva. Cited 12 September 2022. www.who.int/publications/i/item/9789241565257

265. WHO 2016d. *Guideline: daily iron supplementation in adult women and adolescent girls*. Geneva.

266. WHO. 2016b. *WHO recommendations on antenatal care for a positive pregnancy experience*. Geneva. Cited 13 September 2022. www.who.int/publications/i/item/9789241549912

267. WHO. 2017a. *Guidelines for drinking-water quality: fourth edition incorporating the first addendum*. Geneva. Cited 13 September 2022. www.who.int/publications/i/item/9789241549950

268. WHO. 2017b. *Guideline: protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services*. Geneva. Cited 15 September 2022. https://www.who.int/publications/i/item/9789241550086

269. WHO. 2018e. *Healthy diet*. Fact Sheet No. 304. Cited 15 September 2022. https://cdn.who.int/media/docs/default-source/healthy-diet/healthy-diet-fact-sheet-394.pdf

270. WHO. 2018b. *Global action plan on physical activity 2018–2030: more active people for a healthier world*. Geneva.

271. WHO. 2018c. *Global status report on alcohol and health*. Geneva.

272. WHO. 2018d. *Guidelines: saturated fatty acid and trans-fatty acid intake for adults and children*. Draft issued for public consultation in May 2018. Geneva.

273. WHO. 2018a. *Mycotoxins*. Fact Sheet. Geneva. Cited 3 September 2022. www.who.int/news-room/fact-sheets/detail/mycotoxins

274. WHO. 2019a. *Essential nutrition actions: mainstreaming nutrition through the life course*. Geneva. Cited 12 September 2022. www.who.int/publications/i/item/9789241515856

275. WHO. 2019b. *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age*. Geneva. Cited 13 September 2022. www.who.int/publications/i/item/9789241550536

276. WHO. 2019c. *Drinking-water*. Cited 12 September 2022. www.who.int/news-room/fact-sheets/detail/drinking-water

277. WHO. 2020a. *WHO guidelines on physical activity and sedentary behaviour*. Geneva. Cited 3 September 2022. www.who.int/publications/i/item/9789240015128

278. WHO. 2020b. *Healthy diet: key facts*. WHO Fact Sheets [online]. Geneva. Cited 10 July 2021. www.who.int/news-room/fact-sheets/detail/healthy-diet

279. WHO. 2021a. *Adolescent health*. *WHO* Health Topics. Geneva. Cited 21 October 2021. https://www.who.int/health-topics/adolescent-health#tab=tab_1

280. WHO. 2021b. *REPLACE trans fat: an action package to eliminate industrially produced trans-fatty acids*. Cited 2 September 2022. www.who.int/docs/default-source/documents/replace-transfats/replace-action-package.pdf

281. WHO. 2021c. *WHO report on the global tobacco epidemic 2021: addressing new and emerging products*. Cited 20 December 2021. www.who.int/publications/i/item/9789240032095

282. WHO. 2021d. *Malnutrition*. Fact Sheets. Cited 15 September 2022. www.who.int/news-room/fact-sheets/detail/malnutrition

283. WHO & FAO. 2002. *Joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases.* WHO technical report series; 916. Geneva, World Health Organization.

284. WHO, UNICEF & ICCIDD. 2007. *Assessment of iodine deficiency disorders and monitoring their elimination*. Geneva, WHO.

285. Wild, C.P., Miller J.D. & Groopman J.D., eds. 2015. *Mycotoxin control in low- and middle-income countries*. Lyon, France: International Agency for Research on Cancer.

286. Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., De Clerck, F., Wood, A., *et al*. 2019. Food in the anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. *Lancet,* 393(10170): 447–492.

287. Williams, M.T. & Hord, N.G. 2005. The role of dietary factors in cancer prevention: beyond fruits and vegetables. *Nutrition in Clinical Practice*: official publication of the American Society for Parenteral and Enteral Nutrition, 20(4): 451–459. https://doi.org/10.1177/0115426505020004451

288. World Bank. 2012. *Action plan for the provision of vitamins and minerals to the tanzanian population through the enrichment of staple foods*. Washington, DC.

289. Yan, J., Liu, L., Zhu, Y., Huang, G., & Wang, P.P. 2014. The association between breastfeeding and childhood obesity: a meta-analysis. *BMC Public Health*. 14:1267.

290. Yeomans, M.R. 2010. Alcohol, appetite and energy balance: is alcohol intake a risk factor for obesity? *Physiology & Behavior,* 100(1): 82–9.


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