ZAMBIA

Food-Based Dietary Guidelines

Technical Recommendations

2021

REPUBLIC OF ZAMBIA

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Zambia Food-Based Dietary Guidelines
Technical Recommendations

By the

Ministry of Agriculture

2021

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the Food and Agriculture Organization of the United Nations

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Table of Contents

Foreword ..... **iv**
Acknowledgements ..... **v**
Acknowledgements ..... **vi**
Acknowledgements ..... **vii**
Acronyms and Abbreviations ..... **viii**

Executive Summary **1**

SECTION 1: About the Food-Based Dietary Guidelines for Zambia **2**
1. The Zambian food group graphic **3**

2. The Zambia Food-Based Dietary Guidelines at a glance **3**

3.Background and context **6**
3.1Introduction 6
3.2 Rationale and relevance for the Food-Based Dietary Guidelines 6
3.3 About the Food-Based Dietary Guidelines (Technical Recommendations) 7
3.4 Guiding principles 7

4. Methodology/process of developing FBDGs **9**
4.1 The FBDGs development process steps 9
4.2 FBDG diet model cost of diet for a 2 100 Kcal diet per individual 13
4.3 FBDGs products 13

SECTION 2: The Food-Based Dietary Guidelines for the general population in Zambia **15**
5. Recommendation 1: Eat different types of food from each of the six food groups every day to stay strong and healthy. **17**
5.1 Getting to know the six food groups 17
5.2 Why it is important to eat a variety of foods every day 18
5.3 The science behind the benefits of eating a variety of foods 19
5.4 How the body benefits from eating a variety of foods daily 19
5.5 Dietary diversity among Zambians 20
5.6 Rrecommendation and guidance on eating a variety of food 21
5.7 The correct amount to eat from each of the six food groups 22
5.8 Consider the nutrient density of food 28
5.9 Tips on how to consume a variety of foods daily 28

6. Recommendation 2: Eat whole or milled whole grains (cereals), starchy roots and tubers as part of meals every day for a healthy heart and weight. **30**
6.1 Getting to know whole grains, starchy roots and tubers 30
6.2 Why are whole grains, other cereals, starchy roots and tubers part of a healthy diet? 31
6.3 The relationship between whole grains intake and positive nutrition and health outcomes 31
6.4 Myth busters! 32
6.5 Zambia consumption patterns of cereals, starchy roots and tubers 32
6.6 Recommended amounts to eat daily 33
6.7 Recommendations and guidance 35
6.8 Tips on adding whole grains to a diet and eating the right amounts 35

7. Recommendation 3: Eat plenty of different coloured vegetables every day to provide vitamins, minerals and fibre to prevent diseases. **37**
7.1 About vegetables 37
7.2 Different coloured vegetables and their unique nutrients 37
7.3 Importance of vegetables in a diet 38

7.4 The scientific basis of the health and nutritional benefits of eating plenty of vegetables 39
7.5 Recommendations and guidance on eating a variety of vegetables every day 40
7.6 How much vegetables should a person eat every day? 41
7.7 Tips on increasing consumption of vegetables 45

8. Recommendation 4: Eat two different coloured fruits every day to provide vitamins and minerals to prevent diseases. 47
8.1 Definition of a fruit 47
8.2 The unique types and colours of fruits and their unique nutrients and antioxidants for good health 47
8.3 The scientific basis of the health and nutritional benefits of eating a lot of fruits 48
8.4 Fruits are essential in preventing micronutrient deficiencies and promoting good health 48
8.5 Fruits are diet-related non-communicable disease protective 48
8.6 Fruits are a healthy option for weight loss and weight management 49
8.7 Fruits and vegetables as separate food groups 49
8.8 recommendations & guidance on eating a variety of fruits every day 50
8.9 Recommended amounts of fruits per day 50
8.10 Tips on eating at least two servings of fruit a day 51

9. Recommendation 5: Eat pulses, beans, cowpeas, ground nuts or other nuts daily to maintain good health. All these foods are rich sources of protein and a good substitute for meat. 56
9.1 Getting to know pulses, nuts and seeds 56
9.2 Healthy benefits of eating pulses, nuts and seeds 57
9.3 Key functions of micronutrients of public health importance in Zambia 57
9.4 Pulses, nuts and seeds and their relationship to health 57
9.5 Pulses are a healthier alternative to ASF and are NCD protective 58
9.6 How nuts and seeds protect the body from NCDs. 58
9.7 Pulses, nuts and seeds are a protein source for a healthier environment 58
9.8 Recommendations and guidance on eating a variety of pulses, nuts and seeds 59
9.9 How much legumes to eat per day 59
9.10 Tips on increasing intake of pulses, nuts and seeds 61

10. Recommendation 6: Eat fish, insects or animal source foods daily 63
10.1 A closer look: fish, eggs, insects and animal source foods 63
10.2 Importance of eating fish, eggs and ASF 63
10.3 White meat is a healthier meat option than red meat 64
10.4 Limit the intake of red meat and processed meats to reduce the risk of diseases 64
10.5 The role of liver and kidney in addressing iron deficiency 65
10.6 Fish, insects and white meat are healthier and sustainable options. 65
10.7 Recommendations and guidance on eating a variety of fish, insects or animal source foods 67
10.8 Recommended amounts of fish, insects or animal source foods 67
10.9 Tips on consuming fish, eggs, Insects and ASF 70

11. Recommendation 7: Take milk and dairy products for strong bones and teeth. 72
11.1 A closer look: milk and dairy products 72
11.2 Importance of milk and milk products in a diet and for good health 73
11.3 Recommendations and guidance on eating a variety of milk and mill products every day 73
11.4 Take milk and milk products for healthy bones and teeth 74
11.5 Alternatives if one is not able to take milk and milk products 74
11.6 TIPs on taking milk and milk products 75

12. Recommendation 8: Limit eating ultra-processed foods and foods high in salt, sugar, and fats and oils to prevent non-communicable diseases. 79
12.1 About processed Foods 79
12.2 Substances only found in ultra-processed foods. 84
12.3 Identifying ultra-processed foods 85

12.4 Additives in processed and ultra-processed foods 88
12.5 Recommendations and guidance for limiting the consumption of ultra-processed foods ... 89
12.6 Limit intake of salt 89
12.7 Recommendations and guidance on reducing salt intake to less than 5 g per day..... 90
12.8 Tips on reducing salt intake..... 91
12.9 Limit intake of foods high in saturated fats 91
12.10 The health risks of saturated fats and trans fats..... 92
12.11 Recommendations and guidance on avoiding trans fats, limiting saturated fats and replacing them with essential polyunsaturated fats..... 93
12.12 Tips on how to reduce intake of saturated fats 93
12.13 Limit intake of foods containing added sugar 93
12.14 Link between added sugars and diseases..... 93
12.15 Recommendations and guidance on sugar intake..... 95
12.16 Tips on reducing sugar intake..... 95

13. Recommendation 9: Handle, prepare and store food safely. 98
13.1 Ways through which food gets contaminated 98
13.2 Keeping food safe before and while cooking..... 99
13.3 Cooking and storing food safely 99
13.4 Tips on handling, preparing and storing food 100
13.6 Keep food safe from aflatoxin contamination 101
13.7 Health concerns of aflatoxins 101
13.8 Recommendations and guidance on aflatoxins 102
13.9 Helpful tips on decreasing exposure to aflatoxins..... 102

14. Recommendation 10: Engage in physical activity at least 30 minutes every day..... 104
14.1 What is physical activity?..... 104
14.2 Physical activity among Zambians..... 104
14.3 Physical activity and its relationship to health..... 105
14.4 Current global recommendations on physical activity 105
14.5 Recommendations and guidance for physical activity..... 106
14.6 Tips for increased daily physical exercise..... 109

SECTION 3: Special dietary requirements for under-five children, adolescent girls, and pregnant and lactating women in Zambia 111
15. Recommendation A: Begin breastfeeding your baby within one hour of birth. 112
15.1 Importance of early initiation of breastfeeding..... 112
15.2 Tips to ensure successful early initiation..... 112

16. Recommendation B: Feed your baby breastmilk only for the first six months of life and no water, herbs or porridge because mother's milk contains all the food and water your baby needs. 113
16.1Mother's breastmilk..... 113
16.2 Importance of exclusive breastfeeding for babies..... 113
16.3 Breastfeeding benefits the country economy..... 114
16.4 Breastfeeding benefits for mothers..... 114
16.5 Rates of exclusive breastfeeding in Zambia..... 114
16.6 Recommendations and guidance for exclusive breastfeeding for children aged 0 to 6 months..... 115
16.7 Tips for breastfeeding success..... 115

17. Recommendation C: From six months, introduce a variety of foods from the six food groups and continue to breastfeed up to two years and beyond. 116
17.1 Why should children aged 6 to 23 months eat a variety of foods in addition to breastfeeding? 116
17.2 Dietary patterns and nutrition status for children aged 6 to 23 months in Zambia 119
17.3 Guiding principles for appropriate complementary feeding for children 6 to 23 months... 119
17.4 The recommended intake for children aged 6 to 23 months 120

17.5 One serving size equivalents of different food groups 126

18. Recommendation D: Give a variety of foods from the six food groups to children 2 to 5 years to help them grow to their full potential. 128
18.1 Importance of optimal nutrition for children 2 to 5 years of age 128
18.2 Dietary patterns and nutrition status for children aged 24 to 59 months in Zambia 128
18.3 The recommended intake for children aged 2 to 5 years 129
18.4 Tips on feeding children aged 6-59 months 130

19. Recommendation E: Adolescents, especially girls, should eat a variety of foods from the six food groups for healthy weight and growth. 131
19.1 Nutritional needs for adolescents aged 10 to 19 years 131
19.2 Diet and nutrition outcomes for adolescents in Zambia 132

20. Recommendation F: When pregnant or breastfeeding, enjoy a variety of food including animal source foods, pulses, fruits and vegetables with your meals for your and your baby's health. 134
20.1 Nutritional needs for pregnant women 134
20.2 Special nutrient needs for a pregnant adolescent 136
20.3 Recommendations and guidance for pregnant women 137
20.4 Nutrition for lactating women 139
20.5 Dietary practices and nutrition status for pregnant and lactating women in Zambia 139
20.6 Recommendations and guidance for lactating women 140
20.7 Tips for lactating women 140

SECTION 4: Annexes and References 143
21. ANNEXES 143
21.1 Annex 1: Diet model outputs 143
21.2 Annex 2: List of TWG and attendance during the FBDG development process 150

22. References 154

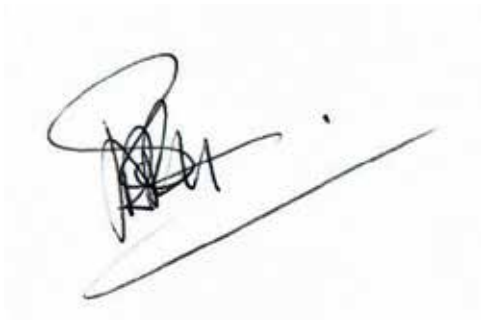
Foreword

Nutrition is one of the main determinants of optimal health throughout the human lifecycle. Promoting a well-nourished population free of all forms of malnutrition and capable of contributing to economic growth and diversification is one of the aims of the Zambia National Development Plan Agenda and the National Food and Nutrition Strategic Plan. The UN Sustainable Development Goal number two (SDG 2) specifically stipulates ending hunger and malnutrition in all its forms by 2030. Zambia faces a triple burden of malnutrition including chronic undernutrition, micronutrient deficiencies as well as the emerging problem of overweight and obesity.

Diet has a profound influence on the nutrition, health and wellbeing of an individual. Healthy dietary practices and regular physical activity are critical in attaining good health and reducing the risk of developing diet-related Non-Communicable Diseases (NCDs). The Zambia Food-Based Dietary Guidelines (FBDGs) provide scientifically proven recommendations on diet and a healthy lifestyle to prevent and reduce the risk of NCDs while meeting nutrient and energy requirements. This FBDG manual is primarily intended for technical experts who promote food consumption and diets for use in designing, implementing and assessing nutrition programmes including the development of policies and nutrition education materials.

The development of the FBDGs was multi-sectoral, therefore, implementing these guidelines ought to also involve stakeholders from different sectors. The guidelines are grounded on the food systems approach. Public policy makers, programme developers, civil society organizations, the private sector, and the general population have a role in promoting and implementing the guidelines in order to reduce the prevalence of malnutrition in Zambia.

The FBDGs are accompanied by the Healthy Eating Guides for the general population to enhance healthy eating for all. The Healthy Eating Guides have been developed using simple language that can be understood by non-technical people. These guides consider local consumption patterns, cultural contexts and the food systems environment, and have the same aim as the FBDGs.



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Minister of Agriculture

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Acronyms and Abbreviations

ASF	Animal Source Foods
BMI	Body Mass Index
CDH	Cancer Diseases Hospital
CHD	Coronary Heart Disease
CSO-SUN	Civil Society Organizations for Scaling Up Nutrition
CVD	Cardiovascular Diseases
DOF	Department of Fisheries
FAO	Food and Agricultural Organisation
FBDGs	Food-Based Dietary Guidelines
FCT	Food Composition Table
GBD	Global Burden of Diseases
Kcal	Kilocalories
IAPRI	Indaba Agricultural Policy Research Institute
LDL	Low Density Lipoprotein
MCDSS	Ministry of Community Development and Social Services
MFL	Ministry of Fisheries and Livestock
MoA	Ministry of Agriculture
MOGE	Ministry of General Education
MoH	Ministry of Health
NAIS	National Agriculture Information Service
NAZ	Nutrition Association of Zambia

NCDs	Non Communicable Diseases
NFNC	National Food and Nutrition Commission
NISIR	National Institute For Scientific And Industrial Research
NRDC	Natural Resources Development College
NSP	Non Starch Polysaccharides
PAL	Physical Activity Levels
PAM	Programme Against Malnutrition
PEP II	Performance Enhancement Programme II
PDCAAS	Protein Digestibility Corrected Amino Acid Score
PUFAs	Poly Unsaturated Fatty Acids
SAER	Situation Analysis and Evidence Review
SFAs	Saturated Fatty acids
SUA	Sokoine University of Agriculture
SUNLE	Scaling Up Nutrition Learning and Evaluation
SUNTA	Scaling Up Nutrition Technical Assistance
TCP	Technical Cooperation Programme
TFA	Trans Fatty Acids
TWG	Technical Working Group
UNICEF	United Nations Children's Fund
UNZA	University of Zambia
UPF	Ultra Processed Foods

Executive Summary

Undernutrition, especially in children under the age of five, has been declining at global level. However, sub-Saharan Africa has one of the highest rates of undernutrition and reduction is slow. Unfortunately, overweight and obesity are also on the rise across the continent and micronutrient deficiencies still persist, creating what has been dubbed the "triple burden" of malnutrition. The causes of undernutrition are multifaceted and they operate in complex ways. Malnutrition is linked to poor quality and quantity of dietary intake, among other factors. A higher dietary diversity score is associated with better nutritional outcomes among individuals. Additionally, regular physical activity plays a vital role in preventing overweight, obesity and non-communicable diseases (NCDs).

In Zambia, undernutrition has remained one of the major public health problems while the prevalence of overweight, obesity and diet-related NCDs, such as diabetes, cancer and cardiovascular diseases, is on the rise. The burden of malnutrition and diet-related NCDs is reflected in the increased risk of morbidity and mortality among the Zambian population. The Zambian FBDGs, grounded on current scientific evidence and principles, have been designed to promote healthy dietary patterns, physical activity and other healthy behaviours such as handwashing and discarding mouldy foods.

The FBDGs will help professionals working in the health, agricultural and nutrition sectors to provide coherent and harmonised nutrition guidance to the general Zambian population. Furthermore, policy makers from both the public and private sectors will benefit from the FBDGs when formulating policies which mainstream healthy dietary patterns and promote physical activity and regular handwashing, particularly at critical times.

The Zambian FBDGs have twelve recommendations for the general public and six recommendations for populations with special nutrition needs. The guidelines have taken into consideration cultural values, food diversity and food consumption patterns prevailing in the country, hence making them very practical and applicable to everyone in Zambian society, regardless of their cultural beliefs and location.

SECTION 1

About the Food-Based Dietary Guidelines for Zambia

1. THE ZAMBIAN FOOD GROUP GRAPHIC

The Zambia FBDGs are based on the six food groups, namely;

1. CEREALS, STARCHY ROOTS and TUBERS
2. VEGETABLES
3. FRUITS
4. FISH, INSECTS and ANIMAL SOURCE FOODS
5. DAIRY
6. LEGUMES, PULSES and NUTS.

Guidance is provided regarding the minimal use of fats and oils in order to balance the important role they play in the diet and the risk of NCDs. The food group graphic (Figure 2) was produced through diet optimization modelled on commonly available foods in each of the six food groups. The food guide features locally available foods, making it flexible and adaptable to every local community in the country.

Figure 2: The six food groups

2. THE ZAMBIA FOOD-BASED DIETARY GUIDELINES AT A GLANCE

The Zambia FBDGs are a combination of nine evidence-based dietary recommendations and three Healthy Practices Guides for the general public.

The dietary recommendations combine healthy food choices from the six food groups and limit calorie intake from other foods to promote healthy eating habits among Zambia's general population. The guidance also includes additional health-related behaviours such as handwashing, physical activity and food safety practices like discarding mouldy food. Each recommendation also has several practical examples of how to follow a healthy dietary pattern using locally available foods, including guidance on portion sizes. The guidelines include scientific and context-based evidence underpinning each recommendation. Furthermore, each recommendation is framed as a memorable key message, following pilot testing with consumers. The FBDGs recommendations could be used in developing consumer promotional materials and programmes.

EAT MORE

Eat different types of food from each of the six food groups every day to stay strong and healthy.	**Whole or milled grains (cereals) and starchy roots/tubers**	**Vegetables of different types and colours**	**Different coloured fruits**
	as part of your meals every day for a healthy heart and weight.	every day to provide your body with vitamins, minerals and roughage to prevent diseases.	every day to provide your body with vitamins and minerals to prevent diseases.
The six food groups are • **Cereals , starchy roots and tubers** • **Vegetables** • **Fruits** • **Fish, insects and animal source foods** • **Dairy** • **Legumes, pulses and nuts**	Aim for **4 servings per day** of whole cereals and starchy roots/ tubers (about 560 g) 	Aim for **3 servings per day** of raw vegetables (about 230 g or 1.5 cups cooked or 3 cups uncooked) 	Aim for **2 servings of fruit per day** (about 300 g or two medium size fruits like bananas or oranges or two cups of cut fruit) 
Beans, cowpeas, groundnuts, or other nuts	**Chicken and other poultry, fish, eggs, insects or caterpillars**	**Milk and milk products (like yogurt, sour milk, cheese)**	* If milk is not available, eat calcium-rich foods such as moringa, amaranthus, cowpeas leaves, cassava leaves, baobab fruit or leaves, tamarind leaves, kapenta and small fish eaten with bones.
daily to maintain good health. All these foods are rich sources of protein and a good substitute for meat.	every day to build and repair your body.	every day for strong bones.	
Aim for **2 servings of nuts and seeds per day** (about 180g [1 cup] cooked pulses or 60 g [6 tablespoons] nuts and seeds or a mix of 90 g [9 tablespoons] of pulses and 30 g [3 tablespoons] nuts and seeds). 	Aim for **1 serving per day** (about 50 to 115 g depending on the food selected from the food exchange list). 	Aim for **1 serving per day** (about 245 g) 	 

EAT LESS

Ultra-processed foods (UPFs) and foods high in salt, sugar, and fats and oils

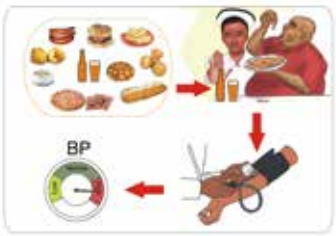
Prevent diseases like high blood pressure, sugar disease (diabetes) and cancer.

Salt: less than 5 g (just under 1 teaspoon) per day
Limit intake

Saturated fats: (such as animal fats and vegetable oil hard at room temperature like margarine):
Limit intake

Trans fats (such as oils used to fry foods in fast-food restaurants and ultra-processed foods:
Not recommended

Utra Processed foods (processed meats like bacon, sausage, and hot dogs; packages snacks like crisps, biscuits, Sugary drinks like soft drink and fruit flavoured juices, ice cream, etc.:
Not recommended



Cooking oil and animal fat

Use less when preparing food and choose meals with less fat and oils to avoid becoming overweight.

Limit added oils to **1 tablespoon (14 g) per day**. Use vegetables oils.

HEALTHY PRACTICES

1. **Throw away grains and legumes that are mouldy** because they are not safe for people and animals to eat. They can cause cancer and affect child growth.

2. **Wash your hands with soap and clean, safe water before handling food,** and wash food before preparation or eating to prevent diseases such as diarrhoea and worm infestation.

3. **Engage in physical activities at least 30 minutes every day.** Choose activities that you enjoy and can do regularly at home and at work, such as walking, carrying out household activities or playing to avoid being overweight and to maintain a healthy heart.

3. BACKGROUND AND CONTEXT

3.1 INTRODUCTION

Malnutrition is a public health problem in Zambia. The country is experiencing a triple burden of malnutrition with high rates of undernutrition, increasing rates of overweight and obesity, and persisting micronutrient deficiencies, despite making progress on some nutritional outcomes such as wasting among children. Thirty-five percent of children under the age of five are stunted (MOH, 2019) and underweight is also prevalent among the women of reproductive age (WRA) group (CSO, 2014). Furthermore, micronutrient deficiencies are also high, largely owing to the consumption of less diverse diets (Kaliwile *et al*., 2019; Grech *et al*., 2018). About 55 percent of WRA are zinc deficient and 18.6 percent have iron deficiency anaemia, while 3.2 percent are at risk of vitamin A deficiency (Alaofè *et al*., 2014).

Furthermore, the prevalence of diet-related NCDs is also on the rise and is contributing significantly to high mortality rates in the country. Unhealthy diets are one of the four major risk factors for NCDs in Zambia. The most common diet-related NCDs include some cancers, type 2 diabetes, hypertension and oral diseases. Other than health problems, the economic cost of malnutrition to individuals, households and the country at large are likely to be quite high (Global panel, 2016). Additionally, both undernutrition and over nutrition contribute significantly to morbidity, disability and mortality among Zambians.

Poor dietary patterns among Zambians remain quite prevalent. Up to nine in ten Zambians do not consume the recommended amounts of fruits and vegetables in a day (Pengpid and Peltzer, 2020). Overall, consumption of nutrient dense plant and animal source foods is quite low among Zambians. This partly explains the persistently high levels of both malnutrition and micronutrient deficiencies in the country (Harris *et al*., 2019). Adults in Zambia consume high amounts of salt, which is a risk factor for elevated blood pressure. There is also evidence of a rapid increase in the consumption of saturated fats among Zambian adults (Micha *et al*., 2014). While the factors associated with suboptimal dietary practices are multifaceted, poor nutritional knowledge is one of the main reasons for poor dietary intake. As a modifiable risk factor, poor dietary habits or behaviours can be improved through nutrition education (Bundala *et al*., 2020). Conflicting and inconsistent nutrition information significantly contributes to poor dietary habits among individuals (Spiteri Cornish and Moraes, 2015).

At the same time, Zambia is endowed with a wide variety of foods, making it possible to consume healthy and diverse diets which are essential for the prevention of malnutrition and diet-related NCDs.

3.2 RATIONALE AND RELEVANCE FOR THE FOOD-BASED DIETARY GUIDELINES

Zambia is facing multiple burdens of malnutrition. At the same time, the country is undergoing a nutritional transition with a shift from predominantly unprocessed traditional foods such as wild and locally produced fruit and vegetables, roots and tubers, to a diet consisting mainly of ultra-processed food and drink products. The nutrition situation – coupled with a complex, crowded, confusing and rapidly evolving nutrition information environment – makes it difficult for consumers to know what a healthy diet really means.

With the increased focus on the need for healthy diets and lifestyles, as well as the need to respond to public health and nutrition priorities, and food production and consumption patterns, the Government of Zambia recognised the importance of developing and implementing, for the first time ever, the Zambia National Food-Based Dietary Guidelines.

FAO and the World Health Organization (WHO) define national FBDGs as evidence-based recommendations which are aimed at promoting healthy diets and lifestyles in a particular country. FAO further defines FBDGs as a package of outputs for governments to outline what constitutes a healthy diet at a national level. The FBDGs are developed through an evidence-based, context-specific multi-sectoral process and a food system approach to serve as a reference for aligning food-related policies and programmes, and supporting social and behaviour change communication for a population to adopt healthier, more sustainable dietary patterns and practices.

FBDGs define what a healthy diet means to a country by providing harmonised food and

nutrition guidance that can inform and orient food-system policies and programmes that go beyond the health sector. The FBDGs provide advice on foods, food groups and dietary patterns that would provide the required nutrients to the general public to promote overall health and prevent chronic diseases while achieving the broader vision of the Zambia National Food and Nutrition Security Policy.

Unlike nutrient recommendations, which are not country specific, the development of FBDGs is driven by an individual country's need to address its public health and nutrition priorities. Furthermore, FBDGs are not meant to be used as clinical guidelines for disease treatment, but rather aim to promote health and prevent malnutrition and diseases. However, individuals with clinical conditions are encouraged to follow the FBDGs to optimise their nutritional and health status. The process of developing FBDGs also considers a number of food systems dimensions including national food production, food composition data, consumption patterns, sociocultural influences and accessibility.

FBDGs are also used to provide policy and programme guidance on food- and nutrition-related matters. The Government of Zambia, in collaboration with FAO, has developed FBDGs for Zambians to promote healthy eating. It is expected that the guidelines will ultimately contribute towards the national nutrition response, hence contributing towards achieving the Government's vision of having a well-nourished population free of all forms of malnutrition and capable of contributing to economic growth and diversification.

3.3 ABOUT THE FOOD-BASED DIETARY GUIDELINES (TECHNICAL RECOMMENDATIONS)

3.3.1 Target users for the FBDGs Technical Recommendations

The target users of this document are the technical experts who promote healthy food consumption and healthy diets. The guidelines are also designed for policy makers to ensure a conducive policy environment that enables consumers to follow the recommendations towards healthier diets.

The FBDGs are a resource for creating evidence-based interventions to form the basis of nutrition communication to the public including, but not limited to, mass and social media messages, nutrition education, promotion of diverse crops and livestock production, the regulation of food industries, and school-based nutrition programmes. However, the guidelines do not cover requirements during emergency situations such as droughts, floods, etc.

These guidelines aim to steer the Zambian population towards attaining a nutritionally adequate and healthy diet. While the FBDGs Technical Recommendations are written for professionals and educators, it is accompanied by a FBDGs Eat Well Guide for the general public that translates the FBDGs' recommendations into messages and visual illustrations tailor-made for all consumers, including those with low literacy levels.

The dissemination of the FBDGs includes the development of other simpler communication materials, including booklets and posters, and mobile apps, translated into three local Zambian languages. Through traditional media and new technologies, the consumer materials will ensure accessibility and ease of use by all. These materials will be made available as electronic and printed copies, and distributed for implementation in schools, health and agriculture extension centres, hospitals, markets and other food environments.

3.3.2 Target population group of the FBDGs

The FBDGs have been developed for the healthy general public between the ages of 0 and 65 years, who do not have significant medical conditions that may warrant specific diet modifications. In addition to the guidelines for the general population provided in Section 2, Section 3 provides added guidance for children under five years of age, adolescent girls, and pregnant and lactating women, given their special nutrition requirements. The FBDGs are meant to promote healthy eating and thus the improvement of the health and wellbeing of the general population.

3.4 GUIDING PRINCIPLES

3.4.1 Evidence based

The FBDGs are based on the prevailing nutrition landscape in Zambia and current scientific evidence on the relationship between diets or dietary patterns and nutritional or healthy outcomes. Prior to developing the FBDGs' recommendations, evidence was synthesized and consolidated into one of the FBDGs' process outputs called the Zambia Evidence Review Document.

3.4.2 Addresses Zambian nutrition priorities

The guidelines aim at promoting healthy dietary patterns to contribute towards addressing the high levels of undernutrition and the emerging problem of overweight and diet-related NCDs, which were identified and prioritised by the FBDG Technical Working Group (TWG) based on the Zambia Evidence Review conducted for the FBDGs. The guidelines target the following priority problems identified at the population level:

1. Undernutrition and micronutrient deficiencies
2. Overweight, obesity and diet-related NCDs (e.g. diabetes, hypertension, cardiovascular diseases, (CVDs) and cancers)
3. Poor diet in terms of quality and/or quantity
4. Poor infant and young child feeding practices
5. Poor hygiene and environments
6. Physical inactivity

3.4.3 Based on globally recommended FBDGs development process

The guidelines are based on a scientific process of developing FBDGs in order to enhance the credibility of the recommendations for public use. These processes included national, multi-sector FBDGs TWG engagement in eight of the ten steps of the FBDGs process as, shown in Figure 2, as per FAO and WHO (1998) guidance.

3.4.4 Considers the cultural diversity of Zambia

The guidelines reflect the cultural diversity of the country. The recommendations apply across the cultural divide and therefore represent optimal dietary practices attainable by all Zambians. The pretesting of the FBDG recommendations and visual illustration included a discussion on the cultural acceptability of the guidance.

3.4.5 Founded on healthy diets from sustainable food systems

The FBDGs are grounded on the sustainable food systems approach driven by the understanding that adoption of the guidelines is, to a larger extent, dependent on a nutrition-sensitive and sustainable food system.

Healthy diets from sustainable food systems are dietary patterns that promote all dimensions of individuals' health and wellbeing; have low environmental pressure and impact; are accessible, affordable, safe and equitable; and are culturally acceptable (FAO and WHO, 2019). The Zambia FBDGs emphasise healthy diet principles, which include making whole grains, legumes, nuts and a variety of fruits and vegetables a major part of the diet.

There is increasing evidence of the health benefits of plants (grains, legumes, nuts and a variety of fruits and vegetables) on human health (Micha, 2014; MOH, 2019). Eating a diet predominantly based on whole grains, legumes, fruits and vegetables, fish and insects is not only good for our health, but it is good for planetary health too. Growing whole grains, legumes, fruit and vegetables, and producing fish and insects does not produce as much greenhouse gas as raising cattle or large livestock. Raising livestock produces 14.5 percent of all greenhouse gas emissions, with cattle (raised for both beef and milk, as well as for inedible outputs like manure and draft power) contributing 65 percent of the livestock sector's emissions (FAO, 2021a).

Whole grains, pulses, fruits and vegetables, insects and fish also help reduce waste and lower pollution. Such a dietary pattern also reduces water and land use, slows deforestation and reduces the destruction of topsoil, among other benefits.
Further, the FBDGs also encourage the consumption of fresh, unprocessed or minimally processed foods as a critical part of sustainable healthy diets.

Reducing the intake of red meats and processed meats like bacon, ham, sausages and burgers, and replacing these with healthier plant-based food options, insects and fish helps to reduce the risk of obesity and associated NCDs such as heart disease, diabetes and cancer. A smaller portion of the meals may include healthier animal source foods like fish, chicken, insects, eggs and low-fat dairy products.

3.4.6 Uses consumer-driven language

The guidelines for the general population (Eat Well Guides) use simplified terms that are easy to understand among the target audience. The use of scientific words is minimal and those that are used are likely to be familiar and understood by the primary targets.

3.4.7 Practical

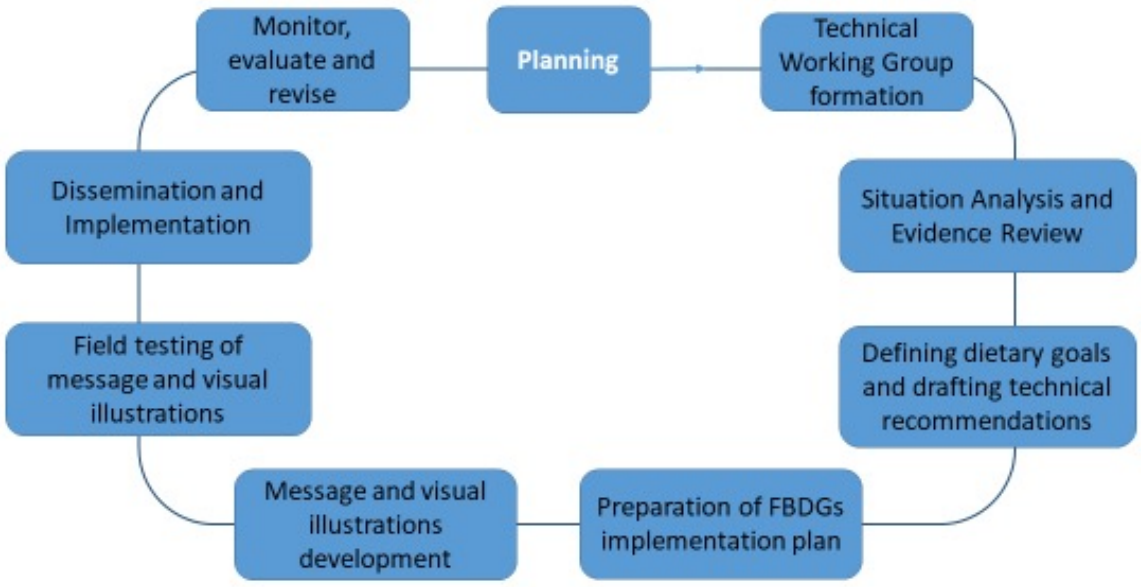
The recommendations contained in the FBDGs are for everyday practical use by all Zambians regardless of their location and economic status.

The foods and dietary behaviours promoted are sensitive to the prevailing conditions among Zambians. The guidelines also include tips to empower consumers to make healthy choices.

4. METHODOLOGY/PROCESS OF DEVELOPING FBDGS

The development of the Zambia FBDGs was necessitated by the need to define what a healthy diet means in the Zambian context, and to harmonise the national nutrition recommendations, guidance and messaging in a systematic, evidence-informed and scientific way. To that effect, the Government of the Republic of Zambia followed the process for developing the guidelines based on the FAO and WHO, 1998 recommended steps, to ensure that the developed guidelines are as credible as possible and to address the prevailing national diet-related public health and nutritional needs. The development process comprised the following eight of the ten key steps (Figure 2). Once the guidelines are endorsed, it is expected that various stakeholders will disseminate and implement the FBDGs and thereby be able to monitor the impact of the FBDGs on the Zambian population.

Figure 2: The 9 steps for developing FBDGs



4.1 THE FBDGS DEVELOPMENT PROCESS STEPS

4.1.1 Planning

Realising that Zambia had inadequate national harmonised and scientifically generated recommendations that promote healthy dietary patterns, the Ministry of Agriculture (MoA) and the National Food and Nutrition Commission (NFNC) initiated the development of the FBDGs in Zambia with a request for technical and financial support from FAO through a Technical Cooperation Programme (TCP). The European Union (EU), through the PEP II programme, also supported the process via the MoA. Thus, the development of the Zambian FBDGs began with planning meetings between FAO, the MoA and the NFNC.

4.1.2 Technical Working Group formation

The MoA facilitated the formation of the national TWG. The TWG is composed of members from both the public and private sectors, comprising 21 stakeholder organizations. In addition to the MoA, the members of the TWG included the

Ministries of Health, General Education, Fisheries and Livestock, Community Development and Social Welfare and the NFNC. Members from the private sector and civil society organizations were from: Civil Society Organizations for Scaling up Nutrition (CSO-SUN), Hivos-Zambia, Programme Against Malnutrition and Nutrition Association of Zambia; and Indaba Agricultural Policy Research Institute. Members from academia and research institutes were from: University of Zambia, Lusaka Apex Medical University, and National Institute for Scientific and Industrial Research and Development. Members from partners agencies were from: WHO, United Nations World Food Programme (WFP), UNICEF, FAO, the EU and United States Agency for International Development (USAID). Each of the TWG members signed a form indicating no conflict of interest. The TWG was further grouped into areas of specialty to help with evidence gathering and validation. The MoA, together with the TWG, NFNC and FAO, then agreed on the road map and resources required for the development of the FBDGs.

4.1.3 Scientific evidence review and situation analysis

The gathering and review of evidence for the development of the Zambia FBDGs was done by the FBDGs TWG, a national consultant and consultants from the Sokoine University of Agriculture in Tanzania. FAO trained the TWG and the national consultant on gathering and reviewing of evidence. The review process was based on agreed upon guiding questions which focused on the following main themes in the Zambian context: Risk factors and problems associated with diet; food consumption patterns; review of policies; review of programmes related to food and nutrition; review of behaviours and food-related habits (knowledge, attitudes, practices); review of other related behaviours; food environment and settings; the media; and food sustainability. The review also looked at global evidence on the relationship between diet and lifestyle with nutrition and health outcomes. The review adopted a systematic search of both peer-reviewed journal articles in electronic databases as well as policy documents and various other government publications.

The main output from this stage was the Situation Analysis and Evidence Review (SAER) Report, which was technically validated during a week-long workshop from 20 October to 2 November, 2018. During the evidence validation process, additional members from academia and civil society were invited to strengthen the feedback on the evidence. Thus, 15 stakeholder organizations represented by 33 participants attended the workshop. The validated evidence facilitated the development of key technical recommendations around which the FBDGs are based.

4.1.4 Drafting the FBDGs Technical Recommendations

4.1.4.1 Ranking priority problems and setting dietary goals

Based on the draft evidence review and situation analysis, 24 TWG members identified over 35 nutrition, diet-related and behavioural problems during a workshop held in May 2018. The TWG consolidated similar problems and compiled a list of 22 problems which they ranked to identify 10 priority problems to be addressed by the FBDGs.

During the ranking of the nutrition problems, each member of the TWG used a 'decision matrix". The matrix ranked problems in terms of magnitude, feasibility, and impact and spillover effect on a scale of zero to five. Once the points were assigned to each problem, the scores were consolidated and the problems with the highest scores were selected.

The TWG then set dietary and lifestyle goals to address the priority problems. They defined critical nutrients and critical foods and food groups to address the nutrition problems. The FBDG TWG decided and agreed on six food groups for the FBDGs and established food intake recommendations for each food group and subgroups, by adopting and adapting one or

DECISION MATRIX

- Magnitude of the problem
- Feasibility to solve the problem through FBDGs implementation interventions including determining how easy or likely it is to change the behaviour.
- Likely impact if the behaviour were to be changed.
- The spillover score was based on the centrality of the behaviour in the system of behaviours and the positive spillover effect if that behaviour were to be changed.

a combination of both locally or internationally recognised standard references from Table 1.

4.1.4.2 Drafting and review of the technical recommendations

TWG members from ten stakeholder organizations represented by 18 participants reviewed the FBDGs technical recommendations during a workshop that commenced on 22 to 26 July, 2019. The FBDGs writing team then drafted the FBDG Technical Recommendations and the FBDGs Eat Well Guide. The process of drafting the technical recommendations was informed by the evidence review, nutrition-related problems and dietary and lifestyle goals.

4.1.5 Diet modelling and food group graphic

Diet modelling is mathematical (linear) programming that translates the nutrient requirement for each population group into food group amounts by simultaneously solving several equations with numerous variables and considerations (constraints), such as consumption patterns, energy and nutrient goals, the cost of the diet, and the environmental impact of the recommendations. The linear programme optimisation selects the best solution for a combination of foods (types and quantities) which will meet the set of goals (constraints).

Some of the products of diet modelling include a breakdown of the contribution of each food group to the total energy and nutrients in several formats, including pie charts. Other products include the total and proportion contribution in food weight amounts, servings and serving sizes for each food group. The pie chart is the basis for the FBDGs food group graphic.

The Zambia Food Group Guide provides a graphic representation of the six food groups, with the aim of visually communicating a desirable eating pattern for each food group through the proportions suggested in the graphic per day. The amount contribution of each food group was calculated through diet modelling and using linear programming to meet the 2 100 kilocalories (Kcal) and essential nutrient requirements per day. The FBDGs food group guide graphic is based on general population requirements.

Furthermore, diet was modelled based on consumption patterns of foods by the general population and the recommended nutrient and energy requirements. During diet modelling, the following factors were considered:

1. The energy levels to be covered by the specific food pattern and specific population needs. The general population energy level for the diet model was set at 2 100 Kcal per day based on the average calculations using the FAO, WHO and United Nations University (UNU) 2004 human energy requirements. The calculations ensured that the energy needs for women of reproductive age (19 to 50 years) are met. The calculations also took into consideration the rural versus urban population proportions and their physical activity levels (PAL); noting that PAL values are the same between men and women who have the same activity levels (FAO, 2004). Birth rate and body weight/body mass index (BMI) for age were also factored into population energy calculation. Diet models for other populations with special needs like under-five children, adolescent girls, and pregnant and lactating women are provided in Section 3 of these FBDGs.
2. The nutrients of key public health importance, especially those micronutrients of concern such as iron, vitamin A, calcium and zinc. This was based on micronutrient needs for WRA from WHO and FAO and WHO (2004) vitamin and mineral requirements in human nutrition.
3. The six food groups that represent a diversified diet for Zambia, and their nutrient profiles. Drawing from food composition tables, the diet model optimization ensures that when combined in various amounts, the six food groups meet the energy and nutrients requirements for the target population.
4. The serving size Kcal or gram (g) outputs should be as close as possible to usual portion sizes and easily estimated using common household measures.
5. Zambia food consumption patterns and local foods that are widely accessible and culturally acceptable.
6. The minimum cost of the proposed recommendations in the food group amounts that meet the energy and essential nutrient targets.

After these decisions were made, the most commonly consumed foods and their nutrient profiles were entered into the programme. The proportion contribution of each food to the food group was weighted appropriately using Zambia's food consumption data or expert opinions when data was not available.. The recommended intake for each food group was calculated by the programme using minimum and maximum food quantities that were compatible with current eating habits, while striving to optimise the pattern to meet nutrient requirements, especially those of interest to the target population. The recommended amounts of each food group were determined when food consumption data was available and the existing diet was also well considered, with attempts made to deviate as little as possible from the current diet when the optimal diet was calculated. After the dietary pattern was optimised, a graphic representation of the model was created to depict the food groups and their proper proportions to be consumed (suggesting each food group's recommended proportion of the total diet).

The Zambia diet modelling was completed with assistance from FAO headquarters and the Sub-Regional Office of Southern Africa by utilizing existing food consumption data and expert opinions. Although the South Africa Food Composition Table (FCT) is close to Zambia's food composition, the models used the publicly available West African and United States Department of Agriculture (USDA) FCTs for nutrient analysis. Data was processed through an Excel programme written by MS-Nutrition (Marseille, France). The diet modelling was preceded by a regional training in Tanzania, including five TWG members from Zambia. One of the outputs from the training was for each country TWG to come up with diet models for their respective countries.

4.1.6 FBDGs' message and food group guide co-creation and pilot testing

The team that prepared the key messages and associated visuals from the FBDGs recommendations comprised a group of 25 members of the general population, agriculture extension officers and health workers drawn from communities around Kafue District in Lusaka Province. These co-created messages and the food group guide were first pilot tested among diverse groups drawn from the public, representing various social backgrounds in Lusaka. Pilot test participants selected the most favoured food group guide format, which was then used as the visual illustration in diet modelling. The co-creation and pilot testing was facilitated by Mango-Tree Enterprises from Uganda from 23 to 26 July, 2019.

Training of pretest facilitators

4.1.7 Field pretesting of messages, food group guide and visuals, and validation of FBDGs

The Zambian FBDGs were extensively pretested to achieve four specific objectives, namely; to ensure that the developed guidelines (in the form of messages, a food group guide and associated visuals) are understood by an average Zambian with very basic or little knowledge of nutrition concepts and terms. The exercise was carried out to ensure acceptability and cultural appropriateness; to ensure applicability of the guidelines to the general public, including an assessment of barriers such as affordability and availability, and motivation for change; as well as to ensure message and image effectiveness. The pretest sought to establish promotional channels that would enhance the adoption of the FBDGs messages and visuals. The developed messages, food group guide and visuals were pretested three times across different sites and times of the year in the English, Nyanja and Bemba languages. For the English messages, the pretesting also ensured that the messages

TWG facilitating a pretesting session with community members

are understood by an average Zambian with a basic education of eight to ten years of schooling. Due to financial constraints, the messages were pretested in Nyanja and Bemba languages only.

In November 2019, pilot pretesting was conducted in 21 locations within Chongwe, Lusaka, Samfya and Luangwa districts, with two Focus Group Discussions per site and a total of 459 community members participating, some in English and others in Nyanja and Bemba. The images and English messages were revised and pretested again in September 2020. A total of 433 women participated in 54 Focus Group Discussions at 18 locations in Chongwe, Nchelenge, Nyimba, Lusaka districts.

The FBDGs, including the diet models, messages and visuals, were validated in multiple steps. In May 2021, a total of 16 TWG members from ten institutions reviewed the draft FBDGs technical manual and provided inputs. A two-day validation workshop was then held in August, 2021, where 56 participants from 21 institutions validated the FBDGs technical document. These institutions included different line ministries, research and academia, the Nutrition Association, food processing companies, UN agencies and other cooperating partners (see Annex 2 for details).

4.1.8 Preparation of the FBDGs Implementation Strategy and Plan

Mango Tree Enterprises, together with the TWG, held discussions on how the FBDGs are to be disseminated and used. The key output achieved was an implementation strategy supported by a multi-sectoral action plan on capacity development, communication and promotion activities.

4.1.9 Dissemination and implementation

There are four main outputs of the FBDGs process that have policy and programme implementation applications: the FBDGs Technical Recommendations for professionals; the FBDGs Eat Well Guide for the general public; the Food Group Guide; and the Situation Analysis and Evidence Review document. The dissemination method depends on the type of the document and the target audience for each product.

4.1.10 Monitor, evaluate and revise

During implementation, monitoring the use and application of the FBDGs and their impacts will be critical to ensuring that the intended objectives of the FBDGs are realised.

4.2 FBDG DIET MODEL COST OF DIET FOR A 2 100 KCAL DIET PER INDIVIDUAL

The diet model used for the six food group quantities costs **ZMW 15.9/per person/day.** The price used in the diet model was sourced from the WFP and is reflective of what was prevailing in the second quarter of 2021. The following foods contributed to the model in various weightings (see Annex 1): Cereals, roots and tubers (cooked nshima, brown rice, boiled cassava root, white bread/rolls, boiled deep yellow sweet potato); fruits: papaya, banana, mango, orange and avocado; vegetables (boiled pumpkin, cassava, amaranth, spinach, moringa [drumstick] and sweet potato leaves, and tomato); pulses, nuts and seeds (boiled cowpeas, beans, and groundnuts), animal sourced foods (ASF) and insects (cooked mopane worms, tilapia, kapenta/anchovy, chicken, chicken eggs, chicken liver and cow, pig, goat and sheep meat). This model was based on the weightings of common portion sizes and frequency of consumption, dairy products (cow's milk), vegetable oil and discretionary foods (sugar).

Another model with a reduced cost of **ZMW 12/ per person/day** was also formulated. This model is based on the same foods as above but with reduced weightings of individual (more costly) foods to the respective food group, while increasing the weightings of cheaper foods (so that the cost of the food group goes down proportionately). For further details, refer to Annex 1.

4.3 FBDGs PRODUCTS

4.3.1 Situation Analysis and Evidence Review (SAER) Report

The SEAR Report provides detailed evidence of the diet and health relationships, risk factors and proven healthy eating patterns that reduce risks and promote healthy outcomes. The SEAR analysed the nutrition and health situation that guided the priority problems to be addressed by the FBDGs and informed decisions on the recommendations. Thus, the SAER ensured that the dietary guidance remained scientifically sound and relevant.

4.3.2 The Zambian Food-Based Dietary Guidelines (Technical Recommendations)

The Zambian FBDGs Technical Recommendations document is primarily intended for use by professionals in the nutrition, health, agriculture, food systems, education and social protection sectors. This technical manual was developed to provide more detailed information on the amounts and types of foods to be consumed for optimal

health and wellbeing, reducing malnutrition as well as minimizing the risk of diet-related NCDs. The manual provides detailed evidence and explains the science behind the recommendations. The document can be used as a basis to develop advisory and education materials for counselling, classroom teaching, community education, health promotion, and menu development or evaluation.

4.3.3 Zambia diet models and serving sizes

The linear programming used provided various diet models. The Zambia FBDGs model met the 2 100 Kcal target for recommended key nutrients intake, which was closest to Zambia's portion sizes and was one of the lower cost models. The models determined the serving sizes based on Kcal outputs linked to food list exchanges in weight and which aligned with common household measures.

4.3.4 The Zambia FBDGs: Eat Well Guide for the general public

The Zambia FBDG Eat Well Guide translates the healthy diets concepts into easy-to-understand practical steps in order to ensure that the ultimate beneficiaries of the guidelines, the Zambian general public, use and practice the recommendations. As part of the FBDGs implementation plan, various sectors will develop additional educational materials for numerous target groups to ensure wide coverage across the entire Zambian society.

SECTION 2

The Food Based Dietary Guidelines for the general population in Zambia

This section details the FBDGs. Each recommendation is described in detail: what it is about, its importance – specifically the importance of consuming the food group in the right amount, and the expected health outcomes, including the scientific reasoning for the recommendation. The section also details the current consumption patterns and the gaps identified as the basis for why the guidelines were developed. Recommended amounts of consumption, including visuals of the correct amounts, proportions and serving sizes required per day are provided. Each guideline also includes tips for small changes individuals can make in order to follow the recommendation.

Recommendation 1

Eat different types of food from each of the six food groups every day to stay strong and healthy

5. RECOMMENDATION 1: Eat different types of food from each of the six food groups every day to stay strong and healthy.

5.1 GETTING TO KNOW THE SIX FOOD GROUPS

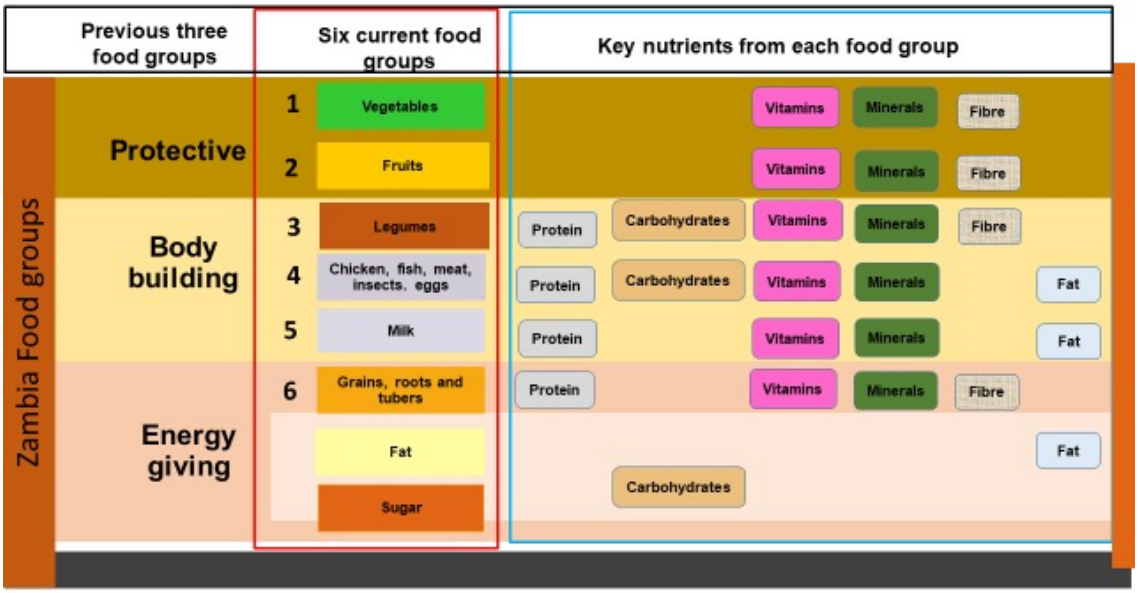
Foods are divided into macronutrients (nutrients required by the body in larger amounts) and micronutrients (nutrients required by the body in smaller amounts). Most foods are mixtures of nutrients. Most of them have a few essential nutrients, with some nutrients in large amounts and others in small amounts or none at all. Food groups are grouped according to the key and similar nutrients that they contain in large amounts. Each of the six food groups has a unique and important role to play in the body. The six Zambian food groups are: (1) cereals and starchy roots and tubers; (2) vegetables; (3) fruits; (4) pulses, legumes and nuts; (5) animal source foods such as insects, poultry, fish and meats; and (6) dairy.

In the Zambian FBDGs, fruits and vegetables are presented as separate groups. This was done in order to encourage the consumption of fruits.

The FBDGs TWG also decided to separate milk and milk products from animal source foods, like many other FBDGs do, for three main reasons: (1) To emphasise this important food and encourage consumption given the low intake of milk in Zambia; (2) Milk and milk products are an important source of calcium, among other nutrients, for all age groups (Willet *et al*., 2019; GBD, 2017; FAO, 2013a); (3) When consumed at an appropriate age (from one year of age), cow's milk is associated with increased linear growth and can help prevent stunting, especially during the first two years of life. This is because in children with a poor nutritional status, milk is likely to supply nutrients that are important for

growth but which are deficient in the diet, while in well-nourished children, the effect of milk on linear growth is likely through the stimulation of insulin-like growth factor 1 (IGF-1) (FAO, 2013a). Previously, foods in Zambia were grouped into three broad categories based on their function in the body. The three categories were body building foods, protective foods and energy giving foods. For example, legumes and meats were grouped only as body building foods. However, legumes are also good sources of energy, vitamins and minerals. In addition, legumes play a key role in reducing some NCDs, while red meats increase the risk factors of NCDs. Globally, the new food grouping system currently puts foods with similar nutrients together. The current grouping system uses food groups like fruits, vegetables, cereals, roots and tubers, pulses, nuts and seeds etc. rather than grouping foods based on the main nutrient provided.

Figure 3: How the old three food groups link to the new six food groups



5.2 WHY IT IS IMPORTANT TO EAT A VARIETY OF FOODS EVERY DAY

Figure 4: The six food groups

Apart from breast milk consumed during the first six months of life, there is no other food or food group which supplies all the daily energy and nutrient requirements. The human body needs more than 50 different essential nutrients to stay nourished and function properly. A person's nutritional status depends on the overall balance of foods eaten on a daily basis, as well as on the needs of the individual. Thus, a diet with limited variety and which does not include all food groups is more likely to be deficient in one or multiple nutrients, placing the individual at risk of malnutrition. In addition, a meal containing a variety of foods is also more appealing, enjoyable and satisfying.

Although foods are grouped together into six food groups because they provide similar key nutrients and similar key functions in the body, different foods within that food group provide varied amounts and combinations of nutrients and other beneficial substances such as phytochemicals and fibre. For example:

1. **Vegetables** are good sources of vitamins (antioxidants), minerals and fibre. Although vegetables are a great source of vitamin C, only dark green leaf and orange-coloured vegetables contain significantly more vitamin A than other vegetables.

2. **Fruits** are good sources of vitamins (antioxidants), minerals and fibre. However, orange fruits like mango and papaya are high in carotenoids such as beta-carotene (pro-vitamin A) while blue and purple fruits contain anthocyanins, another powerful antioxidant. Some fruits like oranges, lemons and baobab (chibuyu) are high in vitamin C, while bananas are high in potassium. Avocados are a good source of healthy fats. Thus, eating different coloured fruits and vegetables ensures that individuals get all the nutrients necessary for good health.
3. **Beans, pulses, legumes and nuts** are good and affordable sources of protein, vitamins, minerals and fibre. Nuts are also a good source of healthy oils.
4. **Poultry, fish, insects, mice and meats** are rich sources of protein, vitamins and minerals such as iron, zinc and calcium. While all fish provide the body with protein, small fish like kapenta are a great source of calcium when eaten with the bones. Livers are the richest source of iron.
5. **Cereals and starchy roots and tubers** provide carbohydrates which are a primary source of energy for the body. Whole grain cereals are also a rich source of fibre. Cereals also supply small amounts of protein, vitamins and minerals while orange-fleshed sweet potato and maize are rich in vitamin A and also contain some vitamin C, vitamin B6, potassium and manganese.
6. **Milk and milk products:** Although milk contains sufficient amounts of calcium and protein, it is comparatively deficient in iron and vitamin C, whereas fruits like oranges are relatively rich in vitamin C but deficient in protein.

Since each food has only a few essential nutrients and not all the nutrients the body needs, eating a variety of food from each of the six food groups and a diverse combination of foods from within the food group will help the body meet all the essential nutrient requirements and prevent diseases, including NCDs. There are plenty of options to choose from within each of the food groups.

Over three quarters of the foods should include a variety of plant-based foods such as fruits, vegetables, grains, tubers, pulses, nuts and seeds daily. A diversified diet includes small amounts of fish, poultry eggs, insects or white meat eaten daily. Red meat should only be eaten occasionally or avoided where possible. Milk and milk products should also be included in diets. Where dairy products are not available, additional servings of small fish eaten with bones, moringa or pulses should be consumed to get the benefits of calcium and protein that dairy products provide.

5.3 THE SCIENCE BEHIND THE BENEFITS OF EATING A VARIETY OF FOODS

The consumption of a variety of foods across and within food groups is associated with improved dietary quality and diet micronutrient adequacy, hence increasing the likelihood of both adults and children meeting their daily nutrient requirements (FAO and FHI, 2016; Martin-Prevel *et al*., 2017; Hatløy, Torheim and Oshaug, 1998; Oldewage-Theron and Kruger, 2008; Steyn *et al*., 2006). Dietary diversity thus prevents various forms of malnutrition, such as stunting, wasting and micronutrient deficiencies.

Basing diets on a variety of foods also reduces the risk of developing several NCDs such as cancers, and other diseases and even death (Wirt and Collins, 2009). For example, individuals consuming a variety of nutritious foods from different food groups and within a food group are significantly less likely to die from cardiovascular diseases (CVDs) such as heart diseases and stroke (Yu, Malik and Hu, 2018; WHO, 2017a).

5.4 HOW THE BODY BENEFITS FROM EATING A VARIETY OF FOODS DAILY

A diet based on a variety of healthy foods provides adequate nutrients and energy. Foods from plants also contain bioactive non-nutrient compounds. The most common biologically active non-nutrient components are called phytochemicals (Zhang, 2015). While phytochemicals are known to be independently associated with improved health and nutritional status, their effect is much more pronounced when consumed in the form of whole plant-based foods than when isolated as single phytochemical compounds (Heneman and Zidenberg-Cherr, 2008; Xi and Liu, 2016). The proposed mechanisms for their beneficial health effects include their role in protecting body cells from toxins found in the body, lipid and blood sugar lowering effects, as well as strengthening the body's immune system (Yu, Malik and Hu, 2018; Kris-Etherton *et al*., 2002).

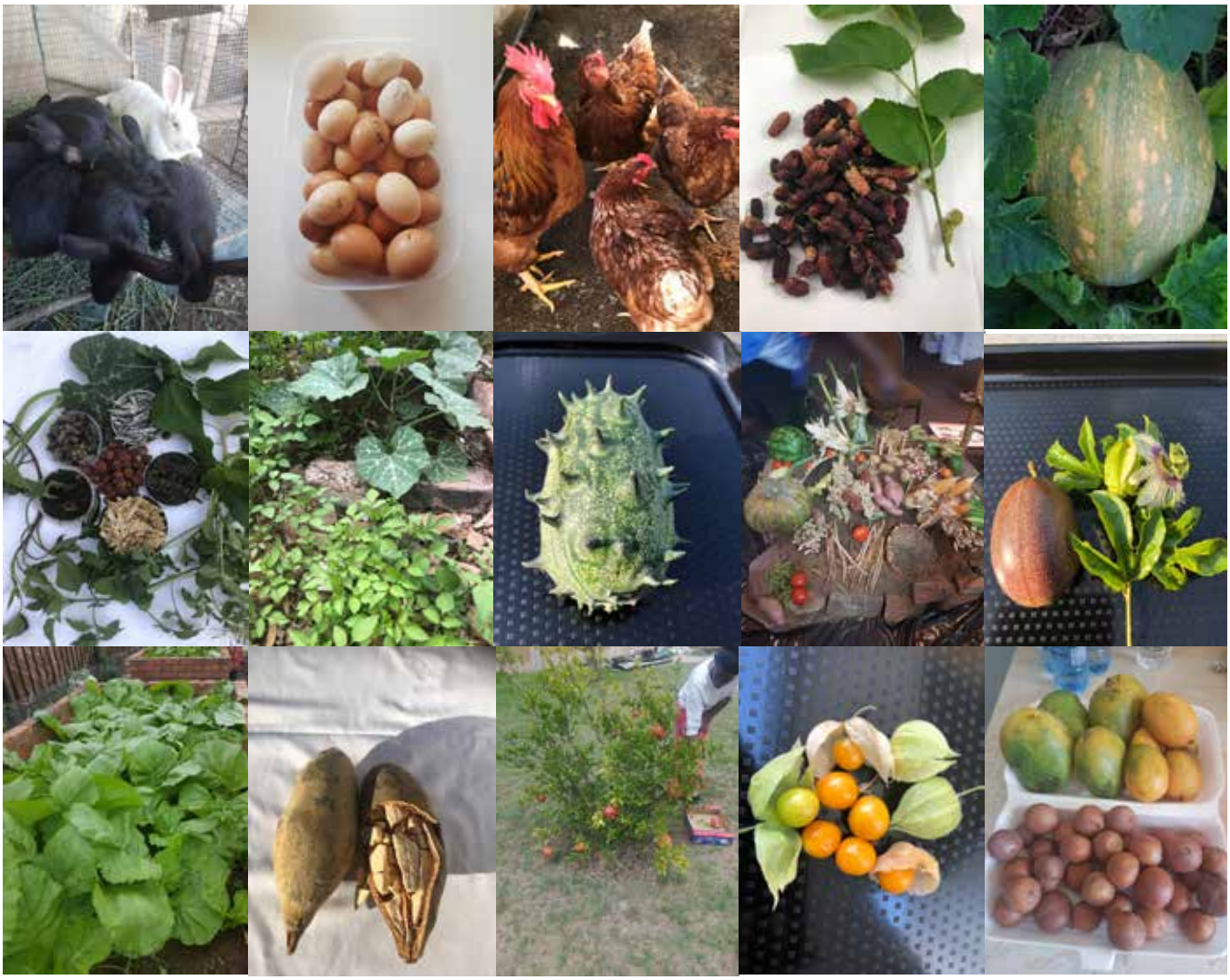
Eating a variety of foods also contributes to preventing both deficiencies or excesses of single nutrients (Smiciklas-Wright, Krebs-Smith, H., and Krebs-Smith, J., 1986) as well as reducing the risk of exposure to contaminants in any single food item, since toxicity increases with an increase in the amount of contaminated foods consumed (Hodgson, Hsu Hage and Wahlqvist, 1994).

5.5 DIETARY DIVERSITY AMONG ZAMBIANS

Evidence suggests most Zambians do not base their diets on diverse foods (Mukuka, Simwanza and Tembo, 2009). The diet of most Zambians is monotonous, mostly dominated by maize-based foods such as nshima, which makes up most of the dietary calories for most Zambian diets. Furthermore, most Zambians prefer highly processed maize flour (breakfast meal), which is low in nutrient density as it just provides carbohydrates. The nshima is mostly accompanied by poorly cooked vegetables which have lost their nutrients. Consumption of protein-rich foods, such as legumes, pulses, nuts and animal sourced foods, which are also rich in essential nutrients, is also quite low among Zambians.

However, Zambia is endowed with a wide variety of nutritious foods available throughout the different seasons, including traditional and underutilised foods on which individuals can base their healthy diets (Mukuka, Simwanza and Tembo, 2009). Both individuals and communities should take advantage of the diverse food sources available, and choose a variety of locally available foods that are relatively affordable (Baldermann *et al*., 2016). Dietary diversity based on locally available foods contributes to sustainable diets.

Figure 5: Examples of food commonly found in Zambia



5.6 RECOMMENDATION & GUIDANCE

ON EATING A VARIETY OF FOOD

1. Eat different types of food from each of the six food groups every day to stay strong and healthy.
2. Make whole grain cereals, vegetables, fruits and beans and legumes a major part of your meals daily.
3. Eat nutrient dense foods to get most of the nutrients your body needs with less calories.
4. Eat whole or milled whole grains (cereals), starchy roots and tubers as part of your meals every day for a healthy heart and weight
5. Eat plenty of different coloured vegetables every day to provide vitamins, minerals and roughage to prevent diseases.
6. Eat different coloured fruits every day to provide vitamins and minerals to prevent diseases.
7. Eat chicken and other poultry, fish, eggs, insects or caterpillars daily to build and repair your body.
8. Eat beans, cowpeas, ground nuts, or nuts daily to maintain good health. All these foods are rich sources of protein and a good substitute for meat.
9. Take milk and milk products or foods rich in calcium every day for healthy bones and teeth.

5.7 THE CORRECT AMOUNT TO EAT FROM EACH OF THE SIX FOOD GROUPS

Eating a variety of foods from all the six food groups daily and in the right amounts is part of a healthy diet. Eating less than the recommended amounts from the food group can lead to malnutrition, such as underweight, stunting, and micronutrient deficiencies caused by a dietary deficiency of certain vitamins and/or minerals. Eating too much or less than the recommended amounts is also associated with diet-related NCDs such as type 2 diabetes, some types of cancers and heart diseases. Thus, eating the right amounts of each food increases a person's chance of living a longer and healthier life.

The amount of nutrients and food required varies according to an individual's specific needs, mostly determined by the person's gender, age, height, weight, physical activity level and physiological state. Since this is a guideline for a healthy population based on a 2 100 Kcal diet, the guidelines do not distinguish the serving size by individual needs. However, everyone consuming the recommended amounts will be able to meet the minimum dietary requirements for optimal health and nutrition status, prevent overweight and obesity and reduce the risk of NCDs. Details of diet model intakes for other age groups and Kcal diets are found in Annex 1.

5.7.1 Global nutrient and food intake recommendations

For each food group, recommended amounts to eat per day in order to get the nutrients that the body requires and to maintain good health are provided. The scientific basis for the recommended amounts per day are based on global guidance on energy contributions from macronutrients and the recommended amounts of different food groups summarised in Table 1, as well as the Zambia diet modelling taking into account the Zambian context.

Table 1: Summary of recommended global daily nutrient and food intake amounts

Summary of recommended global daily nutrient and food intake amounts				
Food groups and nutrients	**EAT-Lancet***	**GBD study**	**FAO and WHO**	**WCRF and AICR**
	Grams (g) and/or percentage of total energy (%)			
Carbohydrates	<60%	-	-	-
Whole grains	232 g 0-60%	>125 g	55-75%	-
Starchy vegetables: potato and cassava	50 (0-100) g	-	-	-
Dietary fibre	-	-	>25 g	>30 g
Vegetables (total)	300 (200-600) g	360 g	400-500 g (fruits and vege-tables)	>400 g (fruits and vegetables)
Dark Vegetables	100 g	-	-	-
Red and Orange Vegetables	100 g	-	-	-
Others Vegetables	100 g	-	-	-
Fruits	200 (100-300) g	250 g	-	-
Milk (or equivalent)	250 (0-500) g	>435 g	-	-

Summary of recommended global daily nutrient and food intake amounts				
Food groups and nutrients	**EAT-Lancet***	**GBD study**	**FAO and WHO**	**WCRF and AICR**
	Grams (g) and/or percentage of total energy (%)			
Protein	10%	-	8-12% Adults: 0.83 kg per kg body weight	-
Animal meat and animal products	-	-	-	-
Beef, lamb (red meat)	7 (0-14) g	<22.5 g	-	300-500 g/ wk (cooked weight)
Pork	7 (0-14) g	<2 g (processed)	-	-
Chicken and other poultry	29 (0-58) g	-	-	-
Eggs	13 (0-25) g	-	-	-
Fish	28 (0-100) g	>250 mg (Omega-3)	1-2 servings/wk	-
Legumes, nuts and seeds (total)	125 g	-	Included in fruits and vegetables	-
Pulses	50 (0-100) g	>60 g (legumes)	-	-
Soya products	25 (0-50) g	-	-	-
Peanuts	25 (0-75) g	>20.5 g (nuts and seeds)	-	-
Tree nuts	25 g	-	-	-
Fats	-	-	15-30% (total energy)	-
Palm oil	6.8 (0.6.8) g	-	-	-
Unsaturated fats	40 (20-80) g	>11% (PUFA)**	6-10%	-
Lard or tallow	5 (0-5) g	<7% (SFA)**	<10% (SFA)**	-
Sweeteners (all)	31 (0-31) g	<2.5g per day from 226.8 g of SSB	<10% <5% for added benefits	
Sodium	-	<3 g/day 24-hour urinary sodium	2 g/day (sodium) 5 g/day (sodium chloride)	
*Based on 2 500 kcal g/d **Polyunsaturated fatty acid (PUFA); saturated fatty acid (SFA); sugar-sweetened beverage (SSB)				
References: FAO, 1998; WHO and FAO, 2002; WHO, 2020a; WHO, FAO and UNU, 2007; Willet et al., 2019; EAT-Lancet, 2019; World Cancer Research Foundation (WCRF) and American Institute for Cancer Research (AICR), 2018; Global Burden of Disease Study (GBD), 2017.				

5.7.2 Zambia-specific nutrient and food intake recommendations

To contextualise this global guidance on nutrient and food intakes for Zambia, a diet model optimised a diet for the country by taking into consideration consumption patterns and commonly consumed foods among other factors. The diet model provided Zambia-specific recommendations on total amounts of food to eat per day for each food group, given in food weight, which were then divided into serving sizes as outlined in Table 2. A serving size is a standardised recommended amount of food to be eaten daily from each of the food groups.

5.7.3 Determinants of Zambian food group serving sizes and amounts

The number of recommended servings depends on the physiological needs and physical activity levels of the various population groups among other factors. In Zambia, the majority of adults living in rural areas are physically active as they engage in farming and other manual labour activities, and rural women spend hours in fetching water, firewood and other household chores. In contrast, urban population would be considered less active given their white-collar jobs.

A serving size for each food group is based on a standardised Kcal value set for that group. Through diet modelling, the linear program optimised various combinations of food items, their foods weights and nutrient and energy density within the six foods groups to come up with a proportion contribution of each food group to the total Kcal a day (2 100 Kcal for the general population). 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, affordability, ease of use and prevailing portion sizes (the amount of food people usually consume).

There are no global harmonised standards for what constitutes a serving size or recommended numbers of servings per day for most food groups (FAO and FHI, 2016). Given this, the serving sizes for the Zambian FBDGs are based on the serving sizes form other countries like the United States of America and Australia for similar foods with Zambia. The serving sizes for Zambia were further adapted to accommodate commonly consumed local foods in Zambia.

Each food group serving size has a Kcal range which, through diet modelling, estimates the amounts in grams of common foods as per Table 2. Determining the serving sizes also took into account the ease of converting these serving sizes into everyday household measures and common portion sizes for the Zambian population.

In these guidelines, a serving size is expressed in Kcal and grams. The serving sizes will also be communicated to the public in everyday household measures such as cups or hand measures to help with estimating the amount to be eaten per day.

5.7.4 Portion size versus serving size

A portion size is the amount of food individuals eat for a meal, snack or other eating occasions. Depending on the amount of food a person eats per meal, a portion can be bigger or smaller than a serving size. For example, a country can set half a cup of cooked rice as the serving size for starches. However, a person can eat three-quarters of a cup of rice per meal which is their portion size. Regardless of the portion size, individuals must meet the daily serving size recommendations for optimal health and to avoid eating too much or too little. General guidance and serving sizes for a healthy general population based on a 2 100 Kcal diet are as shown in Table 3.

Table 2: One serving size standard measure of different food groups

Food group	Energy (Kcal)	Food weight (g)	One serve equivalent (common household measures)
Cereals and tubers*	200	171	• approximately 1 cup of rice, pasta, diced sweet potato and cassava, and ¾ cup cooked nshima
Dairy products	160	-	• one serving 1 cup milk or sour milk (245 g) **or** • one ¾ cup or 1 small tin of yogurt (200g) **or** • four cubes of cheese (30g)
Fats and oil	125	-	• one serving is about a tablespoon of cooking oil
Fruits	80	135	• one medium banana or apple; or one large orange, or peach; or two small tangerines, or peaches, **or** • one cup cut fruit like papaya, mango or small fruit like berries, grapes, masuku **or** • one quarter (1/4) cup baobab pulp
Meat, fish and eggs	135	99	• two eggs (100 g) **or** • two matchbox sized ~60g red meat (beef, goat, sheep) and insects **or** • three matchbox sized ~90g fish (kapenta); or poultry (chicken, quails, duck); or rabbit
Pulses, nuts and seeds	135	84	• one half cup of cooked beans, bambara nuts, soya beans or cowpeas **or** • three tablespoons of peanuts; or seeds like flax, chia, sunflower, pumpkin seeds **or** • one and half teaspoons peanut butter or flour
Vegetables	30	71	• one half cup cooked vegetable **or** • one cup raw leafy or salad vegetables
*Select and combine foods from this food group to make the number of servings needed per day.			
Note: Each food recommendation per food group has detailed food exchange list for one serving size with Kcal, food weight and house measure			

Table 3: Recommended serving size amounts and energy and nutrient contribution per food group for a healthy general population based on a 2 100 Kcal diet

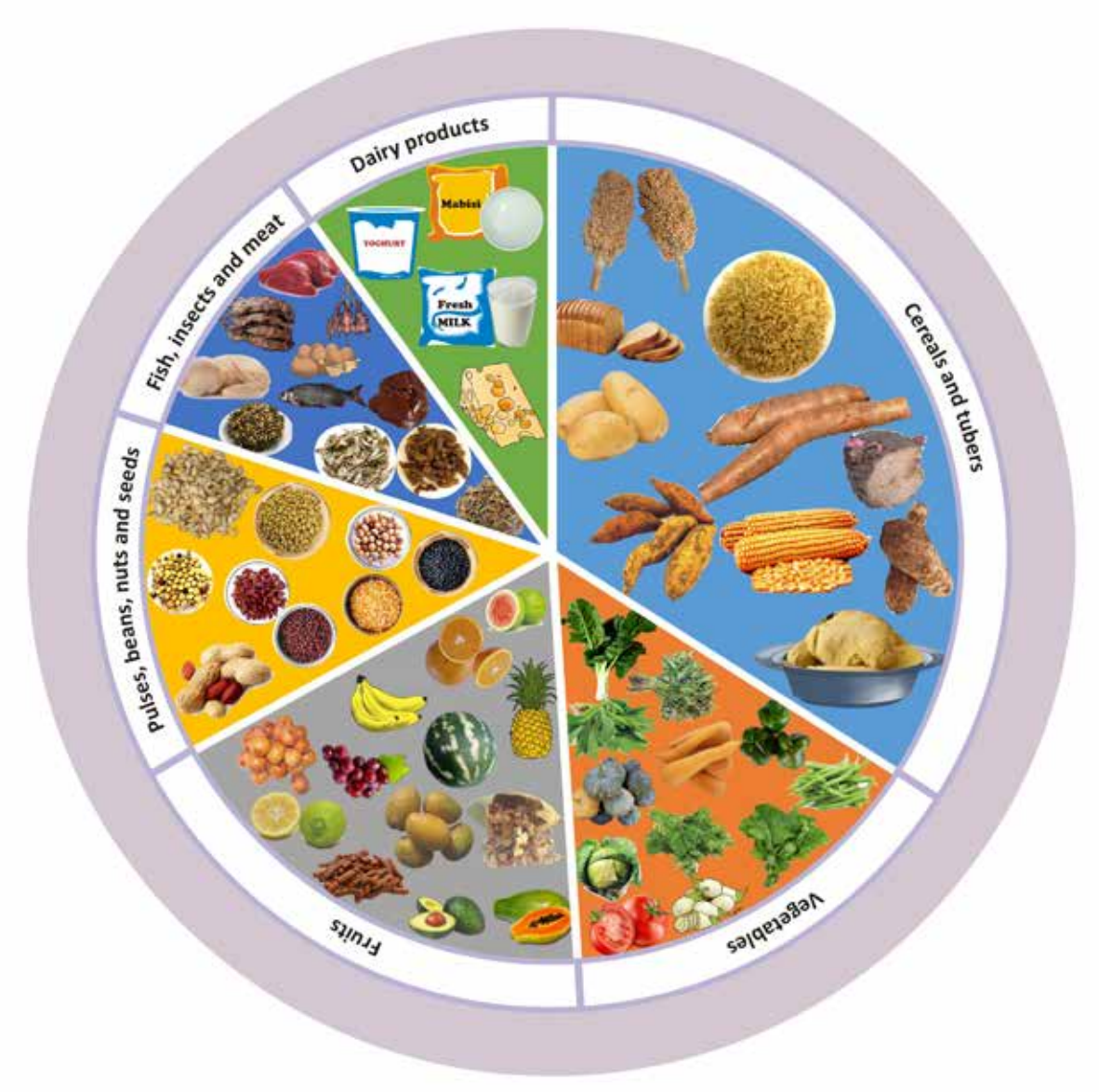
Food group	Recommended amounts		Energy and nutrient values per serving^										
	Number of servings	Total food weight (g)	Energy†	Protein	Fat	Carbohydrates	Ca	Fe	Zn	Vit A*	Retinol	Folate	Fibre
			(Kcal)	(g)	(g)	(g)	(mg)	(mg)	(mg)	(mcg RAE)	(mcg)	(mcg)	(g)
IN TOTAL	-	**1558**	**2094**	**79**	**56**	**301**	**945**	**21**	**10**	**2364**	**966**	**518**	**32**
Cereals and tubers	3.75**	559	781	17	2	168	65	2	2	317	0	57	9
Dairy products	1	248	124	7	7	8	230	0	1	63	60	19	0
Fats and oil	1	14	126	0	14	0	0	0	0	0	0	0	0
Fruits	2	291	189	2	3	36	52	2	0	283	0	74	6
Meat, fish and eggs	1	99	149	20	7	1	45	4	2	957	907	89	1
Pulses, nuts and seeds	2	181	425	21	22	32	53	5	3	4	0	151	10
Vegetables	3	222	131	12	1	15	496	8	1	739	0	126	5
The minimum cost of this food combination is approximately K14.95 (Kwacha)													
^Provided by the diet model food combinations *Measured in micrograms of retinol of activity equivalents (mcg RAE) **Rounded to 4 servings †Protein accounts for 15%, fat accounts for 24 % and carbohydrates account for 58% of the total energy amount													

5.7.5 Food amounts recommendations on the plate

In general, over three-quarters of the foods eaten should include a variety of plant-based foods which should form the basis of what we eat every day. Plant-based foods include vegetables, fruits, grains, tubers, beans, pulses nuts and seeds. Small amounts of fish, poultry, eggs, mice or insects should be added to meals as often as possible. Very small amounts of red meat could be consumed occasionally or if possible avoided completely. Milk and milk products should also be included in moderation.

Finally, small amounts of foods that are rich in healthy (unsaturated) fats such as olive oil, sunflower oil, canola oil, and rapeseed oil should also be included in a diet. This is because, although healthy fats are essential for various functions in the body, they have a high calorie content and if taken in large quantities may lead to overweight and obesity. FAO and WHO recommend that less than 30 percent of total energy should come from fats and oils (WHO and FAO, 2002 and WHO 2018). This is about 70 g (five tablespoons of oils) from all sources of fats and oils. Saturated fats should be 10 percent or less of the total daily energy target. This is about 24 g (1.5 tablespoons) from all sources. Industrial trans fatty acids found in ultra-processed foods and fried fast foods increase coronary heart disease (CHD) risk factors and CHD events. There is no safe intake amount for trans fats.

Figure 6: Proportion amounts of food groups that forms an healthy diet



5.8 CONSIDER THE NUTRIENT DENSITY OF FOOD

Consuming varied diets should be considered alongside nutrient density. A nutrient dense food has lots of nutrients with few calories. Nutrient dense foods are rich in vitamins, minerals, complex carbohydrates, lean protein and phytochemicals. Examples of nutrient dense foods include fruits and vegetables, peas, beans, nuts, whole grains, fish, eggs, insects, etc. Less nutrient dense foods include oils, fats, sugars, salt and refined grains.

In addition, within each food group, there are foods that are more nutrient dense than others. Nutrient dense foods are also called superfoods.

For example:

1. Moringa leaves, black-jack, amaranth, sweet potato leaves and okra are more nutrient dense vegetables compared to cabbage.
2. Whole grain products are more nutrient dense than refined grain products.

Thus, consuming nutrient dense foods is one of the healthiest ways to eat, as it provides individuals with concentrated amounts of valuable nutrients such as vitamins, minerals, fibre, essential fatty acids, phytonutrients and lean protein for less calories.

5.9: TIPS ON HOW TO CONSUME A VARIETY OF FOODS DAILY

Helpful Tips how to add variety to your diet

1. Choose a variety of in season local foods from all the six Zambian food groups. Fresh produce that is in season is usually of a high nutritional quality and is affordable.
2. Make a meal with different coloured foods.
3. Rotate colours of food throughout the week. Try to add as many colours of vegetables and fruits as possible.
4. Eat more mixed dishes. Add different types of pulses, vegetables and meats to stews and relishes.
5. Eat nutrient dense foods. This is one of the healthiest ways to eat because these foods give concentrated amounts of valuable nutrients such as vitamins, minerals, fibre, essential fatty acids, phytonutrients and lean protein for less calories.
6. Plan meals in advance. Practice planning meals for the week in order to incorporate different types of food into your diet.
7. Pay attention to the amount you eat per day from the different food groups.
8. Grow different types of food in a kitchen garden. Exchange vegetables with neighbours for variety.
9. Raising small animals like chicken, ducks, quills or rabbits can provide more variety and nutrients to a diet.
10. Enjoy eating homemade (cooked) meals and local dishes.
11. Eat together as a family or with friends.
12. Follow good food preparation and storage methods to maintain the best nutritional qualities. For example, vegetables should not be overcooked or cooked in too much water.
13. Choose whole foods such as whole fruit instead of industrially processed foods, like fruit juice, which are rich in sugar. Choose minimally processed[1] foods if processing cannot be avoided.

[1] Minimally processed foods are foods that have been subjected to cleaning, removal of inedible or unwanted parts, fractioning, grinding, drying, fermentation, pasteurization, cooling, freezing or other processes that may subtract part of the food but which do not add oils, fats, sugar, salt or other substances to the original food.

Recommendation 2

Eat whole or milled whole grains (cereals), starchy roots and tubers as part of meals every day for a healthy heart and weight

6. RECOMMENDATION 2: Eat whole or milled whole grains (cereals), starchy roots and tubers as part of meals every day for a healthy heart and weight.

6.1 GETTING TO KNOW WHOLE GRAINS, STARCHY ROOTS AND TUBERS

Grains or cereals include maize, rice, millet, sorghum, wheat, barley, oats and rye. These grains are usually processed into grain products such as flours, bread and pasta.

Starchy roots and tubers include cassava, yam, sweet potato, and Irish potatoes.

Plantains and breadfruit are also included in this food group due to their high carbohydrate content.

6.1.1 Foods not included in grains (cereals), starchy roots and tubers

In the Zambian FBDGs, non-starchy roots like carrot, ginger, beetroot and radish are classified as vegetables. Consequently, they are not included under this food group.

6.1.2 What are whole grains?

Whole grains are grains and grain products made from the entire grain seed, retaining all three parts of the grain (germ, endosperm and bran). An example of whole grain products include roller meal, maize flour (mugaiwa), brown rice, whole wheat flour or whole meal bread.

Refined grains are hulled grains. Refining grains usually removes the germ and outer layers of the grain, thereby reducing the fibre and micronutrients content (WCRF and AICR, 2018; Elia and Cummings, 2007). Examples of products with refined grains include white maize flour, white bread, white bleached wheat flour and white pasta.

6.2 WHY ARE WHOLE GRAINS, OTHER CEREALS, STARCHY ROOTS AND TUBERS PART OF A HEALTHY DIET?

6.2.1 They are an important and main source of energy for the body

Whole grains, other cereals, starchy roots and tubers are an important source of carbohydrates. Carbohydrates are the body's main fuel source. The body's tissues require a constant supply of glucose, which is used as a fuel. The main source of glucose is dietary carbohydrate.

The brain and other organs need carbohydrates to function

The brain, kidneys, central nervous system and muscles need carbohydrates to function properly. These carbohydrates are usually stored in the muscles and the liver, where they are later used for energy. Carbohydrates also support other important body functions.

Carbohydrates are needed in large amounts by the body. According to WHO and FAO, over half of the energy from food should come from carbohydrates. These carbohydrates should be in the form of whole grains, starchy roots and tubers.

6.2.2 Whole grains supply the body with vitamins, minerals, fibre and some proteins

Since whole grain flours and products are produced without removing any part of the grain kernels, they contain vitamins, minerals and fibre. The bran, which is the outer layer of the grain, contains fibre, B vitamins, iron, copper, zinc, magnesium, selenium, antioxidants and phytochemicals. The germ, which is the core where the seed germinates, is rich in healthy fats, vitamin E, B vitamins, phytochemicals and antioxidants. When the grain is processed, only the endosperm, which is the inner layer of the grain, remains. The endosperm contains mainly starch and very small amounts of protein, B vitamins and minerals.

6.3 THE RELATIONSHIP BETWEEN WHOLE GRAINS INTAKE AND POSITIVE NUTRITION AND HEALTH OUTCOMES

A high intake of whole grains and fibre from grain sources has been associated with good heart health, a reduced risk of type 2 diabetes and overall mortality (Willet *et al*., 2019; WHO and FAO, 2002). Furthermore, there is strong evidence that the consumption of whole grains probably protects against bowel (colorectal) cancer (WCRF and AICR, 2018).

6.3.1 Dietary fibre has many important health benefits

Dietary fibre, also known as roughage, is the part of plant foods that the body cannot digest or absorb. Instead, dietary fibre passes through the stomach and the body nearly unchanged. Although not a nutrient, fibre has many benefits for the body and is an essential part of a healthy diet.

1. **Helps with bowel movement.** Dietary fibre increases the weight and size of the stool and softens it. A bulky stool is easier to pass, and this can help prevent constipation. If one has loose, watery stools, fibre may help to solidify the stool because it absorbs water and adds bulk.
2. **Helps maintain bowel health.** A high-fibre diet may lower the risk of developing hemorrhoids. Studies have also found that a high-fibre diet reduces the chance of developing colorectal cancer.
3. **High amounts of fibre lower cholesterol levels and help control blood sugar levels.** Fibre slows the absorption of carbohydrates, so it helps sugar to enter the blood stream slowly. This can help people with diabetes control their blood glucose levels. A diet high in fibre may also reduce the risk of developing type 2 diabetes.
4. **Helps in achieving a healthy weight.** High-fibre foods tend to be more filling, hence helping a person to eat less food. Fibre also helps one feel fuller for longer.
5. **Helps one to live longer.** Studies suggest that increasing dietary fibre intake — especially cereal fibre — is associated with a reduced risk of dying from cardiovascular disease and all cancers.
6. **Whole grains also protect against dental caries** as they require more mastication and stimulate increased saliva flow (WHO and FAO, 2002).

THE BEST FIBRE CHOICES

Whole grain cereals and their products (wheat flour and unrefined maize or sorghum) have a lot of fibre. Most fibre and vitamins are found on the outer surface of the grains. Whole grains are grain flours and products that are produced without removing this outer layer.

Other foods rich in fibre are vegetables, fruits, beans, peas, other legumes, nuts and seeds.

6.3.2 Whole grains are important sources of vitamins, minerals and protein

These vitamins and minerals have important functions in the body. For example, B vitamins help the body release energy from protein, fats and carbohydrates. Minerals like iron help the body make haemoglobin (for red blood cells) and myoglobin (for muscles), both of which help carry and store oxygen. Iron also plays a role in many other routine bodily functions. Magnesium is an essential mineral used in building bones and teeth, converting food into energy, body temperature regulation and releasing energy from muscles. Magnesium is also required for hundreds of biochemical reactions, including the transmission of nerve impulses. Magnesium and selenium are important for maintaining a strong immune system. Zinc is important for fighting off bacteria and viruses, helps in wound healing and also helps the body to make proteins and DNA. Zinc is also essential for the proper functioning of senses of taste and smell.

6.4 MYTH BUSTERS!

Carbohydrates have a terrible reputation; some people think starchy foods are fattening. Contrary to what low-carb diets claim, consuming whole grains together with vegetables and fruits decreases the risk of weight gain, overweight and obesity (WCRF and AICR, 2018). In addition, whole grains also have a lower glycemic index than refined grains. Refined grains have a high glycemic index and provide more calories per gram of food.

Although some people avoid carbohydrates fearing weight gain, the body needs carbohydrates to function well. Cereals, especially whole grains, starchy roots and tubers contain starch and fibre which are complex carbohydrates. Thus, eating whole grains will actually contribute to weight loss. Starches, as complex carbohydrates, take a while to metabolise after eating and help maintain a stable level of glucose in the body for several hours. Fibre promotes normal bowel movements, but contributes very few calories to the diet. These types of carbohydrates are healthier and better than other carbohydrates.
Further, avoiding starchy foods in preference for animal source foods will not contribute to weight loss. Gram for gram, carbohydrates contains the same calories as protein, for example from ASF. Both protein and carbohydrates provide 4 Kcal per 1 g. Gram for gram, carbohydrates contains less than half the calories of fat: 1 g of fat provides 9 Kcal. As explained in detail in the guidelines for animal source foods, a high intake of ASF, such as meats, has negative health impacts. Only 10 percent of energy should come from protein sources such as ASF (FAO and WHO, 2002; EAT Lancet, 2019).

In addition, irrespective of the type of energy source (whether from starches, roots and tubers, legumes, animal source foods or fats), too much energy in the diet can lead to excess weight gain. Other carbohydrates from sweets and sugars should be avoided as they are unhealthy. They are discussed and appropriate guidance is provided in Chapter 16, under Guideline 8.

6.5 ZAMBIA CONSUMPTION PATTERNS OF CEREALS, STARCHY ROOTS AND TUBERS

Overall, the main source of dietary energy for the Zambian population is from cereals (Mwanamwenge and Harris, 2017), especially maize (de Groote *et al*., 2019). At the provincial level, starchy roots and tubers also make a significant contribution to the dietary energy intake among households, particularly in the Luapula and Northern provinces (Alaofè *et al*., 2014).

⚠ MYTH BUSTER

Gram for gram, carbohydrates contain the same calories as protein, for example from meats.

Gram for gram, carbohydrates contain less than half the calories of fat.

6.6 RECOMMENDED AMOUNTS TO EAT DAILY

For an optimum diet, FAO and WHO recommend that 55 to 75 percent of total energy should come from carbohydrates, while the EAT-Lancet Commission recommends 60 percent of total energy should come from carbohydrates (FAO, 1998; FAO and WHO, 2002; Willet *et al*., 2019). Through diet modelling for Zambia, this translated to four servings of grains, starchy roots and tubers daily, making whole grain options a major part of this food group. One serving is based on ~200 Kcal. The total amount for this food group is 560 g, providing 995 kcal, which is 53 percent for a 2 100 Kcal a day diet.

6.6.1 What does a typical serving size look like?

A serving size is about one cup of rice, pasta, diced sweet potato or cassava and a three-quarter cup of cooked nshima (nsima or ubwali), with an average food weight of 170 g. A detailed single serving size food exchange list with Kcal, food weight and household measures are provided in Table 4. Combine the foods listed below to make four servings per day.

Table 4: One serving size equivalent for grains (cereals), starchy roots and tubers food exchange list

Cooked foods	Food serving measure*			Nutrient values per serving							
	Cups	Grams (g)	Quantity	Energy** (Kcal)	Protein (g)	Folate (mcg)	Iron (mg)	Calcium (mg)	Zinc (mg)	Fibre (g)	Vit A (mcg RAE)
Bread (thick slice)	-	90	3	225	8	40.5	1.8	44.1	1.3	5.6	0
Bread rolls (white, small: 5x5cm)	-	75	3	200	6.8	21	0.9	19.5	0.6	2	0
Cassava (boiled, diced)	1	132	-	210	1.6	21	0.9	56.5	0.4	2.5	1,7
Irish potato (boiled)	1.5	230	-	187	4.3	25.4	1.9	23.3	0.7	4.2	2.5
Nshima/pap (stiff)	3/4	161	-	210	5.3	1.6	0.2	3.2	0.2	2.1	0
Pasta	1	124	-	190	6.7	6.2	0.6	12.4	0,7	2	0
Potato chips/fries (fried)†	-	70	-	223*	2.4	21	0.6	12.6	0.4	2,7	0
Rice	1	160	-	205	4.2	8.6	0.9	8	0.7	0.9	0
Sweet potato (boiled)	1	200	-	225	2.9	65.5	2	51.9	0.7	6	6.1
Yams	1	170	-	230	3.4	29.7	1.4	43.9	1	7.3	4.2

*Based on the USDA 240ml cup measure and occasionally Australian FCTs; rounded values
**Based on the Zambia Diet Model FCT; rounded values
†Please note that one fast food order of chips has over double the amount of kcal (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".

6.7 RECOMMENDATIONS & GUIDANCE

ON EATING THE RIGHT AMOUNTS OF CEREALS, STARCHY ROOTS AND TUBERS

1. Include traditional grains like millet, sorghum and rice, and roots like potatoes, sweet potatoes, and yams as part of the diet staples.
2. Choose whole grain cereal products like roller mealie meal, mgaiwa, whole meal bread and brown rice to get the most nutrients and most health benefits.
3. Choose bio-fortified foods. Coloured grains like yellow maize, millet and sorghum contain many other good nutrients for the body. For example, orange maize contains a lot of vitamin A.
4. Choose flours fortified with vitamins and minerals.
5. Inspect grains before processing. If they look mouldy, discoloured or shrivelled, discard them as they may contain harmful toxins.

6.8 TIPS ON ADDING WHOLE GRAINS TO A DIET AND EATING THE RIGHT AMOUNTS

Helpful Tips on how to add whole grains to a diet and eat the right amounts

1. Make simple switches: Alternate starchy foods throughout the week. If ngaiwa nshima is eaten on one day, sweet potatoes, cassava, rice or nshima from millet or sorghum should be eaten the next day.
2. To make half of staple food whole grains, switch from a refined grain product to a whole grain product. For example, eat ngaiwa or millet nshima and brown rice rather than refined maize meal nshima or white rice. Choose whole wheat bread instead of white bread.
3. Measure food to get the right amounts of the five servings a day and to avoid overeating.
4. Mix whole grains with other dishes. Meals or snacks made of dried whole maize mixed with beans or ground nuts are excellent ways of eating whole grains.
5. Make whole grain snacks: Popcorn, a whole grain, can be a healthy snack if made with little or no added salt or oil. Roasted dried maize and boiled dried maize make great snacks.
6. Porridge goodness: Whole grains make a good, healthy and wholesome breakfast for the whole family. Porridge can be eaten alone or with added groundnuts or legume flours.
7. Substitute bread for breakfast with roots such as cassava, sweet potatoes or yams.
8. Bake some whole grain goodness: Substituting part of the wheat flour with ngaiwa, millet or oat flour when baking. There are plenty of recipes using whole grains.
9. Be a good role model for children. Set a good example for children by eating whole grains every day as meals or snacks.
10. Be a smart shopper: Check the labels and ingredients list and chose products made from whole grains.

Recommendation 3

Eat plenty of different coloured vegetables every day to provide vitamins, minerals and fibre to prevent diseases

7. RECOMMENDATION 3: Eat plenty of different coloured vegetables every day to provide vitamins, minerals and fibre to prevent diseases.

7.1 ABOUT VEGETABLES

Vegetables are edible parts of a plant and they include leaves, flowers, some roots, stems and fruits. Vegetables are a great source of vitamins, minerals, dietary fibre and phytochemicals.

7.2 DIFFERENT COLOURED VEGETABLES AND THEIR UNIQUE NUTRIENTS

Vegetables come in different colours, and each colour indicates an abundance of specific important vitamins, minerals, dietary fibre and phytonutrients (plant compounds). Some vegetables can be eaten raw, while some can only be eaten when cooked. Vegetables are categorised as follows:

Dark green leafy vegetables. These are rich in vitamins A, B, C, K and folate, and minerals such as iron, calcium, magnesium and fibre. Examples include cowpea leaves, moringa leaves, amaranthus, pumpkin leaves, sweet potato leaves, cassava leaves, black-jack leaves, spinach, rape, kale and mustard greens.

Orange coloured vegetables. Orange and yellow vegetables such as carrots, butternut, orange squash, pumpkin fruit and its flowers, and red and yellow bell peppers (not when processed into spices) are rich sources of vitamin A due to the carotenoids that give these vegetables orange, red and yellow tints. These vegetables are also rich in vitamin C and potassium.

Other vegetables. These include root vegetables like beetroot, radishes, onions and garlic; fruit vegetables like lady's fingers okra, eggplant, tomato, zucchini (baby marrows), mushrooms, celery, cauliflower, cucumber; and fresh seeds like green peas and other green beans. These vegetables also provide a wide range of important nutrients and antioxidants that are high in dietary fibre, as vegetables come in a wide variety of colours, which reflects their varying nutritional composition. Therefore, in order to maximise the nutritional benefits of vegetables, it is recommended to combine different coloured vegetables in every meal.

Foods that do not count as vegetables
Starchy roots and tubers like potato, sweet potato, yam, cassava and taro are NOT part of this food group. They are included in the grain, roots and tubers group because they have a lot of carbohydrates and are energy dense.

7.3 IMPORTANCE OF VEGETABLES IN A DIET

Vegetables are important components of a healthy diet because they are a rich source of vitamins and minerals, fibre, antioxidants and phytochemicals.

These vitamins include vitamin A, vitamin C, vitamin K, vitamin B6, folate (vitamin B9), thiamin (vitamin B1) and niacin (vitamin B3). Vegetables are also important sources of minerals such as potassium, iron, dietary fibre, phytonutrients, antioxidants and plant proteins.

Vitamin A, folate and iron are micronutrients of public health importance in Zambia due to high deficiency rates. Folate is a key vitamin for cell development and is particularly important during pregnancy to preventing neural tube defects in infants, while vitamin B in general helps to release energy from food and supports the nervous system. Vitamin A is important for growth and development; it stimulates new cell growth, keeps cells healthy, and is helpful for night vision and maintaining healthy skin, teeth and bones. It also supports proper functioning of the heart, lungs, kidneys and other organs, while vitamin C is important for the body's immune system by fighting infections, repairing the body and healing wounds. Potassium is important for body fluid and blood pressure regulation and muscle and nerve control, while vitamin K helps the blood to clot.

7.3.1 Vegetables are low in calories and sodium and are nutrient dense

Vegetables are low in calories and sodium, which is important for good health. They are nutrient dense, meaning they provide a lot of vitamins and minerals but have very low calories compared to other food groups. Most vegetables are naturally low in fat and none have cholesterol.

DID YOU KNOW?

Moringa is more nutrient dense than other foods. It has 18 of the 20 amino acids including all the essential amino acids as well as omega 3, 6 and 9.

Gram per gram Moringa contains more than these foods multiple times			Moringa	
			Dry leaves	Fresh leaves
Vitamin A	carrots		10 x	4 x
Iron	spinach		25 x	6 x
Calcium	milk		17 x	4 x
Potassium	Banana		15 x	3 x
Protein	Yogurt		9 x	2 x
Vitamin C	Oranges		0.6 x	7 x

7.3.2 Vegetables boost the body's immune functions

Eating plenty of vegetables boosts the body's immune system and helps to protect from diseases and infections like colds and the flu. As detailed in the preceding section, vegetables are rich in vitamins, minerals, fibre and phytochemicals. The amounts of each of these components vary depending on the type, colour, maturity, form of consumption (raw or cooked) and preparation of the vegetables. Eating raw vegetables results in more health benefits than when they are cooked (FAO, WHO and UNU, 2004). Furthermore, consuming a variety of vegetables within the same meal results in many more benefits than when they are individually consumed (Leenders *et al*., 2013; Liu, 2003).

7.3.3 Vegetables are protective against non-communicable diseases

Several global sources of evidence indicate that eating a lot of vegetables and fruits (at least 400 g) daily helps to lower cholesterol levels and blood pressure. In addition, vegetables reduce the risk of obesity, heart disease, stroke, type 2 diabetes (sugar disease) and some types of

cancers (WHO, 2020a; WCRF and AICR, 2018; GBD, 2017).

7.3.4 Vegetables support weight loss and a healthy weight

Additionally, vegetables are naturally low in calories and are therefore not energy dense. Vegetables contain no cholesterol and have a lot of fibre, which makes a person feel satisfied quickly and for longer periods. Due to their low-calorie content and their filling effect while being healthy and nutritious, vegetables can significantly contribute towards the prevention of overweight and obesity in Zambia.

7.3.5 High consumption of vegetables is associated with longevity

Low consumption of vegetables and fruits is associated with mortality, and WHO estimated that in 2017, 3.9 million deaths worldwide were attributable to inadequate fruit and vegetable consumption. The majority of these deaths occur in low-income countries such as Zambia. Eating vegetables is associated with a reduced likelihood of developing several diet-related NCDs such as cancers, cardiovascular diseases, stroke as well as a reduced risk of mortality (Liu, 2003; Oyebode *et al*., 2014). Increased consumption of vegetables reduces body weight and therefore indirectly contributes to a reduction in the risk of developing type 2 diabetes mellitus (Boeing *et al.*, 2012). The benefits of consuming vegetables are dose dependent, therefore, increasing the amount and variety consumed is associated with stronger beneficial effects.

7.4 THE SCIENTIFIC BASIS OF THE HEALTH AND NUTRITIONAL BENEFITS OF EATING PLENTY OF VEGETABLES

There are several potential mechanisms and pathways for the protective action of vegetables. The most common cited in the medical literature are related to their contribution of dietary fibre, phytochemicals, low energy density and a wide range of vitamins and minerals (Boeing *et al*., 2012; Slavin, 2012). Phytochemicals in particular are singled out for their effects on the modulation of detoxification enzymes, antioxidant activities (removing dangerous free radicals in the body), boosting of the immune system, and antibacterial, antiviral and blood pressure lowering effects (Lampe, 1999).

The different types of fibre, including insoluble and soluble fibre, found in varying amounts in different vegetables are essential for the prevention of diseases, including cancer, heart diseases and intestinal problems like constipation, and are important for the overall health of the gastrointestinal system (Slavin and Lloyd, 2012). Some types of fibre are prebiotics and favour the growth of beneficial bacteria or probiotics in the colon. These bacteria ferment the fibre, producing short chain fatty acids which are a useful energy source for colon cells.

It should be emphasised that vegetables should form part of a varied diet, as described in the preceding section, as other foods like whole grains and fruits are also rich sources of fibre and key micronutrients.

7.4.1 Most of the population in Zambia consume vegetables daily but not in enough quantity

Vegetables are one of the most popular food groups globally; they form the basis of diets for many households across the world, Zambia included.

In Zambia, most adults consume vegetables almost every day (WHO and MOH, 2017; Miller *et al*., 2016). However, the national average amount of vegetables consumed is low and below the recommended amounts. The Zambian adult population eat, on average, 2.1 servings of vegetables per day, with 90 percent consuming less than the recommended amount of three servings (≥210 grams) (WHO and MOH, 2017) with no marked differences between urban and rural areas (Miller *et al*., 2016). These results mean that everyone, whether young or old, living in urban or rural areas should increase their daily intake of vegetables. Considering the diversity of vegetables available across the country all year round, either cultivated or wild, it is possible for individuals to meet the recommendations while maintaining variety. Adequate vegetable intake can contribute to reducing and preventing micronutrient deficiencies (WHO and FAO, 2002; FAO and WHO, 2004). Micronutrient deficiencies remain a public health problem in Zambia. Major deficiencies include iron, vitamin A and zinc, especially among children and women. The main cause of micronutrient deficiencies is low dietary intake of nutrient dense foods, such as vegetables, and a lack of dietary diversity. Consumption of a varied diet with plenty of vegetables is the most sustainable approach to addressing micronutrient deficiencies. Dark green leafy vegetables are rich in vitamin A, iron and zinc. When these vegetables are

prepared with vegetable oils, they significantly contribute to vitamin A intake. The iron and zinc in vegetables is not as readily available for the body to use when compared to iron and zinc from animal source foods. Consuming vegetables together with vitamin C, such as citrus fruits, helps increase the absorption of iron (FAO, 2020).

7.5 RECOMMENDATIONS & GUIDANCE

ON EATING A VARIETY OF VEGETABLES EVERY DAY

1. Choose different colours and varieties of vegetables: dark green, yellow, orange, red, purple, etc. Each colour contributes different combinations of nutrients and phytonutrients.
2. Choose fresh vegetables that are in season – they are packed with lots of nutrients.
3. Indigenous, naturally growing vegetables like amaranthus, black-jack, cassava, pumpkin and sweet potato leaves are packed with nutrients and are healthy options.
4. Add a little bit of oil to green, orange and yellow coloured root and leafy vegetables to maximise the benefits of their vitamins.
5. Always have vegetables as a side dish to meals and add vegetables to other dishes or smoothies.
6. The following simple changes in preparing and cooking vegetables will help get the best out of the vegetables and prevent the loss of nutrients and phytochemicals.
7. Eat raw vegetables as much as possible. Make salads or try to puree vegetables into smoothies to drink.
   - ◊ Cook vegetables for a very short time. Vitamins and minerals are destroyed with over-cooking (over ten minutes).
   - ◊ Do not add soda or ash to vegetables, as they destroy certain vitamins.
   - ◊ Add 1 to 2 tablespoons of vegetable oil when cooking leafy green or yellow vegetables. Oil helps with vitamin A absorption.
   - ◊ Use minimum amounts of water when cooking vegetables. Cooking water should not be discarded. The water can be used to make soup or drunk directly for a good nutrient intake.
   - ◊ Cook with a lid on the pot when steaming or boiling vegetables.
8. Wash vegetables before cutting them. Vitamins are lost when washing cut vegetables, as seen from the water changing colour.
9. Use a sharp knife to cut fresh vegetables to avoid bruising them.
10. Cut off only the inedible parts of vegetables – sometimes the best nutrients are found in the skin, just below the skin or in the leaves.
11. Wash, cut, peel, prepare and/or cook vegetables within a short time and eat the vegetables within 30 minutes after preparation or cooking.
12. Vegetables protect against diseases when they are eaten as food and not taken as supplements.

7.6 HOW MUCH VEGETABLES SHOULD A PERSON EAT EVERY DAY?

Many people in Zambia do not eat enough vegetables and fruits, and hence do not get enough vitamin A. Many children and women in Zambia suffer from vitamin A deficiency.

WHO recommends the consumption of 400 to 500 g and World Cancer Research Fund recommends the consumption of over 400 g of fruits and vegetables per day. Just for vegetable consumption, the EAT-Lancet Commission recommends 200 to 600 g, while the Global Burden of Disease Study (GBD) recommends 360 g per day (WHO and FAO, 2002, GBD, 2017; WHO, 2020a; WCRF and AICR, 2018;Willet *et al*., 2019).

Based on the Zambia diet model, the recommendation for Zambia is at least three servings (about 230 g) of vegetables every day. One serving is between 70 to 80 g of vegetables. A single serving size is similar to one of the following household measures:

Figure 7: One serving equivalent of vegetable exchange list

Add or combine any of the vegetable measures below to make three servings per day for vegetables. Each measure is listed as a one/single serving equivalent

One cup raw or cooked hard vegetables	 Carrots, beet root, green peas, green beans, radishes, cabbage, broccoli, celery, etc.
One cup raw leafy, or soft vegetables and salads	 Leafy: cowpeas, bean, pumpkin, sweet potato, cassava, moringa, okra and baobab leaves amaranths, and black jack, Chinese cabbage, mustard greens, soft mushrooms, egg plants, etc.
Half cup cooked leafy and soft vegetables	 Leafy: cowpeas, bean, pumpkin, sweet potato, cassava, moringa, and okra leaves amaranths, and black jack, Chinese cabbage, and mustard greens, soft; mushrooms, egg plants, etc.

Table 5: One serving equivalent of vegetables exchange list

Food description	Food serving measure*			Nutrient values per serving**							
	Cups	Grams (g)	Table-spoons	Energy	Vit C	Vit A	Iron	Folate	Calcium	Zinc	Fibre
				(Kcal)	(mg)	(mg)	(mg)	(mcg)	(mg)	(mg)	(g)
Amaranth leaves (boiled)	0.5	66	4	28.5	12.5	150.5	3.2	27.7	250.8	0.4	1
Baobab leaves (boiled, without salt)†	-	80	5	59.4	16	313	2.5	39.2	250.7	0.6	6.1
Black-jack leaves (cooked)* **	0.5	70	5	42	68.6	630	38.2	-	154	0.4	1.68
Butternut squash (cubed)†	0.5	103	7	41	15.5	571.9	0.6	19.5	42	0.1	3.3
Carrot (raw, chopped)†	1	128	9	52	7.6	1068.8	0.4	24.3	42	0.3	3.6
Cassava leaves, (boiled, without salt)	0.5	80	5	81.2	13.1	216.4	3.5	49.6	220.9	0.4	3
Chinese cabbage (cooked)†	0.5	85	6	11.1	38.3	189.6	0.7	56.1	89.3	0.2	0.9
Collard greens (cooked)†	0.5	95	6	20.9	3.9	49	0.6	-	122.6	-	1.6
Cowpea leaves (boiled, without salt)	0.5	80	5	34.9	19.2	113.6	3.2	54.3	212.3	0.3	3
Cucumber, with peel (raw, sliced)†	1	104	7	16	2.9	5.2	0.3	7.3	16.6	0.2	0.5
Eggplant (cooked)	1	100	7	32	4.1	2.5	0.8	15.3	13.2	0.1	2.8

Food description	Food serving measure*			Nutrient values per serving**							
	Cups	Grams (g)	Table-spoons	Energy	Vit C	Vit A	Iron	Folate	Calcium	Zinc	Fibre
				(Kcal)	(mg)	(mg)	(mg)	(mcg)	(mg)	(mg)	(g)
Green beans (boiled)	0.5	62.5	4	27	7.3	15.4	0.6	22.9	30	0.2	1.7
Kale/rape (cooked)†	0.5	65	4	23	11.6	94.9	0.5	42.3	97.5	0.2	2.6
Moringa powder (raw)^	2 tbs	10	2	32	1.73	1890^	2.8	-	250	-	1.9
Moringa/drumstick leaves (cooked)	0.5	68	5	40.8	66.2	475.3	3.3	73.4	392	0.5	1.4
Okra leaves (boiled)	0.5	80	5	34.1	12.1	42.5	0.4	49.6	237.6	0.6	4.1
Okra/lady's fingers (boiled)†	0.5	80	5	18	13	11.2	0.2	36.8	62	0.3	2
Onion (boiled, with-out salt)	0.5	80	5	36	3.4	0	0.2	8	23.2	0.2	1.8
Onion (raw)	0.5	80	5	30	8.2	0	0.2	12.8	20.1	0.2	1.4
Pumpkin (cooked, mashed)	0.5	122	8	24.4	6	132	0.7	5.7	18.4	0.36	1.3
Pumpkin leaves (boiled)	1	71	5	21	3.3	129.2	1.3	13.5	252	0.1	1.8
Snow pea (cooked)	0.5	80	5	34	38.3	41.6	1.6	23.2	34	0,3	2.2
Spinach (boiled)	0.5	90	6	26	13.5	348.3	2.3	83.7	119.7	0.5	2.1
Sweet potato leaves (boiled)	1	64	4	34	3.2	296.3	0.4	26.9	92	0.1	1.5
Swiss chard (cooked)†	0.5	87.5	6	16.6	26.3	267.8	1.6	12.3	44.6	0.3	1.4
Tomato (raw)	0.5	74	5	16	21.9	38.5	0.4	15.7	9.6	0.5	1

Food description	Food serving measure*			Nutrient values per serving**							
	Cups	Grams (g)	Table-spoons	Energy	Vit C	Vit A	Iron	Folate	Calcium	Zinc	Fibre
				(Kcal)	(mg)	(mg)	(mg)	(mcg)	(mg)	(mg)	(g)
Tsunga/mustard greens (boiled)†	0.5	70	5	18.2	17.7	432.6	0.6	6.3	82.6	0.1	1.4
Zucchini with skin (cooked)†	0.5	115	8	17.3	14.8	64.4	0.5	32.2	20.7	0.3	1.2
Zucchini without skin & summer squash all varieties (cooked)†	0.5	90	6	18	5	9.9	0.4	18	24.3	0.4	1.3
Consume two daily vegetable servings by choosing any of the foods above. Each food amount listed is the equivalent of one serving.											

*USDA; rounded values
**Based on the Zambia Diet Model FCT unless otherwise stated; rounded values
***Based on the National Food and Nutrition Commission (2009)
†Based on the FDC (USDA, 2020), FCT and Food Exchange List
^Moringa Harvest (2021)

7.7 TIPS ON INCREASING CONSUMPTION OF VEGETABLES

Helpful Tips on easily getting your three servings (230 g) of vegetables per day

1. Select from plenty of tasty and colourful vegetables growing locally and wildly.
2. Plant vegetables around the house. A very small space can yield plenty of vegetables. Some vegetables look beautiful in flower beds.
3. Dry vegetables when they are plenty and in season. Eat them during a lean season.
4. Buy fresh vegetables in season for better value – they are cheaper and fresher.
5. Apart from being a side dish to meals, make vegetables a part of breakfast and snacks.
   - ◊ Add vegetables to other dishes. Carrots, extra onions, green peas and mushrooms make dishes colourful, tasty and nutritious.
   - ◊ Add grated carrots, mushrooms and sliced tomatoes to breakfast meals or omelets.
   - ◊ Add vegetables to smoothies and homemade juices. Carrots, beetroot, cucumber, celery or leafy vegetables are perfect ingredients for a smoothie.
6. Snack on vegetables. Carrots, cucumbers and celery make a quick and easy grab-and-go snack. They are easily carried to work or school.
7. There are many ways to prepare, cook and eat vegetables: Stir frying, steaming, boiling, grilling or baking them etc.
8. Cook different vegetables together and add herbs to make fresh vegetable stews or homemade vegetable soups.
9. Make a plate or pot colourful with vegetables. Use different coloured vegetables to decorate and add interest to meals.
10. Try something new – prepare new recipes and buy new vegetables as part of shopping each month.

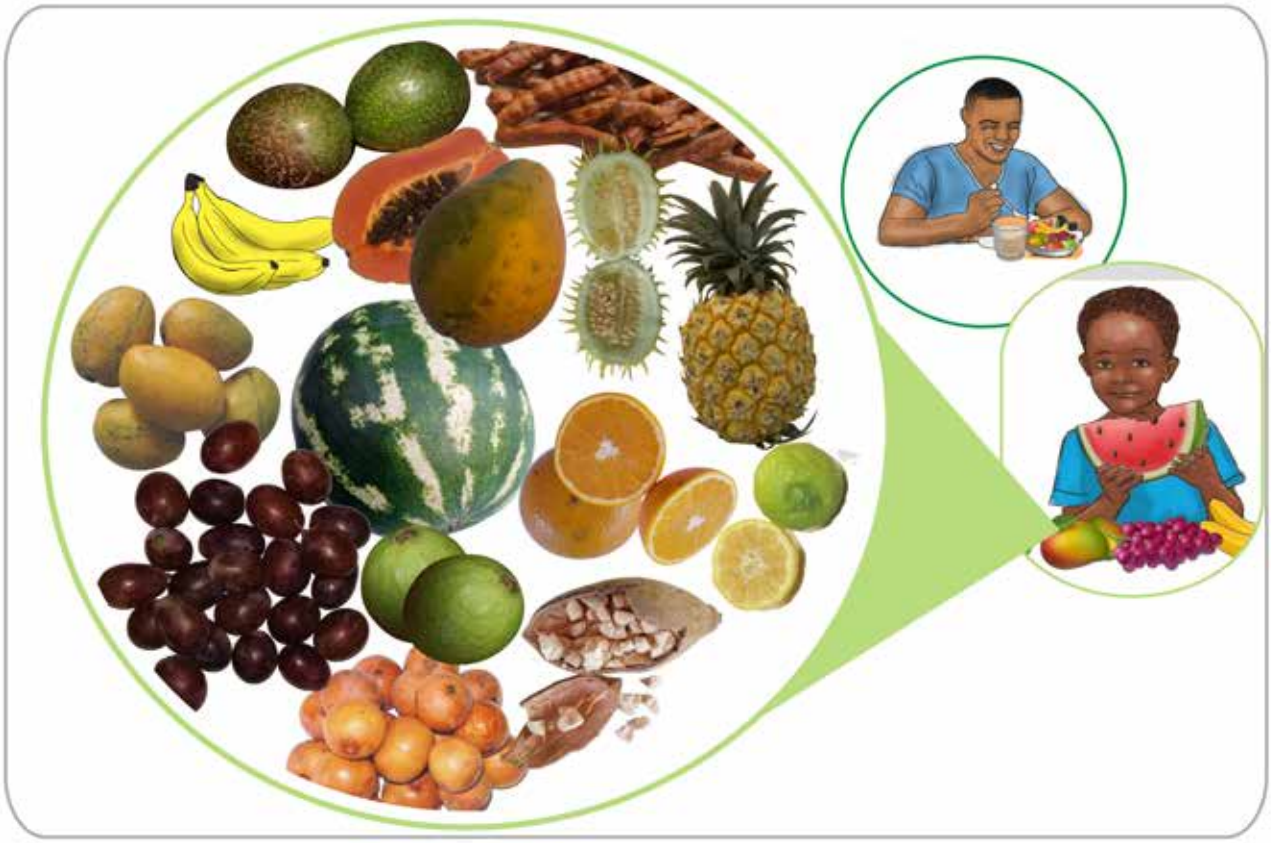
7.7.1 Types of vegetables to enjoy in small amounts

1. **When you eat butternut and pumpkins**, they should count as one serving of vegetables per day. Although butternut and pumpkins are part of the vegetable group and are excellent sources of vitamin A and other nutrients, they also contain some carbohydrates.
   - ◊ Always eat butternut and pumpkins with other vegetables.
   - ◊ 1 cup or more of butternut or pumpkin will count as one portion of vegetables. Get the two remaining servings from other types of vegetables.
   - ◊ For a low-calorie meal, use butternut or pumpkin to replace other starches like rice or nshima.
2. **Limit the intake of salted and fermented or pickled vegetables.** These have been associated with risk of some cancers. Therefore, limit the intake of these foods.
3. **Potatoes are not vegetables because they are very high in starch.** They belong to the roots and tubers group.

Recommendation 4

Eat two different coloured fruits every day to provide vitamins and minerals to prevent diseases

8. RECOMMENDATION 4: Eat two different coloured fruits every day to provide vitamins and minerals to prevent diseases.



8.1 DEFINITION OF A FRUIT

Fruits are the fleshy part around the seeds of a plant and usually have a sweet taste, although some have a sour or bitter taste.

Fruits are a very good source of several vitamins, minerals, fibre, phytochemicals and antioxidants (FAO and WHO, 2004). Fruits come in different types and colours, and each colour and type indicate the different nutrient compositions of specific important vitamins, minerals and phytonutrients (FAO, 2019).

8.2 THE UNIQUE TYPES AND COLOURS OF FRUITS AND THEIR UNIQUE NUTRIENTS AND ANTIOXIDANTS FOR GOOD HEALTH

- Citrus fruits and other sour fruits like baobab and tamarind are rich sources of vitamin C, important for growth, development, repairing of body tissues and supporting immune and anti-oxidant functions.
- Dark yellow and orange non-citrus fruits such as mango, papaya and melons are rich in carotenoids (pro-vitamin A).
- Red fruits like watermelon, red apples, cranberries and strawberries contain the powerful antioxidant lycopene.
- Purple and blue fruits like plums, purple grapes, black currants and blackberries contain antioxidants and anthocyanins.
- Wild fruits like marula, sour fig, mobola plum, baobab and snot apple are also good sources of anthocyanins and flavonoids.
- Other coloured fruits also have unique micronutrients, phytochemicals and powerful antioxidants. For example, bananas and white peaches contain anthoxanthins and potassium, while green fruits like green apple, avocado,

green grapes, kiwifruit and limes contain chlorophyll and vitamin K. Avocado pears also supply significant amounts of minerals such as zinc.

Since different coloured fruits offer varied types of nutrients and antioxidants, individuals should choose from a wide variety of colours in order to maximise the benefits of fruits for health and nutritional status.

8.3 THE SCIENTIFIC BASIS OF THE HEALTH AND NUTRITIONAL BENEFITS OF EATING A LOT OF FRUITS

There are several potential mechanisms and pathways for the protective action of fruits. The most common ones cited in the medical literature are related to their contribution of dietary fibre; phytochemicals; antioxidants (both from nutrients and non-nutrient sources) such as flavonoids and carotenoids; a wide range of vitamins and minerals; and low energy density (Slavin and Lloyd, 2012; Lampe, 1999). Vitamins found in fruits include vitamin A, vitamin C, B vitamins (including folate), vitamin E and vitamin K. Minerals found in fruits include potassium, calcium, magnesium and some iron.

8.4 FRUITS ARE ESSENTIAL IN PREVENTING MICRONUTRIENT DEFICIENCIES AND PROMOTING GOOD HEALTH

Fruits are rich sources of vitamin C and are also good sources of vitamin A, B vitamins including folate, vitamin B6, thiamine and riboflavin. Fruits also provide several minerals such as potassium, calcium, iron and zinc (FAO, 2020).

Some of the health benefits of fruits include:

8.4.1 Lowers risk of neural tube defects

Folate (folic acid i.e. vitamin B9) helps to prevent neural tube birth defects, anencephaly and spina bifida during pregnancy (WHO, 2012a). Folic acid is critical during periods of rapid growth, such as during pregnancy and foetal development, particularly during the first trimester.

Eating fruits such as oranges, tangerines, bananas and peaches which are good sources of folate, in addition to taking folate supplements a few months before and during pregnancy, is very important.

Folate also helps the body form red blood cells, DNA and RNA, and is also involved in protein metabolism.

8.4.2 Prevents vitamin A deficiency

Dark yellow and orange non-citrus fruits are rich in vitamin A in the form of carotenoids (pro-vitamin A). Consuming these fruits and other green and orange vegetables can meet all vitamin A requirements without the need for supplements.

8.4.3 Contributes to the prevention of iron and micronutrient deficiencies

Fruits like bananas, pomegranates, mulberries, apples and black currants are a rich source of iron. When eaten together as part of a meal, as salads or soon after a meal, fruits, especially those rich in vitamin C which enhances the absorption of iron, contribute to the prevention of iron deficiency which is one of the public health problems in Zambia. Citrus fruits, baobab and tamarind are rich sources of vitamin C.

Some fruits, such as avocados or pears, also supply significant amounts of minerals such as zinc. Bananas and citrus fruits are good sources of potassium.

Thus, a diet high in fruits, consumed together with vegetables, would help reduce micronutrient deficiencies which are a public health problem in Zambia.

8.5 FRUITS ARE DIET-RELATED NON-COMMUNICABLE DISEASE PROTECTIVE

Due to their fibre, micronutrient, phytochemical and antioxidant contents, fruits are important in the prevention of diet-related NCDs such as heart diseases, obesity, type 2 diabetes and some cancers, as well as in helping to control blood pressure (FAO, 2020).

8.5.1 Fruits protect a healthy heart

The potassium in fruit can reduce the risk of heart disease and stroke. Fruits rich in potassium include bananas, mango, melons, apples, prunes, plums, pears, cantaloupe, honeydew and apricots. Potassium is linked to blood pressure regulation due to its vasodilation properties.

The fruits mentioned above, as well as berries, grapefruit and oranges, protect the heart and are also rich in flavonoids, carotenoids, fibre and magnesium. These fruits also contain vitamin A, vitamin B6, vitamin C, vitamin E, vitamin K and folate, all of which aid in regulating cholesterol levels and preventing diseases like strokes, atherosclerosis and heart attacks.

Dietary fibre from fruits, as part of an overall healthy diet, helps to reduce blood cholesterol levels. Fruits contain minimal sodium and have no harmful fats, hence they support a healthy heart.

Due to their fibrous composition, fruits have anticarcinogenic properties and are known to prevent colon cancer.

8.5.2 Fruits are type 2 diabetes protective

Fruits help with reducing the risk of type 2 diabetes as they have a low glycemic index (GI) and they help with controlling blood sugar levels. Dietary fibre changes the consistency of stools by increasing the bulk and water content of the stool. Increasing the bulk of the stool distends the colon wall and stimulates the expulsion of the stools.

8.5.3 Fruits reduce the risk of some cancers

Antioxidants in fruits provide protection against cell damage. They help repair the damage done to body cells by free radicals and they have the ability to show hepatoprotective properties which contribute to lowering the risk of some cancers. Inadequate intake of fruits is among the top ten risk factors of death in the world (WCRF and AICR, 2018).

8.6 FRUITS ARE A HEALTHY OPTION FOR WEIGHT LOSS AND WEIGHT MANAGEMENT

Along with their relatively high nutrient density and fibre content, fruits also have low calories (except the avocado pear) and can be consumed in relatively large amounts without significantly contributing to weight gain. Fibre also makes one full quickly and for longer, thereby reducing the amount of food consumed. Fruits do not have saturated fats or cholesterol. Except for a few, fruits are usually fat-free. Avocados and olives contain healthy (unsaturated) fats in small amounts.

8.6.1 Fruits prevent infections and speed up recovery from illness

Fruits are rich in vitamin C, which is a powerful antioxidant. It provides support for healing the common cold, wound healing, the prevention of illness and inflammations, and speeds up recovery. Vitamin C also keeps the lymphatic system healthy.

8.6.2 Fruits support healthy skin, hair, teeth, gums and bone health

Vitamin C is important for the growth and repair of all body tissues, helps heal cuts and wounds, fights skin disorders, and keeps teeth and gums healthy. Fruits also effectively promote healthy hair growth. Fruits like grapefruit and oranges are rich in calcium and vitamin K, both of which aid in maintaining healthy bones and improving bone mineral density. Potassium may also help to decrease bone loss and reduce the risk of developing kidney stones (FAO, 2017; Haddy, Vanhoutte, and Feletou, 2006).

8.6.3 Fruits support a healthy digestion

Fruits have high quantities of water and dietary fibre which help improve the functioning of the digestive tract, thereby reducing the chances of constipation.

8.7 FRUITS AND VEGETABLES AS SEPARATE FOOD GROUPS

The nutritional and health benefits of fruits are similar but also differ to those of vegetables with respect to the quantity and types of bioactive components they contain, which is why it is important to consider them as different food groups.

The benefits accrued to fruits are dose dependent; the more volume and the wider the variety of fruits consumed the more the protective effect. Fruits, when considered independently, have significant positive impacts on human nutrition and health.

However, fruits should form part of a varied diet that includes other food groups. For example, consuming fruits together with vegetables significantly reduces the risk of diet-related NCDs such as cardiovascular diseases, diabetes, cancer, as well as premature mortality.

Further, the consumption of fruits in Zambia is lower than of vegetables, hence, given the importance of fruits in a healthy diet, the TWG agreed that fruits will be in their own food group. Thus, as a food group, fruits would be given the attention and emphasis they require to increase their consumption among Zambians.

8.7.1 Zambians do not eat enough fruits daily

Fruit consumption levels in Zambia are low. In Zambia, adults consume fruits only two days in a week instead of daily, for an average of 57 g per day, which is one-fifth of the recommended two servings a day (290 g).

Consuming two or more servings of fruits a day is possible through homegrown produce, utilising wild edible fruits, capitalizing on fruits that are

in season, as well as those that are available for purchase.

Some fruits, such as bananas, papaya and even watermelons, are available throughout the year. Enjoy an additional variety of in-season fruits such as mangoes, guavas, oranges, and most wild fruits such as masuku, chibuyu (baobab) and busika (tamarind).

*** Fruit juices are not a part of this food group.**

8.8 RECOMMENDATIONS & GUIDANCE

ON EATING A VARIETY OF FRUITS EVERY DAY

1. Choose a variety of and different coloured fruits.
2. Eat the whole fruit including the skin (if it is edible) in order to maximise the benefits of high fibre found in skin as well. Whole fruits add fibre, water and bulk, which helps a person feel fuller on fewer calories.
3. Eat raw fruits for maximum nutritional benefits. Cooked, preserved or processed fruits usually lose some important nutrients due to high heat and extended storage.
4. Smoothies made of whole fruit (fruit pulp + water) are a healthier option than fruit juice. 100 percent fruit juice strips away the fibre leaving lots of natural fruit sugars. Whole fruit smoothies should have no added sugars, artificial flavours, colours or preservatives.
5. Choose fresh fruits when in season – they cost less and are of better value and quality.
6. Eat wild edible fruits – they are packed with nutrients.
7. Avoid any forms of processed fruits such as fruit juices and dried fruits that have concentrated sources of natural sugar and a lot more calories. Some bottled fruit juices also have added sugar.
8. Fruits are protective against diseases when they are eaten as food and not taken as supplements.

8.9 RECOMMENDED AMOUNTS OF FRUITS PER DAY

WHO recommends the consumption of 400 g to 500 g fruits and vegetables while the World Cancer Research Fund recommends over 400 g per day. The EAT-Lancet Commission recommends consuming 100 g to 300 g of fruits daily, while GBD recommends 250 g per day (WHO and FAO, 2002; WHO, 2020a; Willet *et al*., 2019; WCRF and AICR, 2018; GBD, 2017).

For Zambia, through diet modelling, individuals should eat at least two fruits (about 300 g) per day. One serving provides approximately 80 Kcal. As fruits come in different sizes, one fruit serving is about 150 g, about 1 cup, or one medium-sized banana, apple, orange or mango. For small fruits, the serving size can be two small tangerines, guavas, peaches, plums, kiwi and apricot, or a handful of

masuku, tamarind or baobab. For berries and diced fruits like papaya, watermelon and mango, one serving is equivalent to one cup.

To further benefit from fruits, choose from a wide variety of fruits such as citrus fruits, wild fruits like baobab and tamarind, and dark yellow and orange non-citrus fruits such as mango, papaya and melons. Table 6 shows examples of various edible fruits found in Zambia as well as the approximate amount of grams and Kcal per serving.

Make two daily servings of each food group by adding or combining any of the listed foods. Each food listed is one serving equivalent.

Consume two daily fruit servings by choosing any of the fruits listed below. Each food amount listed is one serving equivalent.

8.10 TIPS ON EATING AT LEAST TWO SERVINGS OF FRUIT A DAY

Helpful Tips on easily eating two fruits per day

1. Eat actual fruits as snacks, instead of fruit juices, sugary, salty or fatty snacks.
2. Leave fruits in plain sight for convenient snacking.
3. Pack fruits as an office or school lunch.
4. Plant fruit trees around the house and farm to get more and diversified fruits. This will optimise the health and nutritional benefits of fruits.
5. Indigenous, naturally growing fruits (e.g. masuku, baobab, tamarind,) are healthy options with many essential nutrients.
6. Try to eat different coloured fruits every day. Different colours in foods indicate different nutrients and compounds that promote good health.
7. Choose fruits that are in season as they are fresher and cheaper.
8. When using canned or dried fruits and vegetables, avoid those with added sugar, salt or oil.

Table 6: One serving equivalent of fruits exchange list

Food description	Food serving measure*			Nutrient values per serving**							
	Cups	Grams (g)	Quantity & size	Energy	Vit C	Vit A	Iron	Folate	Calcium	Zinc	Fibre
				(Kcal)	(mg)	(mcg)	(mg)	(mcg)	(mg)	(mg)	(g)
Banana, white flesh	-	120	1 medium; 7-19cm long	120	13	5	<1	23	8.4	0.2	2.4
African locust bean fruit, pulp (raw)	-	30	-	86	67	58	1	-	34	0.28	3.6
Apple, with skin (raw)	-	140	1 medium; 7cm diameter	75	6	4	<1	4	8.4	<1	3.4
Apricot†	4	140	-	70	14	134	0.6	13	18.2	0.3	2.8
Baobab pulp†		45	-	136	111	2.6	2.5	-	124.1	<1	3.1
Diced fruit - e.g. papaya and other cut fruit (raw, ripe)	1	145	-	51.9	84	116	1	36.3	29.6	<1	2.8
Gooseberries†	1	150	-	65	55	1.5	0.5	9	58.5	0.2	6.5
Granadilla/passion fruit (raw, without refuse)†	-	90	5	87	27	58	1.4	13	10.8	0.1	9
Grapes†	1	90	-	60.3	4	4.5	0.3	3.6	12.6	0	0.8

Food description	Food serving measure*			Nutrient values per serving**							
	Cups	Grams (g)	Quantity & size	Energy	Vit C	Vit A	Iron	Folate	Calcium	Zinc	Fibre
				(Kcal)	(mg)	(mcg)	(mg)	(mcg)	(mg)	(mg)	(g)
Guava (raw, without refuse)	2	110	-	65	287	39	<1	8	25.3	<1	6.2
Kiwifruit†	2	140	-	85	130	5.6	0.42	35	47.6	0.1	4.2
Mango, orange flesh (raw)	1	165	-	106.2	60	276	1.1	41.7	28.5	<1	3.5
Masuku/wild loquat (raw, without refuse†††)	5	70††	5††	90	118	-	10.6	-	12	1.2	1.6
Mulberry†	1	140	-	60	51	1.4	2.6	8.4	54.6	0.2	2.4
Orange	-	185	1 large; 7.5-8cm diameter	80	87	14	<1	62	57	<1	3.1
Peach, yellow flesh†	-	175	1 large	70	12	28	0.4	7	10.5	<1	2.6
Peach, sliced†	1	154	-	60	10	25	3.5	9.5	9.2	<1	2.3
Plum†	2	130	-	60	12	22	0.3	7	7.8	0.1	1.8
Pear†	-	150	1 small	85	7	1.5	<1	11	13.5	<1	-
Tamarind (raw, ripe)	-	30	-	75	-	0.3	<1	5	45.3	<1	5.5

Food description	Food serving measure*			Nutrient values per serving**							
	Cups	Grams (g)	Quantity & size	Energy	Vit C	Vit A	Iron	Folate	Calcium	Zinc	Fibre
				(Kcal)	(mg)	(mcg)	(mg)	(mcg)	(mg)	(mg)	(g)
Tangerines (5-6 cm)†	-	150	2 small; 5-6cm diameter	84	40	51	<1	24	55.5	<1	-
Watermelon, (raw)	1.5	230	-	67.2	17	96	<1	8.8	16.1	<1	0.8
Consume two daily fruit servings by choosing any of the foods above. Each food amount listed is the equivalent of one serving.											

*USDA; rounded values
**Calculated from the Zambia Diet Model FCT unless otherwise stated; rounded values
†Values based on the USDA FCT
††One wild loquat =14g
†††Chawafambira *et al.*, (2020). All other values (plain) are from the diet model Food Composition Table (FCT) derived from the West Africa FCT

Recommendation 5

Eat pulses, beans, cowpeas, ground nuts or other nuts daily to maintain good health – they are rich sources of protein and a good substitute for meat

9. Recommendation 5: Eat pulses, beans, cowpeas, ground nuts or other nuts daily to maintain good health. All these foods are rich sources of protein and a good substitute for meat.

9.1 GETTING TO KNOW PULSES, NUTS AND SEEDS

Nuts and seeds have similar nutritional properties and health benefits to pulses and are an essential part of a healthy diet. At the same time, pulses, nuts and seeds also have unique essential nutrients.

Legumes refer to any plant from the Fabaceae family that would include its leaves, stems and pods. A pulse is the edible dried seed from a legume plant, usually with seed pods that have two halves. Pulses come in a range of types, colours, shapes, flavours and textures. The dried seeds of legumes like common beans, cowpeas, peas, pigeon peas, lima beans, soya beans, chick peas, black-eyed beans, green grams and lentils are pulses.

Examples of nuts include dried groundnuts, peanuts, bambara nuts, mungongo nuts, walnuts, almonds, cashew nuts and their butters such as peanut butter.

Examples of seeds include pumpkin, sunflower, chia, flaxseed, and sesame seeds.

9.2 HEALTHY BENEFITS OF EATING PULSES, NUTS AND SEEDS

9.2.1 Pulses, nuts and seeds are a healthy and sustainable alternative to animal source foods

Pulses are an affordable source of protein when compared to animal source foods (ASFs). Pulses can be used as alternatives to ASFs. Pulses, when eaten together with nuts or grains, provide all the essential amino acids the body needs. This is because when combined, the essential amino acids in pulses complement the amino acids found in nuts or grains to provide all the essential amino acids that ASFs provide.

9.2.2 Pulses, nuts and seeds are key for the prevention of micronutrient deficiencies and proper body function

Pulses contain high amounts of protein, fibre (both insoluble and soluble) and are rich in micronutrients, macronutrients and phytochemicals, all of which play important roles in maintaining health. Micronutrients found in pulses include iron, folate, vitamin E, zinc, selenium, copper and manganese, all of which are important antioxidants that can neutralise the effects of damaging agents in the body (Polak, Phillips and Campbell, 2015).

Pulses have no cholesterol and are also naturally low in fat, and are good sources of polyunsaturated and monounsaturated fatty acids including linoleic and oleic acids (healthy fats). Pulses have moderate amounts of complex carbohydrates and therefore provide the perfect base for a nutritious and filling meal.

Pulses are also rich in bioactive components like phytochemicals (phytoestrogens, phytosterols, lycopene, lectins and phytic acid) (Singh *et al*., 2017). These phytochemicals, which are found naturally in plants and act as antioxidants, remove harmful free radicals in the body, thus lowering the risks of cancers and CVDs (WCRF and AICR, 2018).

Nuts and seeds contain many important nutrients, such as protein; iron; zinc; folate and other B vitamins like thiamine, vitamin B6 and niacin; and vitamin E. Nuts and seeds also contain minerals like magnesium, copper, potassium and phosphorus. Certain nuts, like Brazil nuts, can also contain very high amounts of selenium. Nuts and seeds contain healthy fats (monounsaturated and polyunsaturated fats), as well as several bioactive substances with a potential antioxidant effect.

In a vegetarian diet, nuts and seeds contribute, among other things, zinc, selenium, iron, calcium and vitamin B6, which can otherwise be difficult to get sufficient amounts of from other plant sources (Konde *et al*., 2015).

9.3 KEY FUNCTIONS OF MICRONUTRIENTS OF PUBLIC HEALTH IMPORTANCE IN ZAMBIA

Folate helps tissues grow, cells to work and helps form red blood cells, hence is key for anemia prevention; helps produce DNA; and works with vitamin B12 and vitamin C to help the body break down, use and create new proteins. Thus, folate is essential during pregnancy and foetal development, specifically for preventing neural tube defects. High in folic acid, pulses can improve brain function, and mental and emotional health.

Iron: Pulses are a source of non-haem iron (iron coming from plants) which is absorbed well by the body, especially when eaten with foods rich in vitamin C, and thus is key for anemia prevention. Iron also transports electrons within cells and is part of enzymes such as cytochromes which transfer energy within cells.

Zinc is key for the proper functioning of the body's immune system, for cell division, cell growth and wound healing. Thus, zinc is essential during pregnancy, infancy and childhood as the body needs zinc to grow and develop properly. Zinc also enhances the action of insulin and the breakdown of carbohydrates.

Calcium and manganese and other important nutrients in pulses promote the formation of strong bones and a healthy bone structure.

9.4 PULSES, NUTS AND SEEDS AND THEIR RELATIONSHIP TO HEALTH

9.4.1 Protect against diet-related non-communicable diseases

Scientific evidence confirms that pulses, nuts and seeds help protect against developing NCDs due to the high non-starch polysaccharides (NSPs) they contain. Consumption of pulses contributes to a reduction in total energy intake and an improvement in micronutrient intake (WHO and FAO, 2002).

9.4.2 Reduce the risk of heart disease

There is strong evidence that the protective effects of pulses, nuts and seeds against heart disease are provided through fibres that reduce the plasma total and LDL cholesterol (WCRF and

AICR, 2018; WHO and FAO, 2002). Pulses may prevent sharp rises in blood sugar, which is also a risk factor for cardiovascular disease (Afshin *et al*., 2014). In addition, pulses are cholesterol-free and low in fat.

9.4.3 Control diabetes

Plant-based foods, including pulses with complex carbohydrates which are rich in NSPs and high in fibre, have a low Glycemic Index (WHO and FAO, 2002). These pulses, nuts and seeds have the potential to improve glycemic control in people with diabetes by providing a steady glucose release to regulate insulin in the blood (Mann, 2007).

The fibres in legumes may especially help to lower blood cholesterol even without weight changes and may prevent sharp rises in blood sugar, both of which are risk factors for cardiovascular disease (Boeing *et al*., 2012).

9.4.4 Decrease the risk of obesity

A high intake of NSPs reduces the risk of developing obesity (WHO and FAO, 2002). In addition, the soluble fibre makes one feel fuller for longer thereby protecting against weight gain, overweight and obesity.

In spite of the high energy content in nuts, there is a link between the intake of nuts and seeds and the ability to maintain weight and reduce the risk of obesity, as nuts strongly reduce hunger and induce satiety two to four hours after pulse consumption (Afshin, 2014).

9.4.5 Protect against cancers

World Cancer Research Fund concluded that there is strong evidence to show that eating foods containing dietary fibre like pulses, fruits, vegetables and whole grains protects against colorectal cancer (WCRF and AICR, 2018). Further, the fibre and the prebiotics in pulses, nuts and seeds are the body's natural digestive regulators, thereby maintaining gut health.

In the case of the soya bean, it is linked to reducing 11 types of cancers (WCRF and AICR, 2018). Soya foods, which contain high concentrations of phytoestrogens, have weak oestrogenic effects which might block actions of endogenous oestrogens and thus reduce the risk of breast cancer and other hormonally-related cancers. In the Shanghai Women's Health Study, the consumption of soya foods during childhood and early adult life was inversely associated with the risk of premenopausal breast cancer (WCRF and AICR, 2018).

9.5 PULSES ARE A HEALTHIER ALTERNATIVE TO ASF AND ARE NCD PROTECTIVE

Replacing animal sourced proteins, especially processed red meat, with plant proteins is associated with lower all-cause mortality and cardiovascular mortality (Song *et al*., 2016). A meta-analysis of 36 randomised controlled trials also found that substituting plant-based proteins like pulses for red meat reduced risk factors for cardiovascular disease (blood cholesterol, triglycerides, blood pressure) (Guasch-Ferré *et al*., 2019). The intake of legumes is inversely associated with the risk of cardiovascular disease (Kaliwile, 2019; Liu, 2003; Van Duyn and Pivonka, 2000). Consumption of legumes at least four or more times a week was associated with a 22 percent lower risk of CVD (Flight, 2006; Hutchins, 2012).

9.6 HOW NUTS AND SEEDS PROTECT THE BODY FROM NCDS.

Nuts and seeds reduce blood lipid concentrations, oxidative stress, inflammation, visceral adiposity, hyperglycaemia and insulin resistance. In addition, a high consumption of nuts has been associated with a reduced risk of cardiovascular disease and overall mortality, while replacing dairy foods with nuts and other plant-source protein is likely to decrease overall and cardiovascular-related mortality (Johnsons *et al*., 2009).

9.7 PULSES, NUTS AND SEEDS ARE A PROTEIN SOURCE FOR A HEALTHIER ENVIRONMENT

Generally, the production of plant-based foods results in lower greenhouse gas emissions and uses less land and water than producing animal-based foods. Legumes release up to seven times less greenhouse gas emissions per area compared to other crops, and can sequester carbon in soils. Pulses are water efficient and can also make their own nitrogen from the atmosphere, thus reducing the application of nitrogen fertilizers. This leaves nitrogen-rich residues in the soil after harvesting; a benefit for the next crop planted in its place (Stagnari *et al*., 2017). Dry and uncooked pulses do not require refrigeration and can be stored for a long time.

9.8 RECOMMENDATIONS & GUIDANCE ON EATING A VARIETY OF PULSES, NUTS AND SEEDS

1. Eat a variety of pulses such as different types of beans, dry peas, cowpeas etc.
2. Eat a variety of seeds such as sunflower, chia, sesame, pumpkin and amaranth grains, which are a good source of protein, healthy fat and micronutrients.
3. Make soya beans part of your pulses, nuts and seeds options.
4. Eat nuts and seeds as healthy snacks, rather than sugary, salty or fatty snacks.
5. Combine pulses with whole grains, nuts or seeds. Meals or snacks made up of pulses mixed with nuts, seeds and whole grains are excellent ways of getting high quality proteins from just plant-based foods.
6. Sort nuts before eating and throw away any that look mouldy, discoloured or shrivelled. They may contain harmful toxins.
7. Eat beans and lentils with foods high in vitamin C (e.g. oranges, lemon juice or baobab fruit). Vitamin C helps the body absorb iron from these foods.
8. Avoid drinking coffee or tea up to two hours after eating beans and lentils. Coffee and tea can reduce the amount of iron and zinc absorbed by the body from these foods.

9.9 HOW MUCH LEGUMES TO EAT PER DAY

EAT-Lancet Commission recommends the consumption of 125 g of legumes, nuts and seeds daily, while the Global Burden of Disease Study indicates a daily consumption of over 60 g of legumes in order to reduce the risk of diet-related diseases (Willet *et al*. 2019; and GBD 2017).

For Zambia, through diet modelling, the recommended amount is two servings of pulses, nuts and seeds every day. One serving is an average that provides 120 Kcal (100 to 140 Kcal) which is about 90 g or half a cup for pulses. For nuts and seeds, a serving is about 27 to 30 g (3 tablespoons). There are plenty of options to choose from in this food group to make two servings, as per the examples in Table 7. Each food amount in Table 7 is listed is one serving equivalent. Chose any two or combine any food from that table to make two servings

For vegetarians and those who are not eating fish, insects and ASF, a single serving is 1 cup (180 g) cooked dried pulses or 60 g nuts and seeds. Taking two servings of pulses, nuts and seeds will ensure an adequate intake of proteins and other micronutrients that fish, insects and ASF provide.

Table 7: One serving equivalent of pulses, nuts and seeds exchange list

Food description	Food serving measure*			Nutrient values per serving**						
	Cups**	Grams (g)	Table-spoons	Energy	Protein	Iron	Folate	Calcium	Zinc	Fibre
				(Kcal)	(g)	(mg)	(mcg)	(mg)	(mg)	(g)
Bambara nuts (boiled)	0.5	90	-	125	6.7	0.9	-	18.5	1	1.3
Cowpeas	0.5	80	-	94	6.3	1.8	61.8	20.6	1.2	4.5
Peanut butter†	-	24	1.5	134	5.3	0.5	8.4	13	0.6	1.4
Peanuts (dry roasted)†	-	27	3	159	6.5	0.4	26.2	0.96	0.756	2.3
Peanuts (raw)†	-	27	3	153	7	1.3	64.8	24.8	0.9	2.3
Pumpkin and squash seeds (shelled, dried)†	-	30	3	145†	9	2.6	17.4	13.8	2.3	1.8
Red kidney beans (boiled)†	0.5	90	-	111	8.6	2.5	66.6	39.6	0.81	8.4
Seeds, flax , chia sun-flower (roasted)†	-	25-30	3	145-175	4.8-5.7	1-1.14	59-71	1.3 - 1.6	13-1.6	2.8-3.3
Soya beans	0.5	85	-	151	11.8	2.4	69.7	72.7	1.6	3.4
White beans	0.5	90		111	7.4	1.6	65.7	20.7	1.1	3.4
Consume two daily servings of pulses, nuts and seeds by choosing any of the foods above. Each food amount listed is the equivalent of one serving.										

*Zambia Diet Model FCT unless otherwise stated; rounded values
**USDA; rounded values
†Values based on the USDA FCT

9.10 TIPS ON INCREASING INTAKE OF PULSES, NUTS AND SEEDS

Helpful Tips to eating more pulses nuts or seeds daily

1. Mix pulses with whole grains, nuts or seeds to make powerful combinations of plant-based proteins.
2. Adding beans, peas and lentils to soups, stews and starchy dishes is an excellent way to add pulses to the diet.
3. Porridge goodness: Mixed whole grain, pulse, nut or seed flours make a good, healthy and whole some breakfast for the whole family.
4. Powders made from nuts and seeds can be added to foods as condiments.
5. Use pulses, nuts and seed in baked goods – either whole or as a flour.
6. Soak beans and lentils overnight and rinse with fresh water before cooking. This reduces cooking times.
7. Soak pulses before cooking to reduce stomach gas and to make iron more available for absorption.
8. Add vitamin C-rich foods to meals when eating beans, peas and lentils. Vitamin C helps the body absorb iron.
9. Use nut butters (e.g. peanut butter and almond butter) as a spread for bread rather than hard margarine and butter, which are unhealthy.
10. If possible, grow beans, nuts and seeds sustainably.

Recommendation 6

Eat fish, insects or animal source foods daily

10. RECOMMENDATION 6: Eat fish, insects or animal source foods daily.

10.1 A CLOSER LOOK: FISH, EGGS, INSECTS AND ANIMAL SOURCE FOODS

This group includes eggs, fish, insects and ASFs. ASFs refer to meats (muscles or organs) from mammals, including mice, poultry, birds, frogs and reptiles, that are consumed as food. Meats are categorised as white and red meat based on their health and risk factors. White meat includes poultry i.e. chicken, quails, ducks, guinea fowls, rabbits, etc. Red meat includes beef, goat, lamb, mutton, veal, pork and horse.

10.1.1 Foods not included in this food group

- Milk and milk products have their own distinct food group because of their essential functions related to calcium.
- Animal products such as butter, ghee and lard are excluded from this group and are classified as fats and oils because of their high fat content.
- Ultra-processed meats are not part of this food group due to their risk factors. Ultra-processed meats are meats that have been modified through salting, curing, smoking, drying or other processes to preserve them or enhance their flavour. Examples include hot dogs, sausages, bacon and luncheon meats such as bologna, salami, polony, corned or canned meats, deli meat cuts and ready-to-eat sausages.

10.2 IMPORTANCE OF EATING FISH, EGGS AND ASF

Fish, eggs and ASFs are a very good source of complete protein, meaning they provides all nine essential amino acids. ASFs also have high amounts of vitamin B12 and other B vitamins, as well as vitamin D, omega-3 fatty acid docosahexaenoic acid (DHA), heme-iron, zinc and selenium, in addition to other micronutrients. For example, one serving (100 g) of fish like tilapia contains 26 g of protein, a cooked chicken breast contains about 31 g and lean beef contains about 27 g, while two eggs provide about 13 g of protein. The recommended daily amount of

protein is 0.83 g per kilogram (kg) body weight for proteins with a protein digestibility-corrected amino acid score (PDCAAS) value of 1.0. Thus, the recommended daily intake of protein works out to 50 g for a man/woman with a body weight of 60 kg. Extra protein is required for pregnancy and lactation (Leenders *et al*., 2013). This shows that small quantities such as 100 g of ASF, combined with other sources of protein like pulses, grains, nuts and seeds, will be adequate to provide the protein and amino acids requirements to sustain life.

A human body requires around 20 essential and non-essential amino acids to build proteins. ASF, fish, eggs and mice contain all essential amino acids that the body needs to function effectively. While the body is able to produce non-essential amino acids, essential amino acids need to come from food sources as the body is not able to make them.

ASFs also contain some nutrients not found in plant sources or that are highly bio-available compared to plant sources. Vitamin B12 is mainly found in fish, poultry meat and dairy products. Not consuming ASF can lead to vitamin B12 deficiency. Vitamin D is found in oily fish, eggs and dairy. Some plants contain vitamin D, but the body better utilises vitamin D found in ASFs. Heme-iron is predominantly found in meat, especially red meat, which is easily absorbed in the body. Zinc is mainly found in animal protein sources such as meat, and is also more easily absorbed and used from animal protein sources than plant sources. DHA is an essential omega-3 fat found in fatty fish. It is important for brain health and is difficult to get from plant sources.

10.3 WHITE MEAT IS A HEALTHIER MEAT OPTION THAN RED MEAT

As the name suggests, red meat from beef, goat, lamb, mutton, veal, pork and horses is red in colour because it contains a large amount of myoglobin, a muscle pigment. White meat from poultry, such as chicken, quails, ducks, guinea fowls and rabbit, is white in colour because it has a lower concentration of myoglobin. The nutrient content differs slightly between red and white meats. Red meat contains higher levels of iron, zinc and B vitamins (thiamine, riboflavin and vitamins B6 and B12) than white meat.

However, the biggest difference between red and white meat is the fat content. White meat is a leaner source of protein, with a lower fat content. White meat like poultry, when eaten without the skin, is lower in saturated fat but is abundant in good polyunsaturated and monounsaturated fatty acids like omega-3 and omega-6 fatty acids, which help to reduce the 'bad cholesterol' like low-density lipoprotein (LDL) and increase the 'good cholesterol' like high-density lipoprotein (HDL) (Bowen, Harris and Etherton, 2016; Farell, 2012). Further, chicken meat does not contain trans fats, unlike red meat (Farell, 2012).

Red meat contains higher levels of total fat, including bad fats such as saturated fats and trans fats. Saturated fats can increase the bad cholesterol (LDL), causing a risk of heart disease and stroke. Trans fats increase CVD risk factors and diabetes (WHO and FAO, 2002; GBD, 2017).

10.4 LIMIT THE INTAKE OF RED MEAT AND PROCESSED MEATS TO REDUCE THE RISK OF DISEASES

Consuming too much meat, specifically red meat containing saturated fat which increases the bad cholesterol (LDL), can increase the risk of diseases such as heart diseases and strokes (WHO, 2015), type 2 diabetes, certain types of cancers, and weight gain and mortality (Abete *et al*., 2014; Bernstein *et al*., 2010). However, even with the same number of servings of red meat, the consumption of fish, poultry, dairy products and especially nuts were associated with a lower risk of diseases (IARC, 2015; WHO, 2015).

Processed meats are meats processed or preserved by smoking, curing, salting or by adding chemical preservatives. Examples include bacon and hot dogs. Processed meats are linked to cancer. In 2015, WHO placed the risk of eating processed meat in the same category as smoking, which could be attributable to the amount of nitrates found in processed meats. Processed meats also have a very high sodium content.

Therefore, adopting a diet containing a reduced amount of meat, especially red meat, and limiting/avoiding processed meat products is ideal. Select fish, insects, eggs or white meat daily as healthier options, rather than red meat, for this food group. If you eat red meat, limit consumption to 160 g per week and avoid processed meats. The Global Burden of Disease Study defines exposure to a diet high in red meat (beef, pork, lamb and goat but excluding poultry, fish, eggs and all processed meats) as an average daily consumption greater than 22.5 g. The GBD

defines exposure to a diet high in processed meats as an average daily consumption of greater than 2 g of ultra-processed meat (GBD, 2017).

10.5 THE ROLE OF LIVER AND KIDNEY IN ADDRESSING IRON DEFICIENCY

Iron deficiency anaemia is a serious public health problem that particularly affects young children and pregnant women. Iron is required by the body to make haemoglobin. Haemoglobin is found in the red blood cells and helps in the transport of oxygen around the body. Iron also helps in the production of energy throughout the body. Liver and kidney meats are nutrient dense and rich sources of iron. About one serving (100 g) of beef liver provides about 13 mg/100 g of iron, while one serving of beef kidney provides about 7 mg of iron. The recommended daily allowances for the general population aged 19 to 50 years is 8 mg per day for men and 18 mg per day for women (NIH, 2021; FAO and WHO, 2011).

Women need more iron than men during their reproductive age because of menstruation and to build stores for childbearing. (Ka He *et al*., 2004)

10.6 FISH, INSECTS AND WHITE MEAT ARE HEALTHIER AND SUSTAINABLE OPTIONS.

Fish, insects, eggs and white meat are healthier and sustainable options in the following ways:

10.6.1 Fish

Fish and insects are the healthiest options of ASF. People who eat fish regularly are also likely to have a lower risk of heart attacks, strokes and death from heart disease. One study of more than 40 000 men found that those who regularly ate one or more servings of fish per week had a 15 percent lower risk of heart disease (Ka He, 2004). It is recommended to eat fish several days a week with at least two servings (200 g) of oily fish per week. In addition, make small fish eaten with bones a major part of the fish options chosen per week.

10.6.2 Eggs

Eggs are a source of high-quality protein, essential fatty acids and other essential nutrients, and they are relatively low cost and nutrient dense which is beneficial for low-income populations with a poor quality of diet (Alexander *et al*. 2016 and Willett *et al*., 2019). Egg yolk is particularly rich in cholesterol but unlike dairy products and meat, it does not provide saturated fatty acids (SFAs) (WHO and FAO, 2002). Eating eggs does not seem to raise cholesterol levels the way other cholesterol-containing foods do, such as trans fats and saturated fats.

In the past, there have been concerns about possible increases in the risk of heart disease because of the high content of cholesterol in eggs. However, a large meta-analysis of prospective cohort studies concluded that "higher consumption of eggs (up to one egg per day) is not associated with increased risk of CHD or stroke, except among diabetic patients" (Rong *et al*., 2013). Another recent meta-analysis showed that consumption of up to one egg daily may contribute to a decreased total risk of stroke, and that a daily egg intake does not appear to be associated with a risk of CHD (Alexander *et al*., 2016).

However, if eggs are eaten daily, limit consumption of eggs to one egg per day since studies have found that each additional half egg consumed per day was tied to an 8 percent greater risk of death from all causes, and each extra 300 mg of cholesterol was linked to an 18 percent higher risk of premature death (Zhong *et al*., 2019).

10.6.3 White meat

One of the conclusions from a meta-analysis of 13 prospective cohort studies of 1 674 272 individuals by Abete *et al*., (2014) stated that "white meat consumption might be the 'healthy' alternative to red and processed meat consumption". This is because even with the same number of servings of red meat, the consumption of fish, poultry, dairy products and especially nuts was associated with a lower risk of heart diseases like stroke, type 2 diabetes, certain types of cancer, weight gain and mortality (Abete *et al*., 2014; IARC, 2015).

Further, a meta-analysis of 22 studies globally showed an inverse association between white meat consumption and all-cause mortality and a neutral association with CVDs and mortality and morbidity (Alexander *et al*., 2016).

10.6.4 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. Insects contain higher amounts of proteins, hence they provide more essential amino acids compared to traditional sources of proteins, such as meat, dairy products and seeds, on the same weight basis (Defoliart, 2002; Banjo, Lawal and Songonuga, 2006; Cerritos, 2009; Siulapwa, 2014; Oibiokpa *et al*., 2018). Insects contain between 12 g and 77 g of protein per 100 g (Xiaoming *et al*., 2010) while fish, chicken and beef contain between 13 g and 31 g protein. Protein digestibility of insects ranges from 76 percent to 98 percent (Ramos-Elorduy, 1997).

Studies have shown that in some insects like crickets, grasshoppers and mealworms, micronutrients like copper, zinc, manganese, magnesium and calcium were 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).

Farming insects and including them in the diet is not only good for nutrition but also for the environment. Insects are a very sustainable source of protein with less impact on the environment compared to ASF. Insects do not require much land to reproduce and require less feed resources, as they have a feed conversion efficiency where they can convert 2 kg of feed into 1 kg of insect mass (FAO, 2013). Insects like crickets require about 2 000 times less water than beef and produce less greenhouse gas emissions.

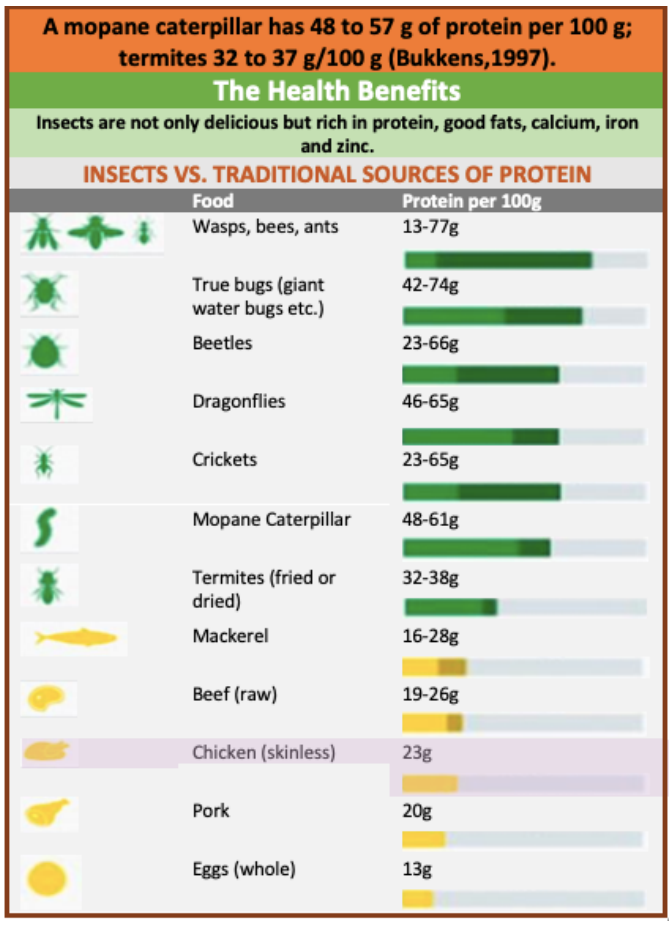
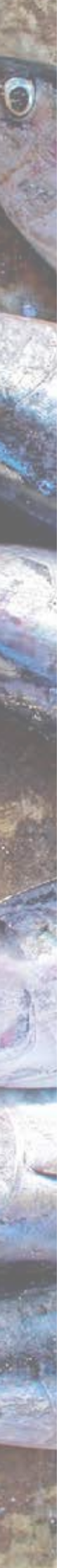


Image courtesy of Western Exterminator company (https://www.westernexterminator.com)



10.7 RECOMMENDATIONS & GUIDANCE ON EATING A VARIETY OF FISH, INSECTS OR ANIMAL SOURCE FOODS

1. Eat fish, including oily and small fish eaten with bones, as often as possible per week.
2. Choose insects, white meat like poultry, rabbits, mice or eggs as healthier options instead of red meats.
3. If red meat such as beef, goat and lamb is eaten, cut consumption down to less than 160 g or the equivalent of 2 servings a week to help protect against heart diseases and some cancers.
4. Avoid charring meat while cooking. High-temperature cooking, like grilling, can form carcinogenic (cancer-causing) compounds in the meat.
5. Avoid ultra-processed meat like polony, bacon, ham, salami, sausages and hot dog.

10.8 RECOMMENDED AMOUNTS OF FISH, INSECTS OR ANIMAL SOURCE FOODS

The body only needs small amounts of protein for its function. For example, an adult requires 0.83 kg proteins per 1 kg body weight (WHO, FAO and UNU, 2007). This translates to 46 g of protein for a 55 kg woman and 58 g of protein for a 70 kg man. In addition, FAO and WHO, 2002 recommend that 8 to 12 percent of total energy should come from protein food sources, include pulses. Thus, very small portions of chicken, other poultry or meat will meet daily requirements for protein or other essential nutrients found in these foods, as shown in Table 8.

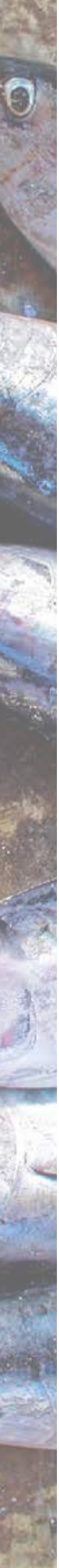
However, most Zambians in urban areas eat more meat than the body requires, which can lead to weight gain, obesity and heart disease. To enjoy the nutritional benefits of meat, poultry or fish without compromising your health, eat no more than the recommended one serving amount per day.

For Zambia, in order to get the benefits from ASFs without overeating, it is recommended that individuals eat one serving of fish, insects or ASF per day. One standard serving from this group provides about 135 Kcal per day, except for some insects. Eat one serving daily by choosing any one of the foods listed in Table 8. Each food amount listed is one serving equivalent.

Table 8: One serving equivalents of fish, eggs, insects and ASF exchange list

Food description	Food serving measure*	Nutrient values per serving*						
	Grams (g)	Energy	Protein	Iron	Folate	Zinc	B12	Calcium
		(Kcal)	(g)	(mg)	(mcg)	(mg)	(mg)	(g)
Beef meat, lean (boiled, without salt)*	65	137	23	2.3	5.2	4	0.9	4.6
Chicken liver (braised, without salt)	80	135	22	9.6	596.8	3.5	19.2	12
Chicken meat, light flesh (boiled, without salt)	95	135	29.5	0.6	5.7	1	0.2	9.5
Eggs [2 large] (hard-boiled)	100	135	12.6	1.7	38	1.2	0.7	53
Flying ant	50	257**	21	11	47	4.9	-	56
Goat meat (boiled, with-out salt)	65	135	17	2.3	2.9	3.3	0.7	8.3
Grasshopper, locust and cricket (dry)	50	217	27	13	185	6.9	6	122
Grasshopper (cooked)	100	145	21	5	-	-	-	-

Food description	Food serving measure*	Nutrient values per serving*						
	Grams (g)	Energy	Protein	Iron	Folate	Zinc	B12	Calcium
		(Kcal)	(g)	(mg)	(mcg)	(mg)	(mg)	(g)
Kapenta/anchovy (steamed)	85	135	23.5	3.2	6	2.2	0.7	109.7
Kapenta/kapenta powder (dry)†††	50	104	33	4.5	-	7	-	398
Mole cricket (blanched)	105	137	16	44	-	-	-	79.8
Mopane worm (cooked)	140	135	19.7	9.8	5	4.5	7	54
Rabbit meat (stewed or grilled)	70	135	22	1.2	3	1.7	7	13.3
Tilapia (steamed, without salt)	115	135	25.4	1.4	23	1.1	1.7	23
Consume one daily serving of fish, eggs, insects and ASFs by choosing any of the foods above. Each food amount listed is the equivalent of one serving.								
*Zambia Diet Model FCT; USDA FCT; West Africa FCT; rounded values Other sources: Steiner-Asiedu *et al.*,1993; Hlongwane Z.T. *et al.*, 2020; Huis *et al.*, 2013								
Note: To match and reach an adequate intake of the key nutrients, the quantity gives a higher than targeted energy. Where fields are blank, no value was available in the food composition table.								



10.9 TIPS ON CONSUMING FISH, EGGS, INSECTS AND ASF

Helpful Tips on healthier consumption of fish, eggs, insects and ASF

1. Make a few meals meatless per week. An extra portion of dried beans and peas (legumes) are a good substitute for meat.
2. Eat fish as often as possible, including oily fish and small fish eaten with bones. This is because fish is possibly the healthiest form of white meat. Watch your portion sizes: a palm of your hand is about 85 to 115 grams of meat. So two palm sizes of red meat exceeds the recommended amount to eat per week.
3. Choose lean meat and trim visible fat to further reduce the amount of saturated fat.
4. Remove the skin from chicken or poultry before cooking.
5. Make sure the meat is cooked thoroughly to eliminate the risk of foodborne illnesses.

Recommendation 7

Take milk and dairy products for strong bones and teeth

11. RECOMMENDATION 7: Take milk and dairy products for strong bones and teeth.

11.1 A CLOSER LOOK: MILK AND DAIRY PRODUCTS

Milk is a nutrient-rich fluid that female mammals produce to feed their young. As such, milk contains valuable nutrients that help support a growing body, including calcium and protein. Breast milk for children under six months is the best and only food for an infant. This is because breast milk contains all the nutrients that an infant less than six months old needs. From six months up to two years and beyond, breast milk continues to be an important source of food for children, in addition to complementary foods.

For babies older that one year, animal milk improves diet quality and nutrient density. The most commonly consumed types of milk come from cows, sheep and goats.

Animal milk is not recommended for infants younger than one year old. This is because babies this age cannot digest cow's milk as completely or as easily as breast milk or formula. Further, cow's milk contains higher amounts of protein and minerals, which can stress the baby's immature kidneys. Cow's milk does not have the right amounts of iron, vitamin C and other nutrients, and does not provide the right types of fat for growing infants (WHO, 2015b; CDC, 2021).

This food group includes only milk and milk products such as cheese, sour milk and yogurt. Other products derived from milk, like butter and ghee, are not part of this food group and are considered as fats and discussed in Chapter 12 under recommendation 8 on reducing fats, oils, sugars and salt.

11.2 IMPORTANCE OF MILK AND MILK PRODUCTS IN A DIET AND FOR GOOD HEALTH

Milk provides many essential nutrients of public health concern, as the Zambian population under-consumes them. Milk is an important source of calcium, potassium and B12, which are lacking in many diets.

Milk is rich in high-quality protein and is considered a "complete protein," as it contains all nine of the essential amino acids necessary for the body to function at an optimal level. Milk contains magnesium; vitamin A; B vitamins like thiamine (B1), riboflavin and pantothenic acid (vitamin B5); and zinc, which make a significant contribution towards meeting the body's needs for these nutrients. Milk also contains hundreds of different fatty acids, including conjugated linoleic acid (CLA) and omega-3s (FAO, 2013).

11.2.1 Milk is important for bones and teeth

A combination of nutrients, including calcium, phosphorus, potassium, proteins and vitamin K from milk are essential for maintaining strong, healthy bones and teeth. The calcium in milk is readily absorbable for the normal development and maintenance of the skeleton, muscle movement and nerve signals. Animal milk can be fortified with vitamin D and other nutrients that benefit bone health. Thus, milk and milk products may prevent bone diseases like osteoporosis.

11.2.2 Milk is essential in preventing non-communicable diseases

High milk consumption is associated with a reduced risk of colorectal cancer and possibly bladder cancer, as well as a reduced risk of diabetes and obesity. However, high consumption of milk is associated with an increased risk of prostate cancer in men (FAO, 2013a; Willet *et al*., 2019). Conjugated linoleic acid and omega-3 fatty acids are linked to many health benefits, including a reduced risk of diabetes and heart disease (Castro-Webb, Ruiz-Narváez and Campos, 2012).

11.3 RECOMMENDATIONS & GUIDANCE

ON EATING A VARIETY OF MILK AND MILL PRODUCTS EVERY DAY

1. Milk is nutrient dense and packed with calcium, high quality protein and essential micronutrients.
2. Milk is an ideal ingredient for many recipes and for addition to many meals.
3. Stay hydrated with milk as a natural alternative to highly-processed and sugary drinks.

11.4 TAKE MILK AND MILK PRODUCTS FOR HEALTHY BONES AND TEETH.

11.4.1 How much milk and milk products should be taken?

The Global Burden of Disease study defines exposure to a diet low in milk as an average daily consumption of less than 435 g per day of animal milk and milk products (GBD, 2017) while the "Healthy Reference Diet" proposed by EAT-Lancet recommends taking 250 g/day with a range of 0 to 500 g (Willett, 2019).

In order to optimise their health, Zambia's general population should consume one serving of milk (245 g) per day (fresh or fermented) or dairy products such as yoghurt (mabisi), especially those with reduced fat. One serving is based on 125 Kcal, with equivalent amounts listed in Table 9.

Table 9: One serving equivalents of milk and milk products - and key nutrients

Milk or milk product	Cups	Grams (g)	Energy (Kcal)	Pro-tein* (g)	Iron (mg)	Folate (mg)	Zinc (mg)	Calci-um* (mg)	B12* (mcg)	Fibre (g)
Milk, cow 2% fat (low fat)**	1	245	120	8.1	0	12.3	1.2	294	1.2	0
Milk, cow 3.5% fat (whole milk)	1	245	160	8.3	0.1	24.5	1	294	1.5	0
Yoghurt, low fat**	2 (small tins)	200	126	8	0	22	1.8	308	-	0
Yoghurt (low fat)*	3/4	200	125	8	0	22	1.8	308	-	0
Yoghurt (whole milk, plain)	3/4	185	115	7	0.2	22.2	1.1	281.2	0.6	0
Cheese (shredded)**	1/3	40	150	9.2	0.1	10.8	1.5	283.9	0.4	0

*Diet Model (DM) conversions based on DM FCT
**USDA FDC (2020)
†The smallest tin of commercial yogurt is 100 g

11.5 ALTERNATIVES IF ONE IS NOT ABLE TO TAKE MILK AND MILK PRODUCTS

The FBDGs Pretesting results show that milk and milk products, just as ASFs, are not affordable for many Zambians (Zambia MoA; FAO, 2021c). GAIN and UNICEF (2021) also had similar findings. Due to unaffordability of ASF like milk, many people are not able to consume the calcium they need from this milk. One serving of milk and milk products contains approximately 300 mg of calcium.

There are plenty of alternative foods that provide similar amounts of calcium the body needs. Individuals who are not able to eat dairy products should take one or more of the following foods daily: moringa leaves; cassava leaves; okra (lady finger) fruits and their leaves; jute (bush okra); amaranthus; baobab fruit pulp and leaves; tamarind pulp and leaves; African locust beans; dried figs; cow pea leaves; spinach and taro leaves; and small fish eaten with bones like kapenta, sardines, and anchovies. Table 10 lists the amounts that provide 300 mg of calcium, which is equivalent to 1 serving of milk (250 g).


Kapenta


Amaranths


Cassava Leaves


Baobab Fruit


Moringa Leaves

DID YOU KNOW?

One serving of dry kapenta (50g) provides over four times the amount of calcium and meets the protein requirements per day.

Make kapenta part of a healthy food choice.

11.6 TIPS ON TAKING MILK AND MILK PRODUCTS

Helpful Tips on increasing the intake of milk and milk products

1. Add milk, yoghurt or sour milk to porridge or breakfast cereals.
2. Make soups creamy by adding milk, sour milk or plain yogurt.
3. Use milk in casseroles and omelets.
4. Add plain yogurt to fruit salads as a snack or desert.
5. Drink plain milk as a beverage during or between meals, instead of fizzy and sugary drinks.
6. Add milk to your teas, coffees and other beverages.
7. Make smoothies with milk or yoghurt.

Table 10: Foods high in calcium in the amount needed to get 300 mg of calcium which is equivalent to one serving of milk (245 g or one cup)

Food group name	Food name in English	Food quantity (grams)	Calcium (mg) per food amount	Notes
Milk	Low fat milk	244 g	293 mg	
Fruits	Baobab, pulp (powder)	100 g	342 mg	
Fruits	Baobab, pulp (powder)	90 g	308 mg	
Fruits	Fig (dried)	150 g	303 mg	
Fruits	Tamarind fruit, (raw, ripe)	200 g	302 mg	
Fruits	African locust bean, fruit, pulp (raw)	300 g	353,78 mg	
Fruits	African locust bean, flour from fruit, pulp	200 g	323 mg	
Fruits	Dattock, dried pulp (raw)	300 g	330 mg	
Fish	Kapenta (dry)	11 g	308 mg	One serving meets all daily calcium needs

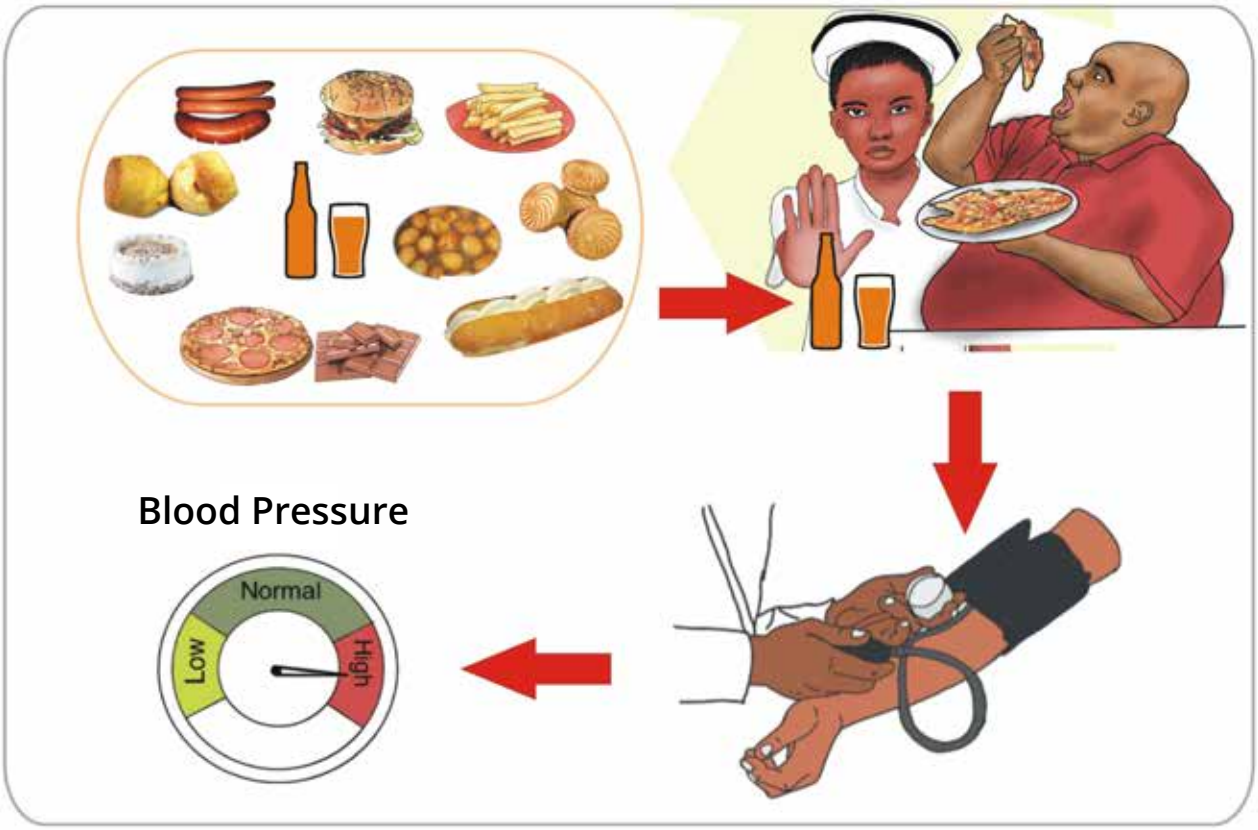
Food group name	Food name in English	Food quantity (grams)	Calcium (mg) per food amount	Notes
Fish	Kapenta powder (dry)	10 g	300 mg	
Fish	Sardines in oil, canned (drained solids with bone)	80 g	305.6 mg	
Pulses & Legumes	African locust bean, seeds (dried)	120 g	349.2 mg	
Pulses & Legumes	Soya bean (boiled)	344 g	351 mg	2 cups
Nuts & seeds	Sesame seeds, whole (dried, raw)	35 g	328.3 mg	4 tablespoons
Vegetables	Amaranth, leaves (boiled)	80 g	304 mg	3/4 cup
Vegetables	Baobab, leaves (boiled)	100 g	312 mg	3/4 cup
Vegetables	Baobab, leaves (dried)	25	310 mg	1/4 cup
Vegetables	Cassava, leaves (boiled)	120 g	331.2 mg	1 cup
Vegetables	Cowpea, leaves (boiled)	130 g	345.02 mg	2.5 cups, chopped
Vegetables	Cowpea, leaves (dried)	30 g	318 mg	1 1/4 tablespoon
Vegetables	Moringa powder	12 g	300 mg	6 tablespoons
Vegetables	Moringa/drumstick, leaves (cooked)	68g	392 mg	1 cup, chopped
Vegetables	False sesame, leaves (boiled)	75 g	348.75 mg	3 tablespoons
Vegetables	False sesame, leaves (dried)	25 g	327.5 mg	1 tablespoon
Vegetables	Jute (bush okra) leaves, (boiled, without salt)	90 g	324 mg	4 tablespoons
Vegetables	Okra leaves (boiled, without salt)	115 g	342 mg	3/4 cup
Vegetables	Okra fruit (boiled)	400 g	308 mg	2.5 cups
Vegetables	Onions (dried)	130 g	310.05 mg	1 cup
Vegetables	Pumpkin leaves (dried)	100 g	330 mg	4 tablespoons
Vegetables	Spinach (boiled, without salt)	250 g	333 mg	1.5 cups
Vegetables	Tamarind, leaves (boiled)	75 g	302 mg	3 tablespoons

Food group name	Food name in English	Food quantity (grams)	Calcium (mg) per food amount	Notes
Vegetables	Tamarind, leaves (dried)	20 g	300 mg	2 tablespoons
Vegetables	Taro, leaves (boiled)	300 g	315 mg	2.5 cups
Spices & Herbs	Anis seed	50 g	323 mg	7 tablespoons
Spices & Herbs	Bay leaf (dried)	40 g	333,6 mg	
Spices & Herbs	Chili pepper (dried)	140 g	336 mg	
Spices & Herbs	Cinnamon (ground)	30 g	300 mg	
Spices & Herbs	Cumin, seed	35 g	325.9 mg	
Spices & Herbs	Black pepper	70 g	308 mg	

Recommendation 8

Limit eating ultra-processed foods and foods high in salt, sugar, and fats and oils to prevent non-communicable diseases

12. RECOMMENDATION 8: Limit eating ultra-processed foods and foods high in salt, sugar, and fats and oils to prevent non-communicable diseases.



12.1 ABOUT PROCESSED FOODS

Most food needs some degree of processing for them to be edible, digestible and to maintain their health benefits. Some processing will make food unhealthy while other types of processing does not necessarily do so. The NOVA food classification system has categorised foods into four groups according to their nature, purpose, the extent of processing they undergo after they are separated from nature, and before they are consumed or made into dishes and meals (Monteiro *et al*., 2019).

For example, products from Group 1 – unprocessed or minimally processed foods – are healthy, and individuals should make natural, whole foods and minimally processed foods the basis of their diets (FAO and WHO, 2019). This is because minimally processed foods do not add substances such as salt, sugar, oils or fats to the original food except during the final cooking stage at home or in restaurants. Limited amounts of Group 2 foods – processed culinary ingredients – can be used to add variety and taste to foods from Group 1 to make freshly prepared dishes and drinks at home and in restaurants. Small amounts of Group 3 foods – processed foods – can also be used as part of meals, with limited frequency of consumption.

The great concern is with Group 4 – ultra-processed foods (UPF) – since these are not modified natural foods but industrial formulations, as they contain a lot of added salt,

trans fats, refined carbohydrates and sugars. They have additives only found in UPFs such as chemical flavourings, preservatives or artificial colours and emulsifiers. During manufacturing, UPFs are manipulated to be addictive and/or hyper-palatable (PAHO, 2015; Monteiro *et al*., 2019).

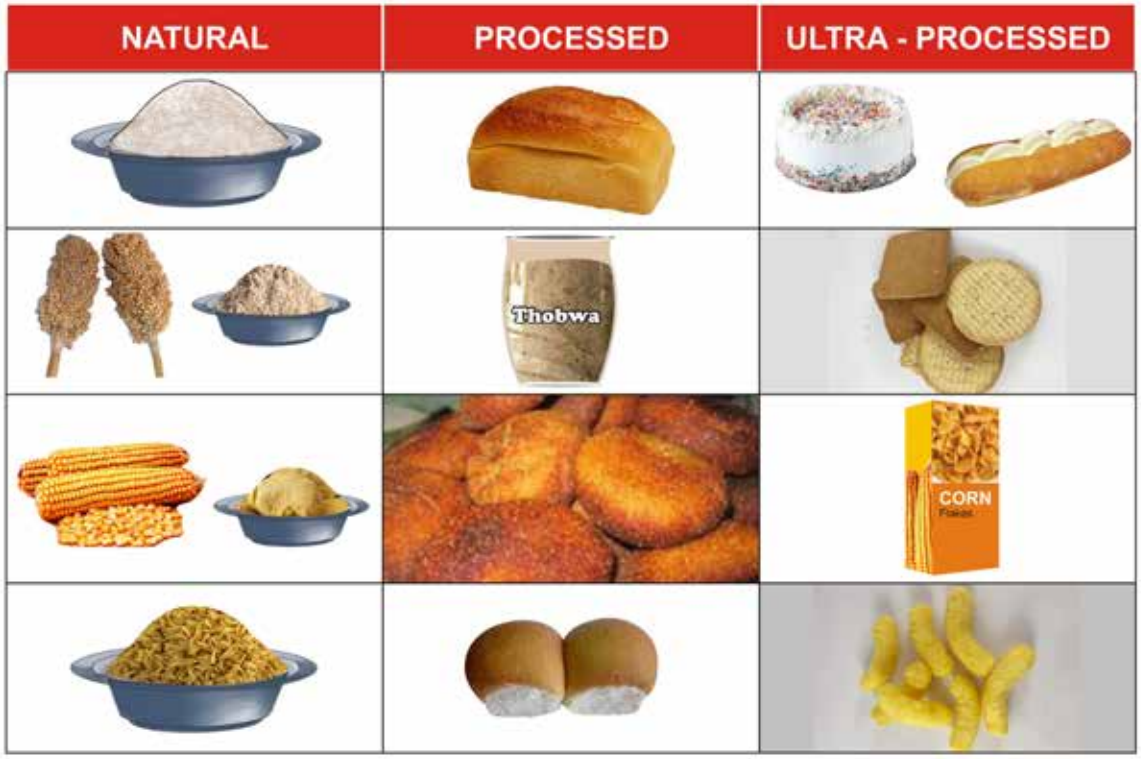
Figure 8: Examples of ultra-processed foods

12.1.1 Group 1: Unprocessed or minimally processed foods

According to Monteiro *et al*. (2016), "unprocessed (or natural) foods are edible parts of plants (seeds, fruits, leaves, stems, roots) or of animals (muscle, offal, eggs, milk), and also fungi, algae and water, after separation from nature". These foods do not undergo any alteration.

Minimally processed foods are "natural foods altered by processes such as removal of inedible or unwanted parts, drying, crushing, grinding, fractioning, filtering, roasting, boiling, pasteurisation, refrigeration, and freezing, placing in containers, vacuum packaging, or non-alcoholic fermentation". The purpose of processing is exclusively to increase shelf life and storability and enhance the edibility and digestibility of a food without changing its major composition and properties of the original food. None of these processes add substances such as salt, sugar, oils or fats to the original food except during the final cooking stage. Examples include fresh, frozen or dried fruits, vegetables and fish, eggs, meat, raw or pasteurised milk, and whole grain flours (Educhange, 2018; Heart and Stroke Foundation, 2021; Monteiro *et al*., 2019; Reardon, 2021). Make these natural, whole foods the basis of your diet.

Figure 9: Cereal (grains) examples of natural/minimally processed, processed and ultra-processed foods



12.1.2 Group 2: Processed culinary ingredients

Processed culinary ingredients are food products mainly used as condiments such as plant oils, animal fats (e.g. butter), sugar, honey, salt, vinegar and aromatic herbs which are extracted and purified from Group 1 foods by processes such as pressing, grinding, crushing, pulverizing and refining. They are used as ingredients to add taste to foods from Group 1 to make freshly prepared dishes and drinks in homes and restaurants (EduChange, 2018; Heart and Stroke Foundation, 2021; Monteiro *et al*., 2019). The products in this group are often produced industrially or by artisanal enterprises rather than by the consumer itself. Processed culinary ingredients typically consist of only one macronutrient in a highly purified form (mainly fat, sugar or carbohydrate) and therefore have low a nutrient density.

Figure 10: Culinary ingredients examples

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

12.1.3 Group 3: Processed food

Processed foods are simple food products made by adding Group 2 foods like salt, sugar, oil and others substances to natural foods (Group 1 foods). Most processed foods have two or three ingredients. These foods are recognisable as modified versions of Group 1 foods and retain most constituents of the original food. The purpose of processing is to extend the shelf life of food and make food more palatable (PAHO, 2015; Monteiro *et al*., 2016). Processing includes canning fish; bottling vegetables, fruits and legumes in brine; preserving fruits in syrup; curing or smoking fish or meat; and preserving tinned fish in oil. Salting or sugaring nuts and seeds, as well as non-alcoholic fermentation to produce, for example, unpackaged freshly-made bread, cheese and sweet beer (mahewu), are other examples of processing (Educhange, 2018; Heart and Stroke Foundation, 2021; Monteiro *et al*., 2019).

Monteiro *et al*. (2016) also indicates that processed foods can have some additives to preserve their original properties or prevent spoilage and increase food safety: "Examples include fruits in syrup with added antioxidants, and dried salted meats with added preservatives. When alcoholic drinks are identified as foods, those produced by fermentation of Group 1 foods such as beer, cider and wine, are classified as Group 3 foods." Some foods like flours are fortified to add nutrients like vitamin A, calcium or vitamin D.

The addition of 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 the basis of your diet.

Figure 9b: Starchy roots and tubers examples of natural/minimally processed, processed and ultra-processed foods

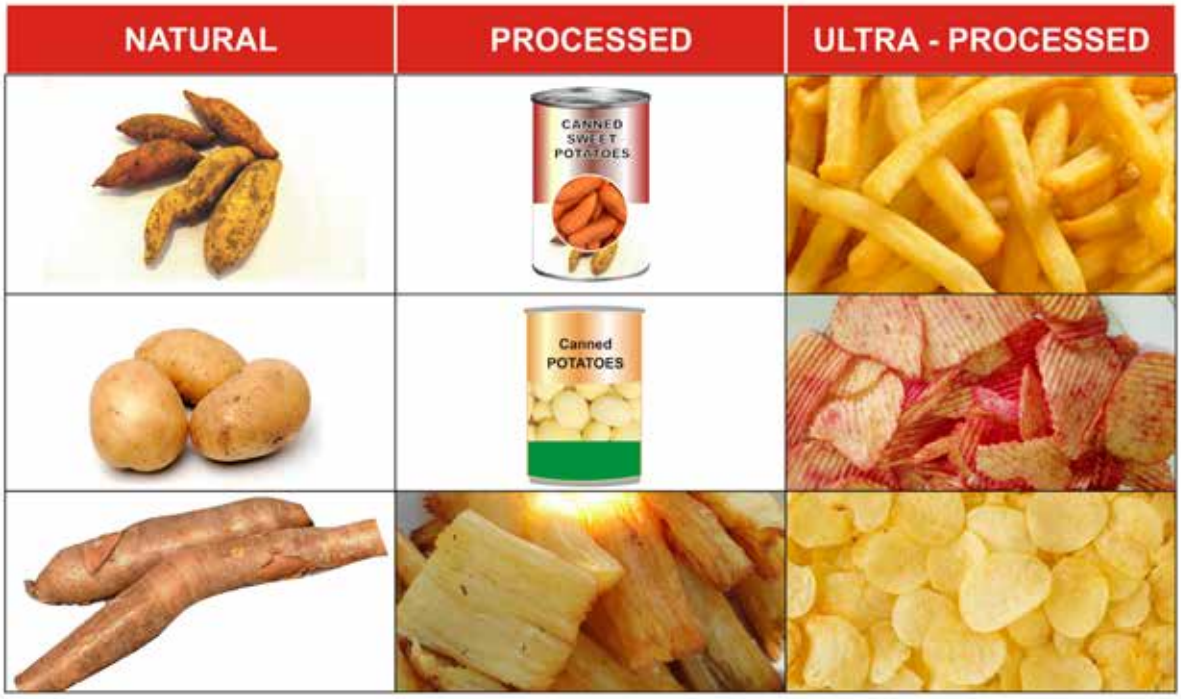
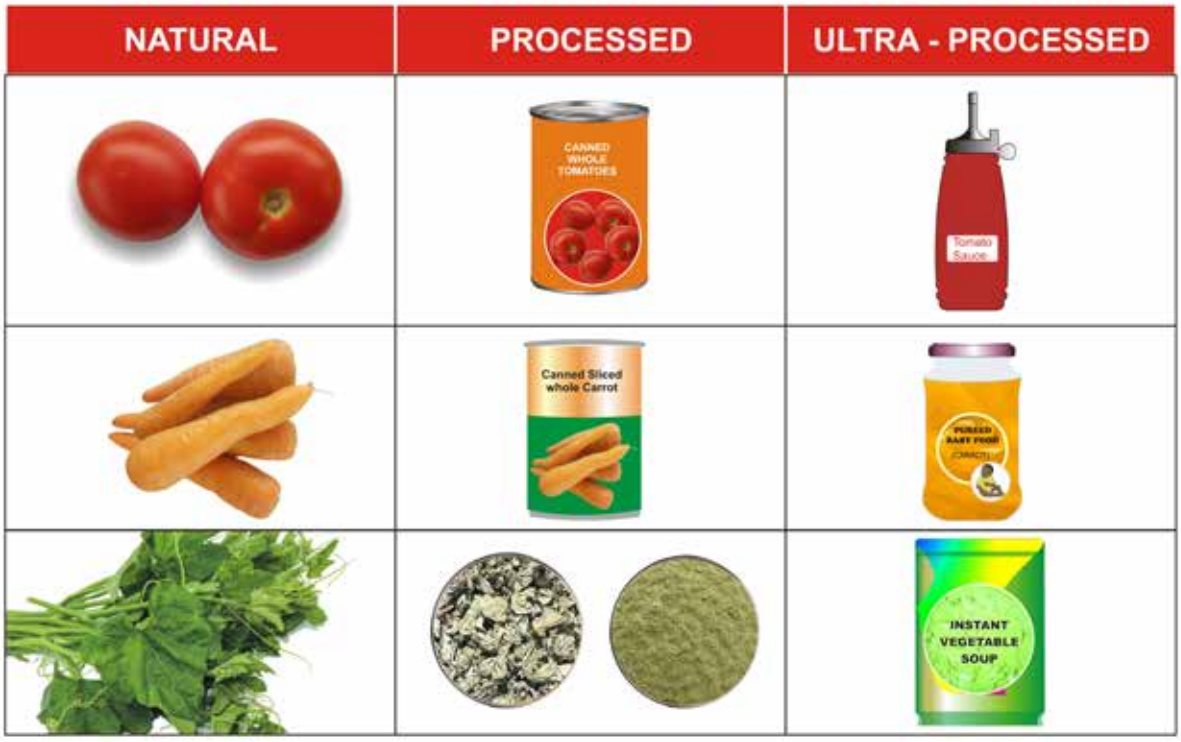


Figure 11: Vegetable group examples of natural/minimally processed, processed and ultra-processed foods



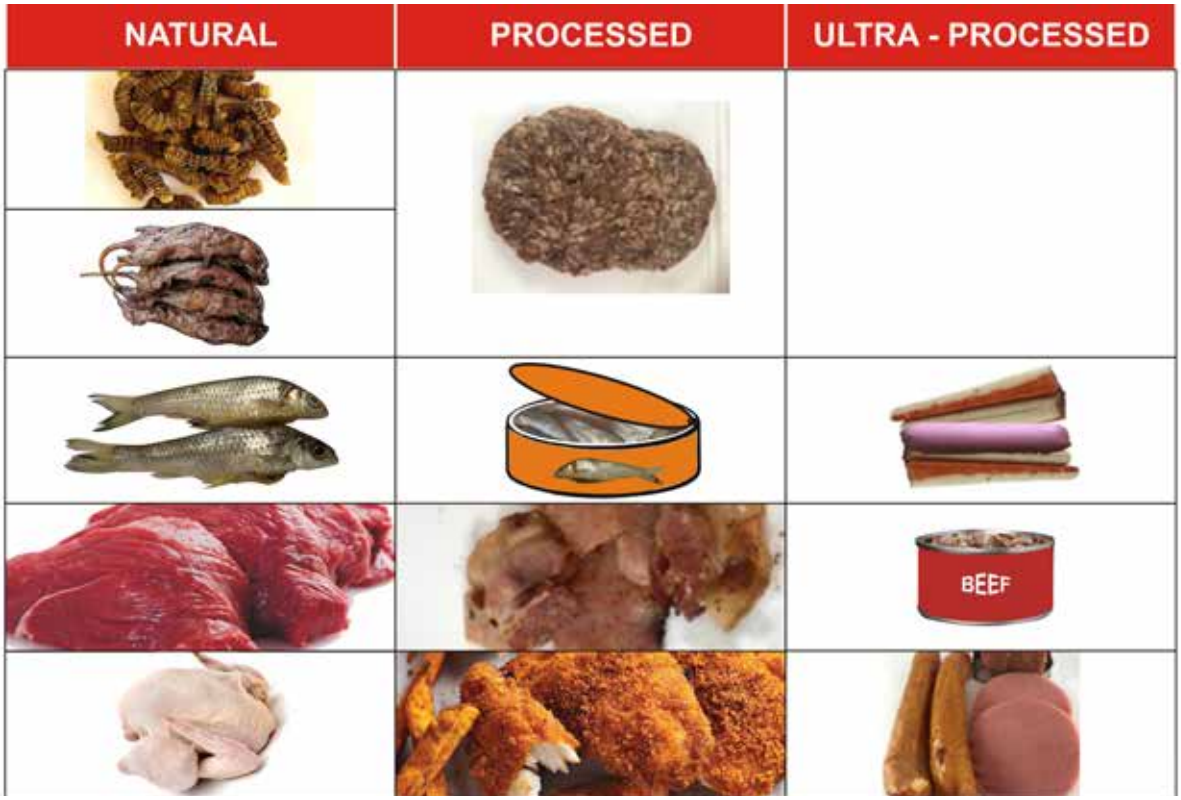
12.1.4 Group 4: Ultra-processed foods

UPFs (foods and drinks) are defined as formulations of ingredients, most exclusively of industrial use, and are typically created through a series of industrial techniques and processes (hence the term 'ultra-processed') (Monteiro *et al*., 2016). These ingredients include those used in processed foods and other ingredients only found in UPFs. Ingredients only found in UPFs are rarely used during home cooking.

Since UPFs are not modified foods and have little or no natural foods from Group 1, they use additives to imitate the sensory qualities of Group 1 foods or the culinary preparation ingredients of these foods, or to disguise undesirable sensory qualities of the final product.

UPFs are manipulated into being addictive and more palatable compared to other foods. The processing and ingredients used also make UPFs nutritionally unbalanced (Moss, 2013; Brownell, 2012). Other characteristics of UPFs include attractive packaging, a long shelf life and aggressive marketing and health claims. Various chemical additives give UPFs intense sensory properties, making them especially attractive to see, taste, smell and/or touch (Monteiro *et al*., 2019).

Figure 12: Fish, animal source food and insect examples of natural/minimally processed, processed and ultra-processed foods



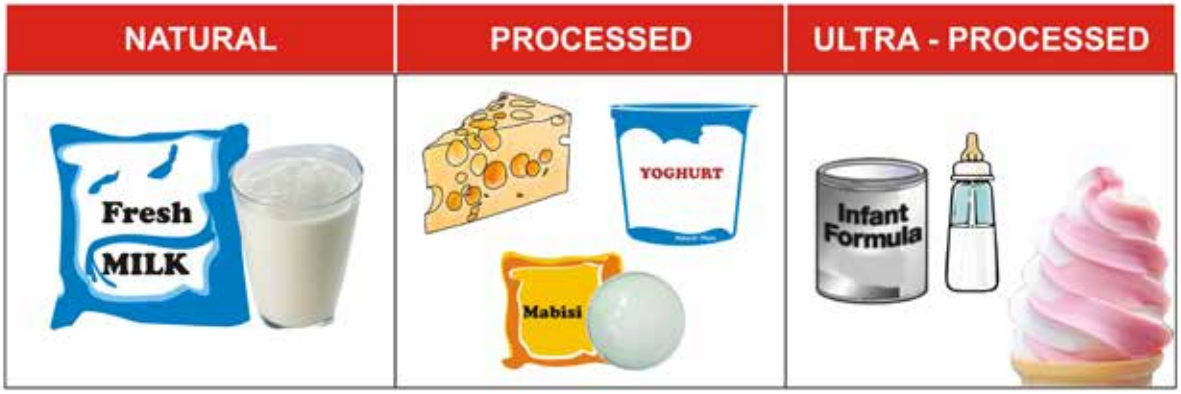
12.2 SUBSTANCES ONLY FOUND IN ULTRA-PROCESSED FOODS.

Monteiro *et al*., (2016, 2019) also indicate that "substances only found in ultra-processed products include some directly extracted from foods such as:

- sugars (fructose, high-fructose corn syrup, 'fruit juice concentrates' invert sugar, maltodextrin, dextrose, lactose).
- hydrolysed proteins, soya protein isolate, gluten, casein, whey protein, and 'mechanically separated meat').
- hydrogenated (trans fats) or interesterified oils, derived from further processing of food constituents, like natural oils.
- Classes of additives only found in ultra-processed products include dyes and other colours, colour stabilisers, flavours, flavour enhancers, non-sugar sweeteners, and processing aids such as emulsifiers, carbonating, gelling, firming, bulking and anti-bulking, de-foaming, anti-caking and glazing agents, sequestrants and humectants" (FAO and WHO, 2017; Monteiro *et al*., 2016).

Monteiro *et al*. (2016) note that Group 4 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. (Monteiro *et al*., 2016).

Figure 13: Milk and milk product examples of natural/minimally processed, processed and ultra-processed foods



12.3 IDENTIFYING ULTRA-PROCESSED FOODS

It is very easy to recognise foods that are minimally processed and/or culinary processed ingredients. Fresh vegetables, fruits, roots and tubers are definitely not ultra-processed; just as pasteurised milk and frozen fresh meat are not. Plant oils, sugar and salt are used as culinary preparations and hence are not ultra-processed. However, distinguishing processed foods from UPFs, especially with foods like breads, breakfast cereals and meat products can be difficult sometimes. However, there are a few tricks to help identify ultra-processed foods.

- Examine the ingredients labels that, by law, must be included on pre-packaged food and drink products. For example, commercial breads made only from wheat flour, water, salt and yeast are processed foods, while ultra-processed breads are those with lists of ingredients under "substances only found in ultra-processed foods".
- Look for ingredients such as emulsifiers, flavouring or flavour enhancers, food colouring or any such ingredient in the list. The practical way to remember UPF ingredients is that they are rarely or not ever used in the kitchen, or are an extracted part of a nutrient component like lactose or fructose, etc.
- The high number of ingredients used.
- Above all, the presence of components with very unfamiliar names indicates that the product is ultra-processed.

Figure 14: Fruit examples of the differences between natural/minimally processed, processed and ultra-processed foods

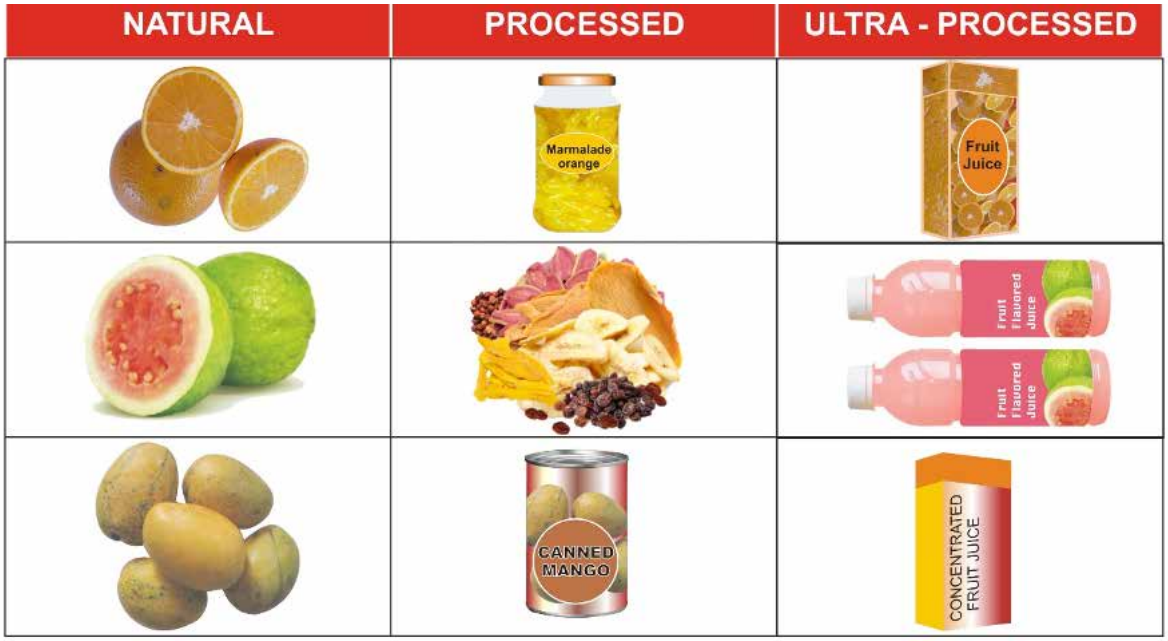
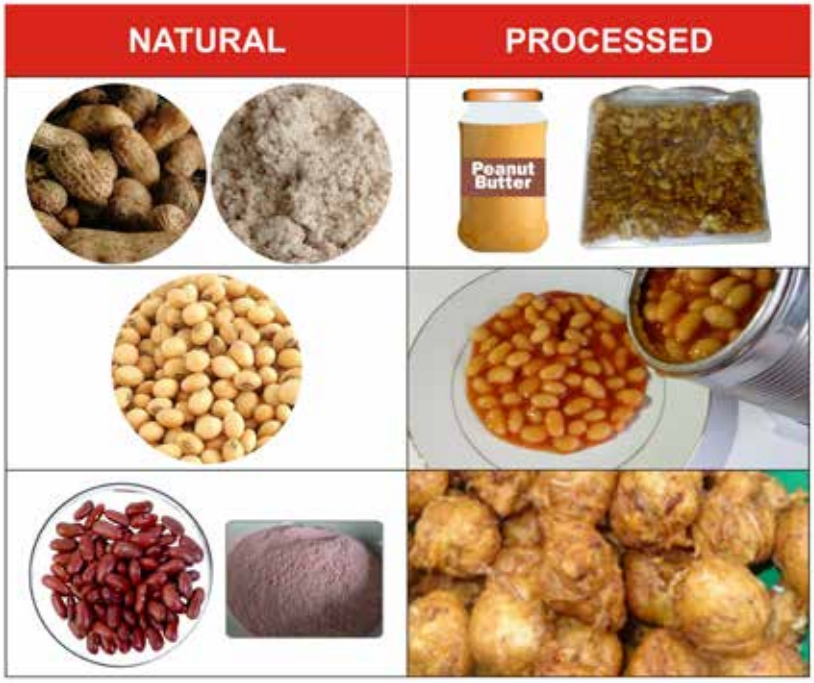


Table 11: Examples of ultra-processed foods

	Ultra-processed	Salt	Sugar	Trans fats	UPFs only additives
Carbonated drinks/soft drinks, sodas and sweetened drinks, sweetened beverages and juices including fruit flavoured juices	x		x		x
Margarines and spreads	x			x	x
Reconstituted meats such as bacon, sausages, hot-dogs, burgers and salami	x	x		x	x
Crisps, chips* and other sweet, fatty or salty packaged snacks	x	x		x	x
Stock cubes and gravy granules	x	x			x
Salad dressings, mayonnaise	x	x	x	x	x
Packaged soup powders or mix and liquids, instant noodles, soups, sauces	x	x			x
Yeast extracts like Marmite and Bovril	x	x			x
Packaged baked goods, biscuits, cookies, cakes, and pastries, pies, crackers (sold on shelves and with a long shelf life)	x	x	x	x	x
Cake mixes, premixed pancakes	x				
Breakfast cereals (cornflakes, crispies)	x	x	x		x
Candy and chewing gum	x		x		x
Mass-produced packaged breads and buns (long-life)	x	x	x		x
Infant formulas, follow-on milks	x		x		x

	Ultra-processed	Salt	Sugar	Trans fats	UPFs only additives
Other baby food products (canned and cereals)	x	x	x		x
Health' and 'slimming' products such as powdered or 'fortified' meal and dish substitutes	x				x
Prepared and ready-to-heat products including pre-prepared pies, pasta and pizza dishes; nuggets (fish/meat)	x	x	x	x	x
Packaged sauces like tomato sauces, soya sauce, oyster sauce, instant sauces	x	x	x		x
Many fast-food restaurants foods	x	x		x	x
Candy and ice cream; chocolates	x		x		x
Doughnuts	x		x	x	
'Energy' bars; 'energy' drinks; milk drinks, 'fruit' yogurts and 'fruit' drinks; cocoa drinks	x		x		
Ready-to-eat packaged meals and snack foods sold in shops (pizzas)	x	x	x	x	x
Ready-to-drink tea and coffee and hot chocolate mix	x		x		x
*Although fast-food chips may look much the same as home-cooked food, their formulations and the ingredients used in their pre-preparation and cooking render them ultra-processed.					

Figure 15: Beans and nuts examples of the differences between natural/minimally processed, processed and ultra-processed foods



12.4 ADDITIVES IN PROCESSED AND ULTRA-PROCESSED FOODS

Processed foods often contain preservatives and other chemicals to make them last longer and to improve their texture, flavour and colour. Some preservatives, like nitrates and nitrites, are used to preserve processed meats. Nitrates and nitrites can react with proteins or high heat to form N-nitrosamine, a carcinogen, increasing the risk of developing colon cancer. Other food additives such as artificial food colours, benzoates, saccharin and sorbates can bring on an array of negative health effects including headaches, allergies and asthma (Dwivedi, 2017). It is best to eat more natural whole foods and limit or avoid processed foods as much as possible.

UPFs can contain additional chemicals that are not listed on their labels. For example, "artificial flavour" is a proprietary blend. Manufacturers do not have to disclose exactly what it means, and it is usually a combination of chemicals.

12.4.1 Ultra-processed foods and processed foods have been linked to non-communicable diseases

UPFs are linked to an increased risk of NCDs such as cardiovascular disease (CVD), coronary heart disease, (CHD) and cerebrovascular disorders, due to added salt and sodium, sugar, saturated fats, trans fats and additives (Pagliai *et al*., 2021; Costa *et al*., 2018; Askari *et al*., 2020; Chen *et al*., 2020; Srour *et al*., 2019; Reardon, 2021). UPFs are also linked to obesity due to the excess calorie intake and are also associated with early mortality (Srour *et al*., 2019; Rico-Campà, 2019; Hall *et al*., 2019). The negative effects of salt and sodium, sugar, saturated fats, trans fats and additives are discussed in detail in the sections that follow.

12.5 RECOMMENDATIONS & GUIDANCE FOR LIMITING THE CONSUMPTION OF ULTRA-PROCESSED FOODS

Limit eating ultra-processed foods, as they are high in salt, sugar and fats and oils, to prevent diseases such as high blood pressure, sugar disease (diabetes) and cancer.

1. Eat fresh, unprocessed or minimally processed whole foods; these foods provide many benefits.
2. Cook more often: make delicious meals with fresh ingredients. Heating up frozen pre-made foods does not count.
3. Cook and cut back on unhealthy ingredients.
4. There are quick and easy recipes for homemade pizza, meatballs, fishcakes and baked beans.
5. Dine out on better choices: Restaurant meals can be fresh and healthy. Half the plate should be filled with vegetables, and baked, poached, stir-fried or grilled foods should be chosen instead of deep-fried.
6. Do not be swayed by food marketing and advertising hype. Ultra-processed foods are often marketed as "healthy," "natural" and "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 ultra-processed food.
7. Read food labels and avoid foods that end with "ose" or have emulsifiers, hydrogenated oil, nitrates, nitrites, artificial food colours, flavouring, texturisers, benzoates, saccharin and sorbates, etc.

12.6 LIMIT INTAKE OF SALT

12.6.1 GETTING TO KNOW SALT AND ITS COMPONENTS

"Salt" is a common name for sodium chloride (NaCl) and is the main source of sodium in diets. Salt is 40 percent sodium and 60 percent chloride (Durack *et al*., 2008). The body requires a small amount of salt for various essential functions in the body. Sodium is important for regulating body fluid balance, maintaining normal blood pressure and for nerve and muscle function (Munteanu and Iliuta, 2011; WHO, 2012b). The body needs chloride to regulate the proper balance of body fluids and the acid–base balance. It is one of the most important electrolytes in the blood as it helps maintain proper blood volume, blood pressure and body fluid pH levels (WHO, 2012b). Chloride is part of the gastric acid (hydrochloric acid composed of chlorine and hydrogen) which aids in digestion. Chloride is also an essential part of regulating the secretion of digestive (stomach) juices and plays a part in the immune system where the cells require chloride, while red blood cells use chloride anions to remove carbon dioxide from the body (Munteanu and Iliuta, 2011). Most salts are fortified with iodine (WHO, 2014a).

Salt in Zambia is fortified with iodine, making it the main source of iodine for its population. Iodine is important for the production of thyroid hormones which control the body's metabolism and many other important functions. The body also needs thyroid hormones for proper bone and brain development, especially during pregnancy and infancy. Iodine deficiency leads to goiter and mental developmental problems in children.

Although salt is essential, it is needed in small amounts and most people eat too much without being aware of it. This is because salt is found

naturally in unprocessed foods like meat and seafood. Major sources of salt are processed and UPFs like breads, cottage cheese, cured meats, canned goods, ready-to-eat meals, manufactured condiments like stock cubes, packaged sauces and soup mixes. A high salt intake causes health problems.

12.6.2 How much salt should we consume?

WHO recommends that the daily intake of salt in adults should be less than 5 g per day (i.e. less than 2 g of sodium per day) – that is around 1 teaspoon. (WHO, 2012b; WHO, 2014a). Five grams of salt (sodium chloride) contain the sufficient amount of sodium required per day.

12.6.3 Negative health effects of high salt in diets and its consumption levels among Zambians

A high intake of salt (over 5 g) is unhealthy. Adding more salt than recommended to food or frequently consuming salty foods, such as processed or ultra-processed meals, increases the risk of blood pressure, cardiovascular diseases, stroke and CHD (He, Li and MacGregor, 2013; WHO, 2012b; GBD, 2017; HSPH, 2021). Hypertension is on the rise in Zambia, with about 20 percent of Zambians aged 18 to 69 affected.

12.6.4 Salt consumption in Zambia

Zambians consume 10 g of salt, which is double the recommended safe intake per day. Most of the salt in Zambian diets is added during cooking and meal times to enhance flavour. A significant amount of salt is also consumed from processed and ultra-processed foods. A big proportion of salt eaten is already added in everyday foods, including bread and breakfast cereals although they may not taste salty. A good way to know how much salt (including hidden salt) is in the food is to read the food labels. Pay attention to the following terms: salt, monosodium glutamate and any other name containing the word sodium.

Table 12 has examples of UPFs high in salt, which are therefore high in sodium, and a list of processed foods high in salt, sugar and oils.

Literature sources have demonstrated that an increase in urbanisation is characterised by, among other things, the consumption of processed foods high in salt, as well as fast-foods from restaurants and fast-food outlets. Zambia is one of the most urbanised countries in Africa, and therefore the need to pay attention to salt intake is critical in reducing the burden of hypertension associated with sodium intake (WHO and MOH, 2017).

12.7 RECOMMENDATIONS & GUIDANCE ON REDUCING SALT INTAKE TO LESS THAN 5 G PER DAY

1. Use only iodised salt.
2. Use less salt when preparing food and do not add salt to food when eating the food.
3. Limit consumption of processed and ultra-processed foods, as well as fast foods, as they contain high amounts of salt.
4. Read food labels and do not rely on taste alone.
5. Look for the total sodium amount on food labels not just added salt.
6. It is easy to meet sodium requirements without adding more salt when eating meals.

12.8 TIPS ON REDUCING SALT INTAKE

Helpful Tips on reducing salt intake

1. Choose fresh foods as much as possible.
2. Avoid adding salt at the table.
3. Use less or no salt during cooking.
4. Replace salt with locally available herbs, spices, garlic, ginger, pepper, onions, lemon and vinegar to add flavour to foods.
5. Keep an eye on foods consumed outside the home and limit consumption of fast food and takeaway meals.
6. Limit fluids containing high salt amounts, including sports drinks and vegetable juice.
7. Limit intake of ultra-processed foods like savoury snacks, breads, pies, sauces, etc.
8. Make fresh stock and gravy using vegetables, fish or poultry instead of using cubes, granules or soup mixes.

12.9 LIMIT INTAKE OF FOODS HIGH IN SATURATED FATS

12.9.1 About fats and oils

Dietary fats belong to the macronutrient group, together with proteins and carbohydrates. Fats are energy dense; they provide 9 Kcal of energy per gram while protein and carbohydrate provide 4 Kcal per gram. The major categories of dietary fats are unsaturated fats, saturated fats as well as trans fats.

Unsaturated fats: Unsaturated fatty acids that include monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFAs) are liquid at room temperature. MUFA include olive oil, canola oil, sunflower and safflower oil, mustard seed oil and rapeseed oil (FAO and WHO, 2010). Of the PUFAs, eiocosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are the most important n-3 fatty acids in human nutrition. EPA and DHA are components of marine lipids, and fish such as mackerel, salmon, sardine, herring, cod liver oil and smelt are excellent sources (WHO, 2018). Alpha-linolenic acid (ALA) is the parent fatty acid of the n-3 family and is found in oils such as flaxseed oil, perilla oil, canola oil and soya bean oil. These are considered good fats, specifically long chain PUFAs, alpha linolenic acid, EPA and DHA, as they contribute to the prevention of CHD as well as to healthy neonatal, infant and child development (WHO, 2020a).

Saturated fats are usually solid at room temperature. The major sources of saturated fats are ASFs including meats and meat products such as fatty beef, pork, poultry with skin, butter, ghee, lard and cheese. Many baked foods e.g. biscuits and pastries, and some fried foods also contain saturated fats. Some plant-based oils, such as palm oil, palm kernel oil and coconut oil, also have saturated fats (WHO, 2020a). Saturated fats, and especially palmitic acids (C16:0), have negative health effects as they increase LDL cholesterol.

Some meat and dairy products have a small amount of naturally occurring trans fats. It is not clear whether this naturally occurring trans fat has any benefits or is harmful.

Trans fatty acids (TFAs) are predominantly a by-product of trans fat industrial processing (partial hydrogenation), where hydrogen atoms are added to vegetable oil to cause it to become solid at room temperature. TFA is also found in ruminant fat in dairy and meat products (WHO, 2020a). Industrial hydrogenation increases the shelf life and flavour stability of foods. Some restaurants use partially hydrogenated vegetable oil (TFA) in their deep fryers to avoid changing the oil as often as they would with other oils. The main sources of TFA in a diet are processed foods, fast foods, snack foods, fried foods, frozen pizza, pies, cookies, margarines and spreads (WHO, 2020a). TFAs increase CHD risk factors and CHD events.

12.9.2 Importance of fats in a diet

Fats and oils are great sources of energy as they contain almost twice as much energy per gram when compared to other food groups. Fats and fatty acids are important for cell membrane function, control gene transcription and expression, and interact with each other. In

addition to providing essential fatty acids, dietary fats also provide the medium for the absorption and transportation of fat-soluble vitamins (A, D, E and K) and hormones. Many children and women in Zambia are deficient in vitamin A.

Fats and fatty acids are a key nutrient for the growth and healthy brain and cognitive development of unborn babies and young children. PUFAs, eicosapentaenoic acid (EPA) and (DHA play a crucial role in neonatal and infant mental development (WHO, 2020a). EPA and DHA are found in fish like mackerel, salmon, sardines, herring, cod liver oil and smelt.

Fats and oils make food more palatable and are frequently used in cooking, Fats slow down gastric emptying and intestinal motility, thereby prolonging satiety.

Thus, unsaturated fats, especially the long-chain PUFAs, alpha linolenic acid, EPA and DHA can be part of a healthy diet contributing to the prevention of CHD.

However, all fats are energy dense and provide a lot of calories. Consuming large amounts of any fat can lead to overweight and obesity, even healthier unsaturated fats. In addition, saturated and trans fats are linked to an increased risk of NCDs, hence their intake should be limited.

12.10 THE HEALTH RISKS OF SATURATED FATS AND TRANS FATS

Eating foods that contain saturated fats raises cholesterol levels in the blood, which increases the risk of heart disease and stroke. Dietary fat is more energy dense than carbohydrates and protein, thus eating foods high in fats also increases the risk of weight gain, overweight and obesity (Forouhi *et al*., 2018).

Trans fats increase CHD risk factors, as well as the risk of heart attacks and stroke. This is because TFAs increase LDL, or "bad" cholesterol, and decrease the good HDL cholesterol, thereby affecting the arteries through fatty deposits. TFAs are also associated with a higher risk of developing type 2 diabetes. Trans fats have no known health benefits and there is no safe level of consumption. In the Global Burden of Disease Study, exposure to a diet high in TFAs is defined as an average daily consumption of greater than 0.5 percent of trans fat from all sources, mainly partially hydrogenated vegetable oils and ruminant products (Willet *et al*., 2019). This is equivalent to 1 g of fat (note that 1 teaspoon of oil is about 5 g).

Food group	Number of servings	1 serving equivalent
Fats and oils	1	14 g (1 table spoon) * Choose vegetable oils

12.10.1 Recommended intake of saturated fats

In order to meet the body's requirement for dietary fat, it should contribute a minimum of 15 percent of the total energy requirement per day, in order to ensure adequate consumption of essential fatty acids and fat-soluble vitamins (WHO,2020a). Total fat intake should not exceed 30 percent to avoid unhealthy weight gain (WHO, 2020a).

Total intake of saturated fatty acids should not exceed 10 percent of total dietary energy. For a 2 000 Kcal diet, this translates to a maximum of 200 calories or 22 g of saturated fats per day. Replace SFAs with unsaturated fats, especially n-3 and n-6 PUFAs, as evidence indicates it can decrease the risk of CHD (FAO and WHO, 2019; USDA and USDHHS, 2015; American Heart Association, 2017).

Based on the Zambia diet modelling, on average, Zambian adults should aim to consume one serving of added oils per day. One serving is about 1 tablespoon (14 g), of added oil/fat, most of which should come from vegetable oils and fish oil (FAO,2010). This lower limit takes into account other fat sources in the diet that contributes to the 30% total fat intake aside from the added oil/fat.

12.11 RECOMMENDATIONS & GUIDANCE ON AVOIDING TRANS FATS, LIMITING SATURATED FATS AND REPLACING THEM WITH ESSENTIAL POLYUNSATURATED FATS

1. Limit intake of foods high in saturated and trans fats, for example biscuits, cakes, pastries, pies, fatty meats, processed meats, burgers, pizza and ice cream.
2. Limit the consumption of fast foods such as potato chips, pizza and fried chicken.
3. Use vegetable oils when preparing foods. Vegetable oils are rich in healthy unsaturated fats.

12.12 TIPS ON HOW TO REDUCE INTAKE OF SATURATED FATS

Helpful Tips on reducing salt intake

1. Remove visible fats on meat before cooking.
2. Remove the skin from chicken before cooking.
3. Reduce the amount of cooking oil added to foods during cooking.
4. Use cooking methods which enhance the loss of fat from meat i.e. grilling instead of frying.
5. Choose healthy vegetable cooking oils.
6. Read food/nutrition labels when using packed foods.

12.13 LIMIT INTAKE OF FOODS CONTAINING ADDED SUGAR

12.8.1 Description of sugars

Naturally occurring sugars

Sugars, also known as simple carbohydrates, are one of the components of foods with several important physiological functions. Some foods naturally contain sugars (also called intrinsic sugars) in various amounts and types. Sugars naturally occurring in foods such as fruits, vegetables, milk and honey do not adversely affect human health.

Added sugars

Extrinsic/free sugars can also be added to foods for various reasons, including enhancing flavour, as a sweetener and as a preservative (Clemens *et al*., 2016).

Sugars are added to foods and beverages by the manufacturer, cook or consumer. Thus, it is important to know the foods to which sugar has already been added, even if they do not have a sweet taste. Major sources of added sugars in diets are sugar-sweetened beverages such as soft drinks, fruit drinks, sweet bakery products and ready-to-eat cereals.

12.14 LINK BETWEEN ADDED SUGARS AND DISEASES

Added sugars increase the energy density while reducing the nutrient density of foods (Elia and Cummings, 2007). The body breaks down refined, or simple, carbohydrates quickly, leading to rapid spikes in blood sugar and insulin levels. When these levels then drop, a person may experience food cravings and low energy.

Because refined carbohydrates cause frequent increases and decreases in blood sugar, consuming them is linked with an increased risk of type 2 diabetes. In addition, added sugars are associated with weight gain, overweight and obesity, and increased cardiovascular mortality (Johnson *et al*.,2009; WHO, 2015b; Gibney, 2019; Louzada *et al*., 2018; Monteiro, 2009; Luger *et al*.,

2017; Malik *et al*., 2013; Malik *et al*., 2010; Tavares *et al*.,2012). Free sugars – particularly in the form of sugar-sweetened beverages – increase the overall energy intake and may reduce the intake of foods containing more nutritionally adequate calories and nutrients, leading to micronutrient deficiencies. Dietary free sugars are the most important risk factor for dental caries (Gibney, 2019). Examples of foods high in added sugars are shown in Table 12.

12.14.1 Recommended intake of added sugars and consumption levels in Zambia

WHO guidelines recommend that the intake of free sugars should provide less or equal to 10 percent of total energy intake. This is equivalent to 50 g (or around 12 level teaspoons) for a person of healthy body weight consuming approximately 2 000 calories per day. This quantity can be met by only eating natural foods like fruits, vegetables and milk. Thus, limit or avoid adding sugars to foods and drinks like tea, or taking foods and drinks high in added sugars. WHO suggests further reducing the intake of sugar to less than 5 percent of total energy (25 g or 6 tablespoons) to protect dental health and for additional health benefits throughout life (Gibney, 2019; WHO, 2015). The recent EAT-Lancet Commission paper also indicated that because sugar has no nutritional value and has adverse metabolic effects, a limited intake of less than 5 percent of total energy per day is recommended (Johnson *et al*., 2009).

How to calculate the amount of sugar from food and drinks?

1 teaspoon of sugar = 4 g of sugar

For example, if a product has 45 g of sugar, then the number of teaspoons is equivalent to:

Number of teaspoons = 45 g ÷ 4 g

= 11 ¼ teaspoons

Figure 16: Amount of sugar found in popular soft drinks and beverages

DO YOU KNOW HOW MUCH SUGAR IS IN YOUR BEVERAGES?

250 ml to 330 ml beverages, sodas and fruit-flavoured drinks have between 5 to 9 teaspoons (25 g to 45 g) of sugar. Although these drinks have a high sugar content, some do not taste sweet but sour.

Sugar consumption in Zambia

There is every reason to believe that a good number of Zambians consume foods high in added sugars. In the 2019 national budget, the Government of Zambia introduced excise duty on each litre of sugar-sweetened beverages as a way to lower the consumption of sugar-sweetened beverages and contribute towards the prevention of overweight and obesity (Gibney, 2019; USDA and USDHHS, 2015; Bailey *et al*., 2018; Chi and Scott, 2019; Leme *et al*., 2018; Singh *et al*., 2015; GRZ, 2018).

12.15 RECOMMENDATIONS & GUIDANCE ON SUGAR INTAKE

1. Limit consumption of sugar-sweetened foods such as pastries, sodas and beverages, soft drinks and fruit flavoured drinks, and sweetened yogurts.
2. Reduce the intake of sugary drinks (e.g. fizzy drinks, juices and cordials) to small amounts and to occasional consumption.
3. Limit the intake of sugary foods (e.g. cakes, banana fritters, chocolates and candies).
4. Limit the intake of condiments containing added sugar such as canned or bottled tomato sauces.
5. Minimise the intake of highly-processed foods such as biscuits and cakes.
6. Limit the intake of dried fruits and choose natural and fresh fruits. Although dried fruits have natural sugars, they are concentrated sources of sugar since the water has been removed, making it a very high-sugar snack. Dried fruits also stick more easily to teeth, hence increasing the risk of dental caries.

12.16 TIPS ON REDUCING SUGAR INTAKE

Helpful Tips on reducing intake of added sugars

1. Choose water as the main drink instead of sugar-sweetened beverages like sodas, juices and squashes.
2. Other healthier beverage options are those with no added sugar, such as sparkling water, coffee and herbal tea.
3. Use fruits instead of sugar to sweeten foods. For example, add fruits to breakfast cereals in place of sugar.
4. Use fruits and vegetables as snacks instead of sugar-sweetened snacks.
5. Check the ingredients list of food and drinks and look for other names for sugar. Anything that ends with 'ose' is a form of sugar, e.g. maltose, dextrose and sucrose, and anything which contains any form of syrups or concentrates has sugar in it, even if it claims to be sugar-free.
6. Choose fresh fruits and low-fat yoghurt with no added sugar instead of high-sugar desserts such as ice-cream and mousse.
7. Add little or no sugar to foods and drinks. Replace table sugar with honey (which has a lower blood sugar raising effect).
8. While choosing breakfast cereals, opt for whole grain varieties e.g. All-Bran cereal, Weetabix and oatmeal instead of sugar-coated ones like coco pops and fruit loops.

Table 12: Examples of ultra-processed Foods high in salt, sugar and other additives

	Salt	Sugar	Fat	Other additives
Salt	x			
Salted/cured/processed meats, e.g. bacon and ham	x		x	x
Canned foods in brine (salt-water)	x			x
Fresh-baked bread	x			
Pickles, olives in brine	x			
Salty snacks, e.g. salted groundnuts	x		x	x
Cheese	x			x
Processed vegetables canned or bottled in brine	x			x
Canned fruits in sugar syrup		x		x
Fruit juices, vegetable juices and drinks		x		x
Canned beans	x			x
Ready-to-drink tea and coffee		x		x

Recommendation 9

Handle, prepare and store food safely

13. RECOMMENDATION 9: Handle, prepare and store food safely.

Eating safe food is as important as eating nutritious food. When food is contaminated with germs or chemicals, it can cause fever, diarrhoea, vomiting, malnutrition and even death (WHO, 2015c). Everyone is at risk of foodborne diseases, but children, pregnant women, the elderly, the sick and the immunocompromised are the most vulnerable. WHO indicates that the burden of foodborne diseases is comparable to the human immunodeficiency virus (HIV), malaria and even tuberculosis (Havelaar *et al*., 2015).

In Zambia, diarrhoea and cholera are the most common foodborne diseases responsible for a high burden of diseases and mortality (Chan, 2014). According to UNICEF and WHO, diarrhoea remains a leading killer of young children globally. In Zambia, diarrhoea accounted for approximately 8 percent of all deaths among children under the age of five in 2017 (UNICEF 2021,a; WHO, 2018b; Carvajal-Vélez *et al*., 2016). Further, diarrhoea infections contribute to long-term gut damage that prevents nutrient absorption for both children and adults. For children, each diarrhoeal episode worsens malnutrition, and malnourished children are more susceptible to diarrhoea and other infections (Selimoglu *et al*., 2021). Another severe threat posed by diarrhoea is dehydration for both children and adults. Severe dehydration for all age groups is life threatening.

This is why ensuring food safety is cardinal to ensuring the health of the whole population, which is one of the prerequisites for national economic development.

13.1 WAYS THROUGH WHICH FOOD GETS CONTAMINATED

There are several ways through which food can become contaminated (Nyachuba, 2010), such as microbial, chemical and physical contamination. Bacteria exist everywhere in nature. They are in the soil, air, water and the foods we eat. Germs can contaminate food through handling food with unclean hands, not cooking the food thoroughly,

and not keeping cooked or perishable food below 5 degrees Celsius (°C) for a long time.

Food may also be contaminated through the use of contaminated food storage and preparation areas; (Kapaya *et al*.,2018) and improper holding temperatures (Bryan *et al*., 1997; Kachapulula *et al*., 2018; Schmitt *et al*., 1997). In Zambia, poor transport and storage infrastructure for perishable foods, such as milk, also contributes to food spoilage (Knight-Jones *et al*.,2016). Another cause of food contamination is the use of sewage-containing water for irrigation, hand washing and washing foods such as fruits and vegetables (Lanata, 2003; Hald *et al*.,2016). Food may also be contaminated through unhygienic practices by food handlers (NHMRC, 2013; Di Renzo *et al*., 2015).

In addition, food such as maize, groundnuts, other cereals and milk can be contaminated with aflatoxins (moulds). In Zambia, food contamination with aflatoxins is very high (Kachapulula *et al*., 2017). Livestock that eat grains with aflatoxins can also get contaminated. While all foods can be contaminated, some are more at risk, for example raw or undercooked foods of animal origin (Kapaya *et al*., 2018). Extra care is needed when handling these foods. The guidelines presented here, however, place an equal importance on all foods.

13.2 KEEPING FOOD SAFE BEFORE AND WHILE COOKING

Wash hands and surfaces often: Our hands touch many things during the day. When hands are not washed properly, especially during critical times such as after using the toilet or touching nappies, germs from faeces can be transferred to the food and then ingested. Wash your hands with warm water and soap for at least 20 seconds before and after handling food and after using the bathroom, changing diapers and handling pets. In addition, wash all the areas used for food preparation and the surfaces touching the foods with hot soapy water to get rid of dirt, debris and faecal matter. Protect cooking and food storage areas from insects and rodents.

Do not cross-contaminate: 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 one cutting board or plate for fruits and vegetables and a separate one for raw meat, poultry and seafood. If it is 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. When animal source foods are prepared first, always wash knives and cutting boards or surfaces with soap and hot water before preparing fruit and vegetables. Never place cooked food on a plate that previously held raw meat, poultry, seafood or eggs.

13.3 COOKING AND STORING FOOD SAFELY

Bacteria grow most rapidly in temperatures 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. Cooking food above minimum internal temperatures will kill bacteria.

To kill germs naturally present in food, cook the food with heat thoroughly. Cook all food to reach minimum internal temperatures before removing food from the heat source. Internal temperatures vary between foods from 63 °C to 74 °C (USDA, 2021). 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 .

13.3.1 If a refrigerator is not available

If a refrigerator is not available, cooked food should not be left out at room temperature for more than two hours. Food that has been out at room temperature for more than two hours should be discarded for safety purposes. If food is left out in a room or outdoors where the temperature is 32 °C or hotter, refrigerate or eat the food within just one hour. Share leftovers with others within two hours of cooking to avoid wasting food. Cook raw meat, poultry and fresh fish as soon as it is bought or slaughtered, and do not let them keep for more than two hours before cooking. Once cooked, apply the relevant rules.

Foods contaminated with germs may look and smell alright, but remember that germs do not have to carry a certain smell or be visible to the naked eye to be considered harmful. To save food from being wasted, try to cook only what is needed, especially if there is no fridge. Although cooking kills germs, toxins produced by the germs can cause serious illness or death. Therefore, it

is important to throw away any cooked food that has stayed over an hour at temperatures of 32 °C and above or after two hours at temperatures between 5 °C and 32 °C.

13.3.2 Where a refrigerator is available

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. Never let raw meat, poultry, eggs, cooked food or cut fresh fruits or vegetables sit at room temperature for more than two hours before putting them in the refrigerator or freezer. In warm temperatures (over 32 °C), do not keep the food outside the fridge for over one hour (FAO, 2017b).

The ideal refrigerator temperature should be between 1°C and 5 °C, while for the freezer just below 0°C. Do not keep cooked foods in the fridge for over three days. Freezing will keep foods up to 6 months or more.

Check your fridge to make sure that food is properly stored and kept fresher for longer in your fridge. Store products in the right places in the fridge, and follow the instructions on the packaging or the fridge manual. The coldest parts of the fridge are at the back and the bottom so foods that require the coldest temperatures should be stored there. Do not pack the fridge too full: you will use less energy and you will be less likely to forget to use the food you bought (FAO, 2017b). If keeping raw meats in the fridge, keep them in a closed container to avoid blood spillage. Keep the refrigerator clean to prevent the spread of harmful bacteria. Wipe spills immediately and regularly clean the inside of the fridge with hot water and soap, and dry with a clean cloth or paper towels. Clean the fridge quickly to prevent keeping the refrigerated foods out for too long.

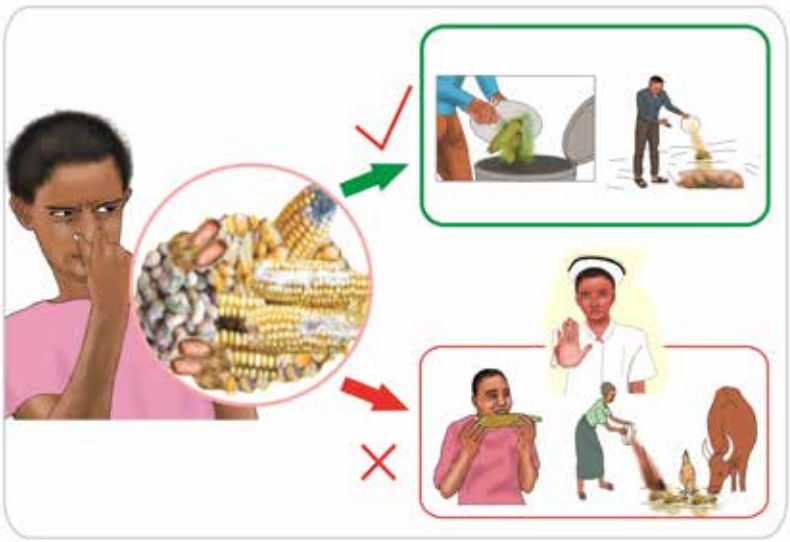
13.4 TIPS ON HANDLING, PREPARING AND STORING FOOD

Helpful Tips on handling, preparing and storing food

1. Wash hands with warm water and soap for at least 20 seconds before and after handling food and after using the toilet, changing nappies and handling animals and pets.
2. Separate raw meats, poultry and fish from fresh fruit and vegetables and other cooked foods to avoid cross contamination.
3. Cook raw poultry, fish and meats immediately where refrigeration is not available.
4. Cook food thoroughly to kill microorganisms.
5. Store foods at below 5 °C to prevent microbial growth.
6. Eat or refrigerate cooked foods immediately. Discard cooked food that has stayed out of the fridge for more than two hours or more than one hour in hot weather (above 32 °C).
7. Use clean and safe water for food preparation.
8. Clean food preparation areas with hot water and soap to remove dirt and germs before and after preparing each food item.
9. Wash fresh fruits and vegetables with clean water even when you plan to peel them because bacteria can spread from the outside to the inside during cutting or peeling.
10. Scrub firm-skinned fruits and vegetables in clean water and rinse well.

13.5 KEEP FOOD SAFE FROM PHYSICAL AND QUALITATIVE LOSS AND DAMAGE

Proper food handling and storage is essential in order to prevent post-harvest losses and contamination at every stage, from harvesting, drying and storage. Minimise physical losses by preventing the entry of insects and rodents into the storage area and maintaining environmental conditions that discourage the growth of micro-organisms. Keep the moisture content of foods low and maintain the right temperature and humidity in storage areas. Harvest crops at appropriate stages of maturity; do not harvest too early or delay harvesting.



13.6 KEEP FOOD SAFE FROM AFLATOXIN CONTAMINATION

Proper food preparation and storage is essential in order to prevent food contamination with aflatoxins and avoid foodborne diseases including diarrhoeal diseases and some cancers. (Devi, 2015).

13.6.1 Getting to know aflatoxins

When some moulds grow on crops, they produce toxic substances that can remain in the crops. These are called mycotoxins. A common example are aflatoxins, which affect maize, groundnuts and other cereals and legumes which are highly consumed in Zambia (Nleya, Adetunji and Mwanza, 2018). In addition to eating contaminated nuts and seeds, humans can be exposed to aflatoxins through consuming animal milk. When lactating animals are fed with contaminated feeds, the toxin is passed into the milk (Mohamed, 2011). Therefore, it is advised not to feed animals with mouldy grains or nuts.

These toxic compounds are naturally produced by certain moulds that can grow on plants any time before or after harvest. According to the World Cancer Research Fund, aflatoxins are produced by some moulds when foods are stored for too long at warm temperatures in a humid environment. Aflatoxin-producing moulds can be found in the soil and can contaminate grains while they are still in the field. Countries with high temperatures, like Zambia, offer good conditions for aflatoxin-producing moulds to grow and affect crops while still in the field.

Although moulds are destroyed by cooking, the toxins they produce may remain. Thus, it is important to avoid foods that may have been stored for a relatively long time in warm, ambient temperatures with high humidity, even if they show no visible signs of mould (WCRF and AICR, 2018).

13.7 HEALTH CONCERNS OF AFLATOXINS

1. Chronic exposure to aflatoxins can cause liver cancer (Afshin *et al*., 2014), immunosuppression and stunting.
2. Some aflatoxins cause severe illness immediately after eating contaminated food, while acute outbreaks can cause death. The Kenya outbreak of 2004 to 2005 had 125 known fatal cases.
3. Sources of aflatoxins in commonly consumed foods in Zambia include maize, groundnuts, peanut butter, bambara nut and milk (Mohamed, 2011).

13.8 RECOMMENDATIONS & GUIDANCE ON AFLATOXINS

1. Throw away grains and legumes that are mouldy because they are not safe for people and animals to eat. They can cause cancer and affect child growth.
2. Aflatoxins are one of many serious hazards transmitted by foods.
3. Dry grains and legumes completely and quickly before storing. Store grains and legumes under dry conditions. Do not allow grains and legumes to become wet.

13.9 HELPFUL TIPS ON DECREASING EXPOSURE TO AFLATOXINS

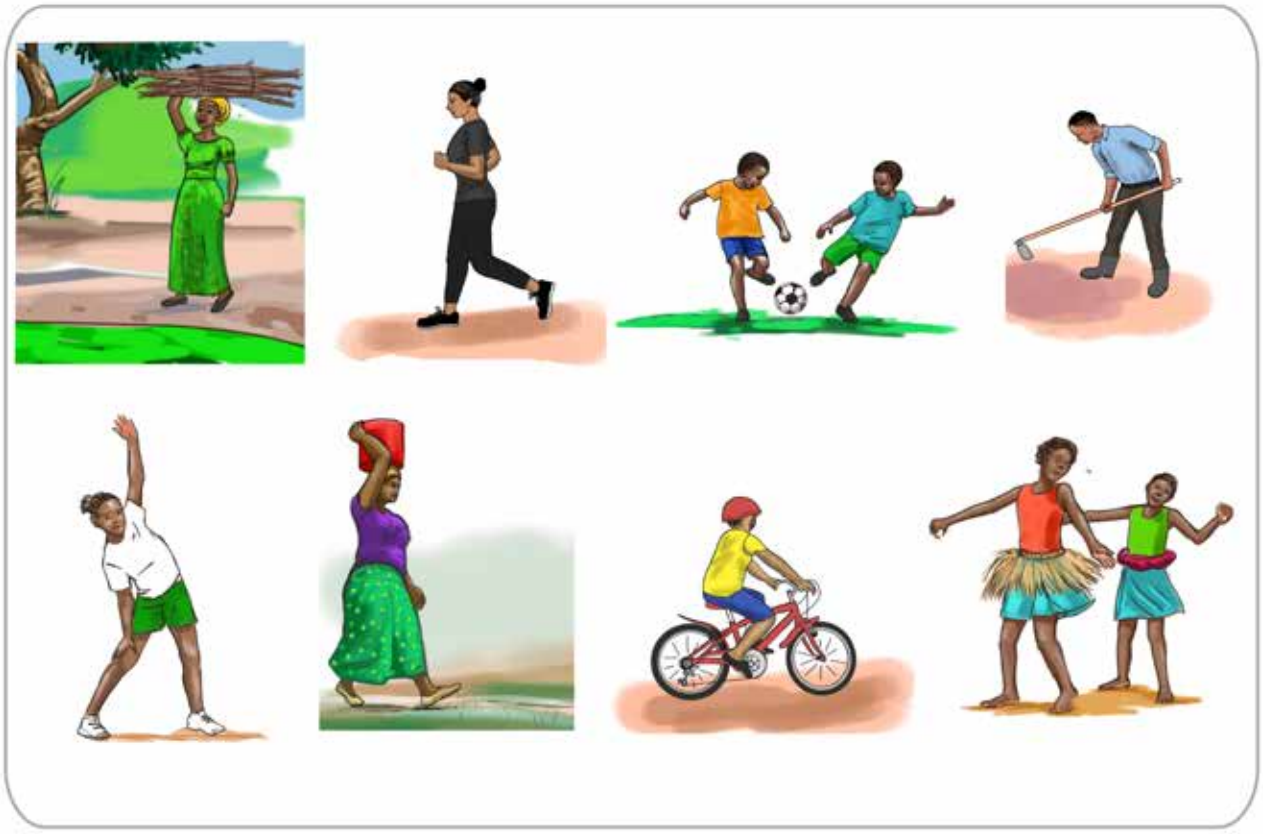
Helpful Tips on decreasing exposure to aflatoxins

1. Inspect grains, dried fruits and nuts. If they look mouldy, discoloured or shrivelled, discard them.
2. Store all dry food like grains, nuts, dried fruits and spices in a closed-lid container in a cool, dry area safe from air, heat and moisture to prevent toxic compounds from growing.
3. Store dry foods in closed containers to keep away insects and rodents.
4. Do not keep dried foods for long periods of time before using them.
5. Eat a variety of foods to reduce the chance of eating the same potentially contaminated foods.

Recommendation 10

Engage in physical activity at least 30 minutes every day

14. RECOMMENDATION 10: Engage in physical activity at least 30 minutes every day.



14.1 WHAT IS PHYSICAL ACTIVITY?

Physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" (WHO, 2020b). Generally, one works up a sweat, breathes heavily and increases their heart rate during exercise. Exercise on the other hand is defined as "physical activity that is planned, structured, repetitive" (Caspersen, Powell and Christenson, 1985) for the purpose of conditioning any part of the body used to improve health and maintain fitness. Examples of physical activities include, but are not limited to, walking, stretching, gardening, digging, carrying water/wood, chopping wood, dancing, jumping ropes, lifting weights, running and bicycling. Exercise is a subcategory of physical activity that is planned, structured and repetitive, with a primary purpose of improving or maintaining physical fitness, physical performance or health (WHO, 2020b).

14.2 PHYSICAL ACTIVITY AMONG ZAMBIANS

The STEPS survey (WHO, 2017b) indicated that 10.4 percent of participants had insufficient physical activity, defined as having spent less than 150 minutes of moderate-intensity activity per week or equivalent. The proportion of males with insufficient physical activities was 5.7 percent and that of females was 18 percent. Females were more likely to have insufficient time for moderate-intensity physical activity than males. The proportion of participants not engaging in vigorous activity was 35 percent (24 males and 45.5 percent females). The median time spent on physical activity per day was 187 minutes (249 males and 137 females). According to WHO guidelines (2020b), adults should do at least 150 to 300 minutes of moderate-intensity aerobic physical activity; or at least 75 to 150 minutes of vigorous intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week, for substantial health benefits.

In the Global School-based Student Health Survey (GSHS 2004–2013), the prevalence of physical activity of 60 minutes daily was about 91 percent among adolescents boys and 89 percent among adolescent girls but for less than seven days per week. This clearly shows that the level of physical activities was low among adolescents in Zambia (Darfour-Oduro, 2018). WHO (2020) recommends that children and adolescents should do at least an average of 60 minutes per day of moderate- to vigorous-intensity, mostly aerobic, physical activity across the week. Moderate-intensity aerobic physical activity of more than 300 minutes; or more than 150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week provides additional health benefits (WHO, 2020b).

14.3. PHYSICAL ACTIVITY AND ITS RELATIONSHIP TO HEALTH

The WHO global recommendations (WHO, 2010; Reiner *et al*., 2013,) report that physical inactivity, and overweight and obesity are responsible for 6 percent and 5 percent of total global deaths, respectively, after high blood pressure (13 percent), tobacco use (9 percent) and high blood glucose (6 percent). It has been shown that participation in regular physical activity provides the following health outcomes: improved all-cause mortality, decreased cardiovascular disease mortality, incident hypertension, incident site-specific cancers and incident type 2 diabetes. Physical activity also improves mental health (reduced symptoms of anxiety and depression); cognitive health and sleep (WHO, 2018c; WHO, 2020b). Physical activity is also negatively related to weight gain or obesity, Alzheimer's disease and dementia (Reiner *et al*., 2013).

In children and adolescents, physical activity confers benefits for the following health outcomes: improved physical fitness (cardiorespiratory and muscular fitness), cardiometabolic health (blood pressure, dyslipidaemia, glucose and insulin resistance), bone health, cognitive outcomes (academic performance, executive function), mental health (reduced symptoms of depression) and reduced adiposity (WHO, 2020b).

In addition to the benefits mentioned earlier, physical activity in older adults helps prevent falls and fall-related injuries, as well as declines in bone health and functional ability (WHO, 2020b). Physical activity focused on balance training and moderately intense muscle strengthening activities reduces nearly 30 percent of the risk of falls in older adults with poor mobility (Paterson and Warburton, 2010). Physical inactivity levels are rising in many countries, with major implications for the prevalence of NCDs and the general health of the population worldwide. Additionally, physical activity is a key determinant of energy expenditure, and thus is fundamental to energy balance, weight control and ultimately overweight and obesity control (Alexander *et al*., 2016).

14.3.1 Importance of achieving and maintaining a healthy weight

Obesity can predispose and lead to many conditions and diseases such as diabetes, high blood pressure and high cholesterol, leading to heart disease; stroke; and certain cancers of the breast, colon, kidney, liver and endometrium (WHO, 2018c). Overall, people who are obese have a lower quality of life and lower productivity (Goettler, Grosse and Sonntag, 2017; Raozjabek *et al*., 2020).

14.4 CURRENT GLOBAL RECOMMENDATIONS ON PHYSICAL ACTIVITY

All children and young people should engage in moderate to vigorous intensity physical activity for at least 60 minutes and up to several hours every day. Vigorous-intensity activities, including those that strengthen muscle and bone, should be incorporated at least three days a week. All children and young people should minimise the amount of time spent being sedentary (sitting) for extended periods (Damian, M., Oltean, Damian, C., 2018; Olusola and Olanipekun, 2017; WHO, 2020c).

Adults aged 18 years and above should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week. Aerobic activity should be performed in bouts of at least 10 minutes duration. Muscle strengthening activities should be done involving major muscle groups two or more days a week. 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-intensity activity (WHO, 2020c). Adults 65 years and above with poor mobility should perform physical activity on three or more days a week to enhance balance and prevent falls. 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.

14.4.1 How to be more physically active

Incorporating enjoyable physical activities as part of a daily or weekly routine can help one become more physically active. Being physically active with other people can make it more engaging and enjoyable. Also, including other people can mean more encouragement and accountability.

Planning a big exercise regimen can seem daunting, especially if one has not been physically active in the past. It would be smart to start with an activity one can do and enjoys doing. Some easier activities include gardening, walking, dancing and cleaning. More vigorous activities include running, hiking, cycling and jumping ropes. If one has not been very active before, it is advisable to start with a small goal and increase the intensity or duration of the activities as one progresses. Intensity and consistency are important in maintaining physical fitness.

Activity-related adverse events such as musculoskeletal injuries can be reduced by progressively increasing the activity level and by selecting low-risk activities (WHO, 2020b).

14.5 RECOMMENDATIONS & GUIDANCE FOR PHYSICAL ACTIVITY

1. Aim to be active daily. Sit less, move more! Break up long periods of sitting by taking brief, active breaks.
2. People who sit less and do any amount of moderate-to-vigorous physical activity gain some health benefits.
3. Over a week, activity should add up to recommended minutes (hours) based on the age group. Break up the total hours in short segments per day.

14.5.1 Recommendation for physical activity - Children and adolescents

CHILDREN AND ADOLESCENTS
(aged 5–17 years)

In children and adolescents, physical activity confers benefits for the following health outcomes: improved physical fitness (cardiorespiratory and muscular fitness), cardiometabolic health (blood pressure, dyslipidaemia, glucose, and insulin resistance), bone health, cognitive outcomes (academic performance, executive function), mental health (reduced symptoms of depression); and reduced adiposity.

At least 60 minutes a day

moderate- to vigorous-intensity physical activity across the week; most of this physical activity should be aerobic.

It is recommended that:

› Children and adolescents should do at least an average of 60 minutes per day of moderate- to vigorous-intensity, mostly aerobic, physical activity, across the week.

Strong recommendation, moderate certainty evidence

On at least 3 days a week

vigorous-intensity aerobic activities, as well as those that **strengthen muscle and bone** should be incorporated.

› Vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, should be incorporated at least 3 days a week.

Strong recommendation, moderate certainty evidence

It is recommended that:

› Children and adolescents should limit the amount of time spent being sedentary, particularly the amount of recreational screen time.

Strong recommendation, low certainty evidence

LIMIT

the amount of time spent being sedentary, particularly recreational screen time.

Source: WHO, 2020b

14.5.2 Recommendation for physical activity - adults

ADULTS
(aged 18–64 years)

In adults, physical activity confers benefits for the following health outcomes: improved all-cause mortality, cardiovascular disease mortality, incident hypertension, incident site-specific cancers,[1] incident type-2 diabetes, mental health (reduced symptoms of anxiety and depression); cognitive health, and sleep; measures of adiposity may also improve.

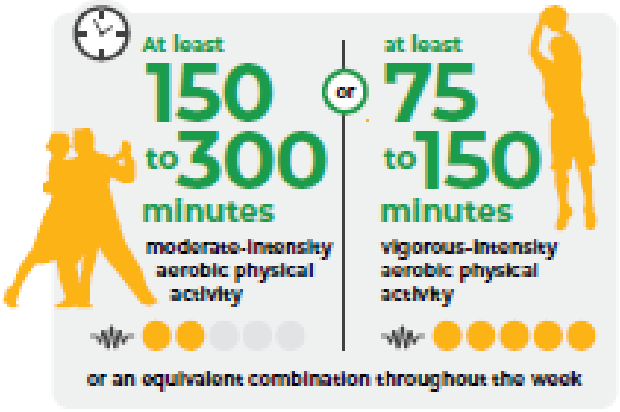
It is recommended that:

› All adults should undertake regular physical activity.

Strong recommendation, moderate certainty evidence

› Adults should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week, for substantial health benefits.

Strong recommendation, moderate certainty evidence



› Adults should also do muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on 2 or more days a week, as these provide additional health benefits.

Strong recommendation, moderate certainty evidence

WHO guidelines on physical activity and sedentary behaviour

It is recommended that:

› Adults should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.

Strong recommendation, moderate certainty evidence

› To help reduce the detrimental effects of high levels of sedentary behaviour on health, adults should aim to do more than the recommended levels of moderate- to vigorous-intensity physical activity.

Strong recommendation, moderate certainty evidence

Source: WHO, 2020b

14.6 TIPS FOR INCREASED DAILY PHYSICAL EXERCISE

Helpful Tips for being more physically active

1. Choose activities that are enjoyable and can be done regularly at home and at work. Walking, dancing, gardening, cleaning and other daily activities that require physical movement count towards being physically active.
2. Be physically active with other people to make it more enjoyable and to keep each other accountable.
3. Sit less, move more! Break up long periods of sitting by taking brief, active breaks.
4. Move about every 30 minutes after working on a computer, studying or watching television .
5. Walk or bike instead of using a vehicle whenever possible. Use the stairs instead of the elevator.
6. Set a time aside for structured physical activities. Start small and increase intensity and duration as you progress.
7. Be consistent to form a habit.
8. Over the course of a week, total activity should add up to the recommended minutes (hours) based on your age group. Break up the total hours into short segments per day.
9. Reduce screen time on computers, phones or the television.
10. Move while watching television. Try simple movements like stretching, squats, lunges or crunches.
11. People who sit less and do any amount of moderate-to-vigorous physical activity experience health benefits.

SECTION 3

Special dietary requirements for under-five children, adolescent girls, and pregnant and lactating women in Zambia

The most critical time for good nutrition is during the 1 000-day period from pregnancy until a child's second birthday. Optimal nutrition and care during this period determines whether the child will survive, thrive and reach his/her full potential. The first 1000 days sets the foundation for life long health, development and prosperity. Sub-optimal diets during this foundation affects brain development and intelligence (Cusick and Georgieff, 2016). Further, poor nutrition is associated with an increased risk of obesity, hypertension, diabetes and coronary heart disease in future adult life. In addition, the general eating habits and patterns are formed in the first few years of life (UNICEF 2020 b).

Children from 3 to 5 years continue to grow and develop rapidly and begin to consume food more independently. They therefore require a diversified diet to avoid growth faltering and nutrient deficiencies (UNICEF 2020a)

Good nutrition during pregnancy and lactation is important not only for the baby but also for the mother's survival and wellbeing. Adolescent nutrition especially foe girls in critical due to their rapid growth and development.

15. RECOMMENDATION A: Begin breastfeeding your baby within one hour of birth.

15.1 IMPORTANCE OF EARLY INITIATION OF BREASTFEEDING

Early initiation of breastfeeding, particularly within the first hour of birth, provides infants with colostrum; prevents infections that can lead to death in newborns; and ensures successful breastfeeding (FAO, 2004; UNICEF, 2016)

Colostrum is the special breastmilk that the baby gets the first few days after birth. It is the thick, yellowish milk formed during pregnancy and lasts for a few days post-delivery. Colostrum is high in antibodies and vitamin A which provides the first immunization for the newborn baby and prevents death (FAO, 2004; WHO, 2019). In addition, colostrum helps the child to pass the first stools with ease whilst getting rid of meconium and preventing suboptimal intake jaundice or breastfeeding jaundice (Y de Vries *et al*., 2018; Toscano *et al*., 2017; CDC, 2021b). Colostrum comes in very small amounts and the flow is slow so that a baby can learn to breastfeed, a skill that requires a baby to suck, breathe and swallow at the same time.

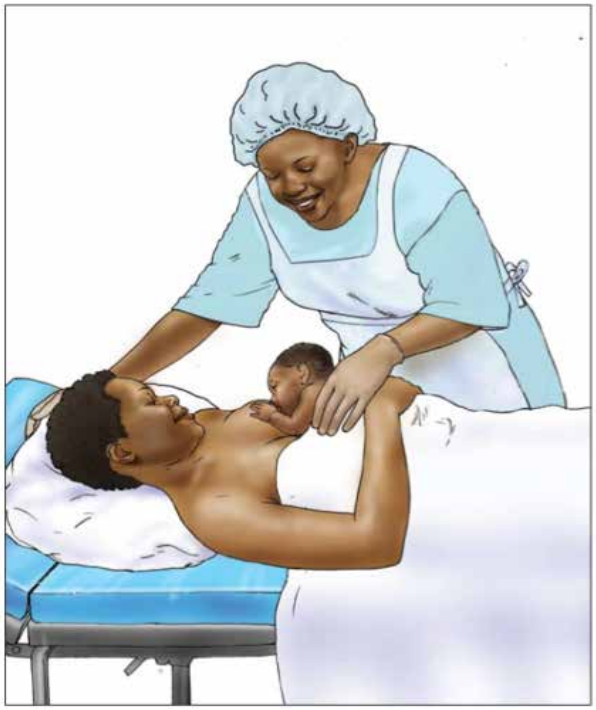


Photo credit: UNICEF and URC/CHS

15.2 TIPS TO ENSURE SUCCESSFUL EARLY INITIATION

Helpful Tips on ensure successful early initiation

1. To facilitate early initiation of breastfeeding within the baby's first hour of life, place the newborn's body skin-to-skin with the mother immediately after birth.
2. Skin-to-skin contact immediately after birth until the baby's first breastfeeding is important because it increases the chances of babies being breastfed, helps to extend the length of breastfeeding, and improves rates of exclusive breastfeeding (UNICEF, 2020).

16. Recommendation B: Feed your baby breastmilk only for the first six months of life and no water, herbs or porridge because mother's milk contains all the food and water your baby needs.

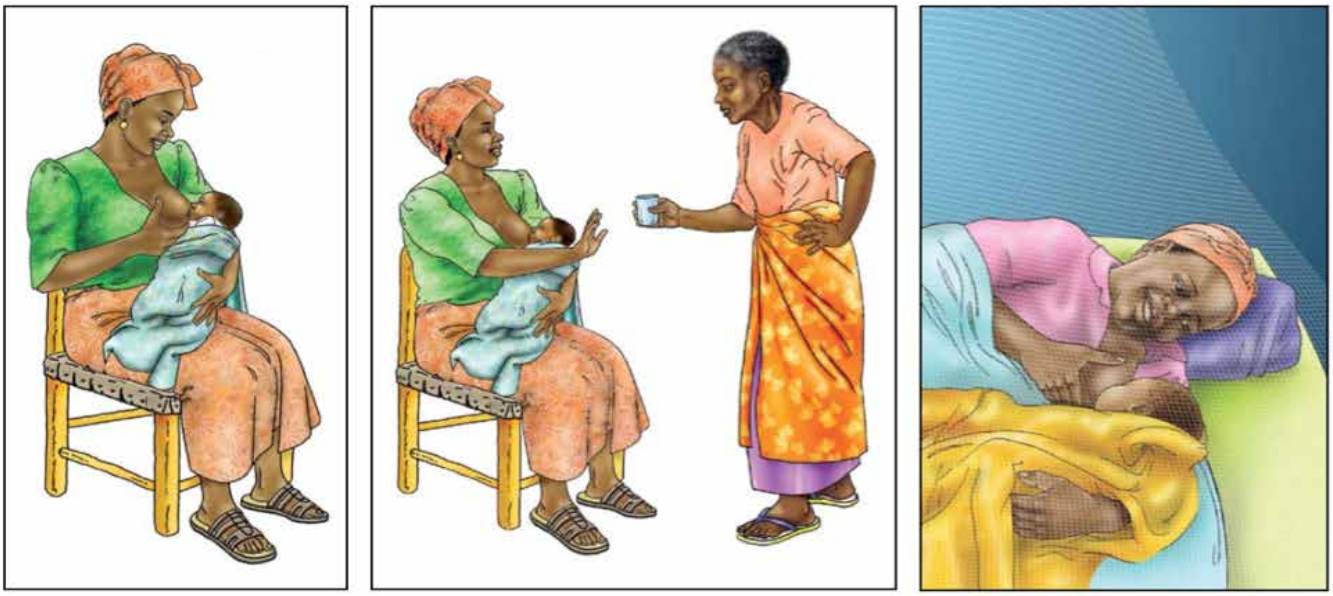


Photo credit: UNICEF and URC/CHS

16.1 MOTHER'S BREASTMILK

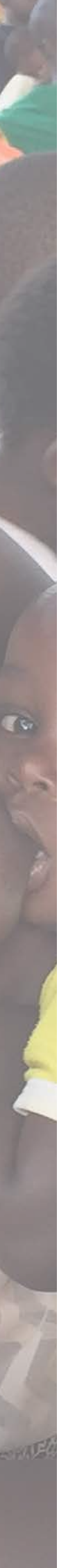
Breastfeeding is the best, safest and healthiest way to feed infants in every country of the world. New and stronger evidence continuously proves the many nutrition, health, psychological and economic benefits of breastfeeding (Lancet 2016; UNICEF, 2016).

Breastmilk provides all the nutrients and energy that the infants need to grow and develop from 0 to 6 months (FAO, 2004; WHO, 2017c). It is the most ideal food for babies because it is nutritious, easy to digest and prevents constipation.

Breastmilk alone can quench the thirst of babies aged 0 to 6 months because breastmilk consists of 88 percent water (WHO, 2009; UNICEF, 2020a; WHO, 2019b).

16.2 IMPORTANCE OF EXCLUSIVE BREASTFEEDING FOR BABIES

Breastfeeding saves lives and improves the health of children: Breastfed infants are protected against dying before the age of six months. According to the EAT-Lancet Commission report, breastfeeding could prevent 13 percent of all deaths of children under five globally. Breastfeeding protects children from illness such as respiratory infections, diarrhoeal diseases and other life-threatening ailments (FAO, 2004; WHO, 2009; WHO, 2021a; Lancet, 2016). Infants who are exclusively breastfed are also protected against obesity (Victora *et al*., 2016; WHO, 2019a) and non-communicable diseases such as diabetes later in life (WHO, 2009; Pereira *et al*., 2014).



Breastfeeding helps prepare children for a successful future: Breastmilk is a rich source of fatty acids that contribute to brain development (UNICEF, 2020a). As a result, breastfeeding improves cognitive intelligence in children who are breastfed versus those who are not (WHO, 2009; UNICEF, 2016; Victora *et al*., 2016). This improved cognitive performance of up to three points on average on an intelligence test translates to improved academic performance, increased long-term earnings and productivity.

16.3 BREASTFEEDING BENEFITS THE COUNTRY ECONOMY

Economic losses due to not breastfeeding are about US$ 302 billion annually at a global level, and about US$ 70 billion annually in low- and middle-income countries representing 0.39 percent of Gross National Income (GNI) (Rollin *et al*., 2016; Lancet, 2016). The losses are due to high maternal and child mortality, higher healthcare costs due to increased illness and disease, and loss of future wages because of reduced cognitive development in infants not breastfed (UNICEF and WHO, 2017c).

Breastfeeding not only has nutrition, health and future earning potential benefits, but it also saves the family the money which would be spent on buying infant formula.

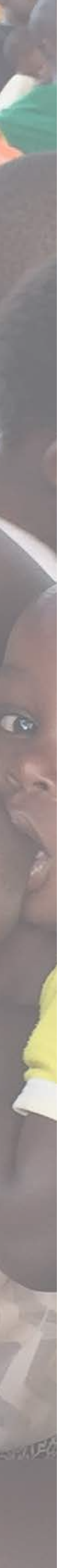
In addition to economic gains, breastfeeding reduces millions of US dollars in annual healthcare costs (Lancet, 2016).

16.4 BREASTFEEDING BENEFITS FOR MOTHERS

- Breastfeeding is associated with decreased risks of diabetes and overweight and obesity for mothers (Horta *et al*., 2015; Victora *et al*., 2016).
- Women who breastfeed have a reduced risk of breast cancer of 6 percent for every 12 months of breastfeeding in a woman's lifetime. Breastfeeding also reduces the risk of ovarian cancer (WHO, 2017c; WHO, 2021a; Victora *et al*., 2016; Lancet, 2016).
- Since during breastfeeding the mother uses up the fat stored during pregnancy, a mother who exclusively breastfeeds her baby loses pregnancy weight faster than a mother who does not (Riordan and Auerbach, 1999; Eiger and Wendkos Olds, 1999).
- Breastmilk is readily available, does not require any special preparation, saves time and makes night feeding easier.
- Breastfeeding delays the return of fertility, hence can improve birth spacing. Mothers who breastfeed exclusively and frequently have less than a 2 percent risk of becoming pregnant in the first 6 months postpartum, provided that they still have amenorrhoea, where menstruation has not returned (WHO, 2021a).

16.5 RATES OF EXCLUSIVE BREASTFEEDING IN ZAMBIA

The Zambia Demographic Health Survey (ZDHS) found that in Zambia, almost all children (98 percent) were breastfed. However, only 68 percent of the children were breastfed within the first hour of birth and seven out of ten children aged between 0 to 6 months were exclusively breastfed (ZamStats, MOH and ICF, 2019).



16.6 RECOMMENDATIONS & GUIDANCE FOR EXCLUSIVE BREASTFEEDING FOR CHILDREN AGED 0 TO 6 MONTHS

1. Breastfeed your baby within 1 hour of birth.
2. Give your baby only breastmilk from 0 to 6 months.
3. Breastfeed on demand, day and night.
4. Do not give any other food or liquids to your baby, not even water, during your baby's first 6 months.
5. Even during very hot weather, breastmilk will satisfy your baby's thirst.
6. Breastmilk provides all the food and water that the baby needs during this time. Breastmilk also protects your baby against sickness and infection.
7. Giving your baby anything other than breastmilk will cause him or her to suckle less and will reduce the amount of breastmilk that you will produce and may make your baby sick.

16.7 TIPS FOR BREASTFEEDING SUCCESS

Helpful Tips ensure successful breastfeeding

1. Place the newborn skin-to-skin with the mother immediately after birth to facilitate successful breastfeeding.
2. Look for the following signs to know whether the baby is getting adequate breastmilk:
   - ◊ A baby will have at least 6 to 8 very wet nappies/diapers in 24 hours from day five (a baby's urine frequency increases from two wet diapers on day 2 to three to four wet diapers on day 3 and 4).
   - ◊ The baby's urine is clear as water a few days after birth.
   - ◊ A baby will produce bright yellow stools from day 5. 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.
   - ◊ Your baby has good skin colour and muscle tone.
   - ◊ Your baby will be alert, responsive and contented.
   - ◊ Your baby will gain weight and grow in length and head circumference starting with regaining their birth weight by 10 to 14 days old.

17. Recommendation C: From six months, introduce a variety of foods from the six food groups and continue to breastfeed up to two years and beyond.

Image credit: UNICEF and URC/CHS

Around the age of six months, an infant's need for energy and nutrients starts to exceed what is provided by breastmilk, and complementary foods are necessary to meet those needs. An infant of this age is also developmentally ready for other foods.

17.1 WHY SHOULD CHILDREN AGED 6 TO 23 MONTHS EAT A VARIETY OF FOODS IN ADDITION TO BREASTFEEDING?

17.1.1 From 6 months, children need a variety of foods to complement breastmilk

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

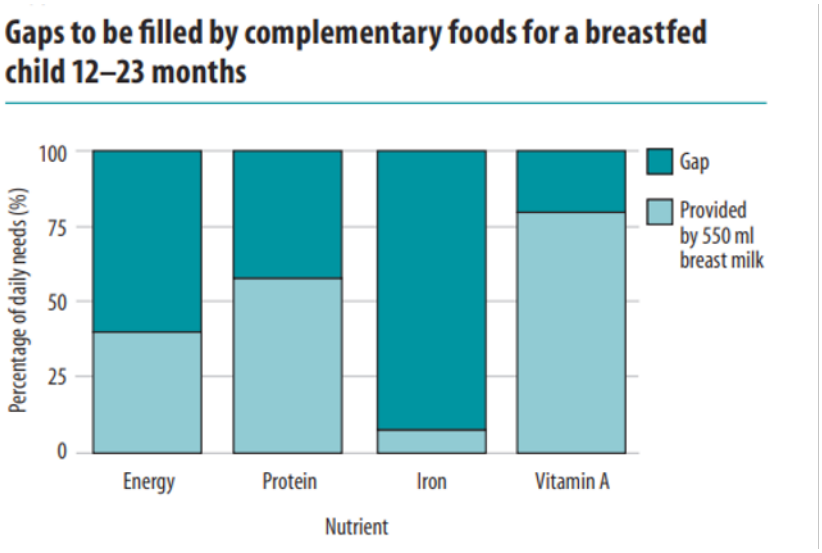
As per Table 13, from six months, breastmilk cannot meet all the energy and nutritional needs of a growing child that support optimal growth and development (WHO, 2006; PAHO and WHO, 2002; WHO, 2009).

However, breastmilk continues to be important for children between 6 to 23 months and beyond (WHO, 201821a; UNICEF, 2016). Breastmilk provides energy and nutrients required for growth and development, and prevents illness. Between 6 to 12 months, breastmilk provides half or more of the child's energy needs whilst it provides slightly more than a third of the energy needs between 12 to 24 months (PAHO and WHO, 2002; WHO, 201821a). Breastmilk is also a critical source of energy and nutrients during illness, and reduces mortality among children who are malnourished (WHO, 201821a). In addition, continued breastfeeding up to age two or older can provide children with nutrients where access to a diverse range of foods is limited (UNICEF, 2016).

Table 13: Estimate of energy and nutritional requirements compared to what is provided by breastmilk (WHO 2002, WHO, 2006

Child age	Energy needed	Energy from breastmilk	Energy gap	Iron needed	Iron from breast-milk	Iron gap	Vitamin A needed	Vitamin A from breastmilk	Vitamin A gap
(months)	(Kcal)	(Kcal)	(Kcal)	(mg/ day)	(mg/day)	(mg/ day)	(mcg RE/ day)	(mcg RE/ day)	(mcg 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 of iron and vitamin A is zero in the first six months because it is covered from the baby's birth stores.									

Figure 17: Nutrient gaps to be filled by complementary foods for a breastfed child 12 to 23 months (WHO, 2009)



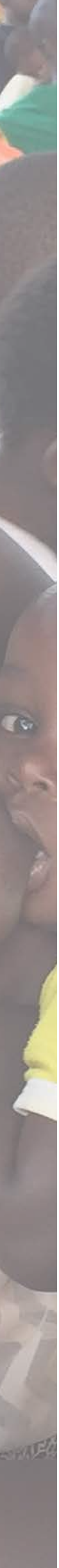
17.1.2 Increased nutritional needs for children from 6 months of age

The nutritional needs for children 6 to 23 months of age are greater per kilogram of body weight than at any other time in life. If children are not fed a variety of foods from the six groups in the right amounts and frequency, they are at risk of undernutrition and poor growth (WHO, 2021a; UNICEF, 2020b; WHO, 2019a). Young children are more susceptible to the consequences of poor dietary diversity compared to older age groups given that young children's growing brains and bodies need good nutrition the most (UNICEF, 2016).

The increase in body size and developmental needs should be fulfilled by introducing age-appropriate foods (PAHO and WHO, 2002). Complementary foods are not meant to replace breastmilk but to complement it. Delaying the introduction of complementary foods may lead to malnutrition due to inadequate nutrition (FAO, 2004; UNICEF, 2016). As per Table 13, after six months, breastmilk cannot meet all the energy and nutrients needs for a baby. Additional energy, proteins, vitamins, minerals and healthy fats are important for children aged 6 to 23 months and two to five years. As children grow, they need additional energy and proteins and healthy fats to support their growth and development. In addition, they require micronutrients such as vitamin A, iron, zinc and calcium. Specific nutrient requirements are provided in Table 28 in Annex 1.

17.1.3 Importance of vitamin A for children aged 6 months to 5 years

Vitamin A is required to support rapid growth and reduces the risk of respiratory and gastrointestinal infections (FAO and WHO, 2004).



Vitamin A deficiency is a public health problem in children under six years of age (FAO and WHO, 2004). About a quarter of the children are deficient in vitamin A (Alaofè *et al*., 2014). There is a high risk of infant mortality in the first year of life due to vitamin A deficiency (Christian *et al*., 2001). Deficiency in vitamin A can cause night blindness especially in children aged less than three years (Sommer, 1994; FAO and WHO, 2004). Diarrhoea is worsened by Vitamin A deficiency and prolonged diarrhoea causes vitamin A loss in young children (WHO, 2019b). In addition, vitamin A deficiency in children under six years of age is associated with concurrent infections which may lead to death (Beaton *et al*., 1993; FAO and WHO, 2004).

In well-nourished populations, the levels of vitamins A and B6 in breastmilk, as well as the infant's birth reserves of vitamin A, are adequate to meet the requirements for infants throughout the first six months of life. Between 6 to 23 months, breastfeeding provides most of the 400 µg RE/day of vitamin A required by the body with only few amounts needed from the diet. Complimentary dietary sources are only 60 µg RE for 6 to 8 months; 90 µg RE for 9 to 11 months; and 120 µg RE for 12 to 23 months (WHO, 2002; WHO, 2006; WHO, 2009). From the age of two, children transition from dependency on breastmilk for vitamin A to dietary sources (FAO and WHO, 2004).

17.1.4 Importance of iron

Iron is required for growth and survival in children. It is important for children's cognitive development and brain function. Iron is needed in the formation of blood haemoglobin and in the production of energy throughout the body. Iron deficiency anaemia in children under five is a serious problem in Zambia, which can lead to infant deaths. Fifty-eight percent of children aged 6 to 59 months are anaemic (Alaofè *et al*., 2014, ZamStats, MOH and ICF, 2019).

Children's iron needs double during the first year of life. For the first six month, an infant's iron requirements are met by birth reserves (WHO, 2002; WHO, 2006; WHO, 2009). From around six months, the child's iron reserves in the body will start to deplete. A breastfed infant aged 6 to 8 months old needs more than eight times the amount of iron and four times the amount of zinc per 100 Kcal food of an adult male (Dewey and Vitta, 2013). The body's iron content is doubled again between 1 and 6 years of age. The absorbed iron requirements in children are quite high in comparison to their energy needs (FAO and WHO, 2004).

7.1.5 Importance of Zinc

Zinc is important for cell division and the synthesis of protein and growth in children (FAO and WHO, 2004). Deficiency in zinc affects the growth of children and increases their risk of severe infectious diseases (FAO and WHO, 2004). Results from zinc supplementation studies suggest that a low zinc status in children not only affects growth but is also associated with an increased risk of severe infectious diseases (Black, 1998).

17.1.6 Importance of calcium

Calcium is needed for building strong bones and teeth during childhood (FAO and WHO, 2004). From zero to five years, children are growing rapidly and by three years, a child doubles his/her height and quadruples his/her weight.

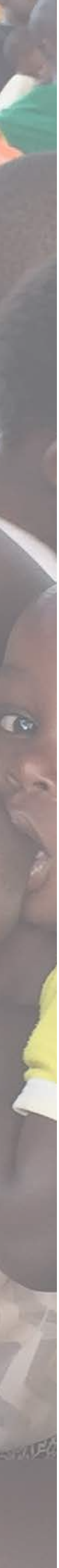
Infants and young children with low calcium and vitamin D intake are at an increased risk of developing rickets (WHO, 2019c). Vitamin D aids in calcium absorption. Rickets is a bone-softening condition that can cause severe leg bending (bowing), poor growth and sometimes muscle pain and weakness.

Developing strong bones in childhood is important, as bone calcium begins to decrease in young adulthood and progressive bone loss can occur as a person ages, especially in women.

17.1.7 Importance of fats

Fats are an energy-dense source (FAO, 2004): Dietary fats play an important role as energy sources for the body, especially for growing children who are at risk of suffering energy deficiency due to the high energy demands at this stage of rapid growth. Fats are energy-dense as they contain 9 Kcal/g of fat compared to 4 Kcal/g of protein or carbohydrates.

Weaning foods are starch-based and are characterised by a low energy density and an unpalatable viscosity in many developing countries, including Zambia (Sakala and Curry, 2017). Oils and fats can play a critical role in reducing the viscosity and improving the energy density of weaning foods. Breastmilk contains 40 to 55 percent of its energy in the form of fat (FAO and WHO, 2010). During the complementary feeding period, it has been suggested that 30 to 45 percent of energy should come from fat and the rest from other sources such as



carbohydrates and proteins (Dewey and Brown, 2003).

Fats are important for brain development and for immunity: Fats and oils are an important source of polyunsaturated fatty acids. PUFAS, especially omega 3 and omega 6 fatty acids, play a key role in cognitive development, immune functions and early growth and development in infants and children (WHO, 2020a; FAO and WHO, 2010). In addition, dietary fats also provide the medium for the absorption of fat-soluble vitamins (A, D, E and K). The role of fat in absorption of vitamins is key since vitamin A deficiency in under-five children is a problem in Zambia.

17.2 DIETARY PATTERNS AND NUTRITION STATUS FOR CHILDREN AGED 6 TO 23 MONTHS IN ZAMBIA

On average, children aged 6 to 23 months in Zambia eat a diet composed of two to three different types of foods in a day (Sakala and Curry, 2017). The same study found that 60 to 80 percent of children were fed on diets mainly composed of starchy foods and vegetables, while animal source foods were eaten by less than 40 percent. GAIN and UNICEF (2021) also found low consumption of animal source foods.

Children in Zambia are prone to malnutrition due to poor dietary practices, especially low dietary diversity. Only 13 percent of children between the ages of 6 to 23 months were fed a minimal acceptable diet (ZamStats, MOH and ICF, 2019). Less than half of children (42 percent) were given meals at the recommended minimum frequency, while 23 percent achieved minimum dietary diversity (ZamStats, MOH and ICF, 2019).

The low dietary diversity is characterised by a diet mostly composed of grains (84 percent among breastfeeding children and 88 percent among non-breastfeeding children) followed by fruits and vegetables rich in Vitamin A. Animal source foods which include meat, fish and poultry are included in less than half of the children's diets. Only 40 percent of breastfed and 47 percent of non-breastfed children eat flesh foods. Further, eggs are eaten by 21 percent of breastfed and 31 percent of non-breastfed children aged 6 to 23 months.

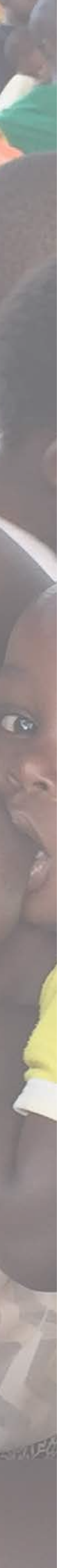
The poor infant and young child feeding practices in Zambia have resulted in high levels of malnutrition among children under five years of age. Approximately 35 percent of the children are stunted, 12 percent underweight and 4 percent wasted (ZamStats, MOH and ICF, 2019). Overweight in children is becoming a burden in Zambia, with 5 percent of children under the age of five weighing more than expected for their height (ZamStats, MOH and ICF, 2019).

17.3 GUIDING PRINCIPLES FOR APPROPRIATE COMPLEMENTARY FEEDING FOR CHILDREN 6 TO 23 MONTHS

After six months of age, the babies require additional foods while continuing to receive breastmilk, since an infant's need for energy and nutrients starts to exceed what is provided by breastmilk, necessitating the introduction of complementary foods to meet the additional needs. If complementary foods are not introduced at the age of six months, or if they are given inappropriately, an infant's growth may falter. In addition, unlike infants from 0 to 6 months, children at the age of six months are also developmentally ready for other foods besides breastmilk (WHO, 2019a; WHO, 2021a). Guiding principles for appropriate complementary feeding are based on WHO, UNICEF and FAO guidance (WHO, 2021a; UNICEF, 2016, UNICEF 2011; UNICEF 2020a; FAO, 2004).

These include the following:

- Continue frequent, on-demand breastfeeding until 2 years of age or beyond.
- After 6 months of exclusive breastfeeding, introduce safe, adequate, diversified foods from the six food groups. These foods are rich in energy, protein and micronutrients such as iron and vitamin A and C.
    - ◊ Give children iron-rich foods especially from animal sources such as puréed or mashed liver meats, fish and poultry; and plant sources such as pulses and iron-fortified cereals to address the issue of iron deficiency anaemia.
    - ◊ Give foods rich in vitamin A such as orange and yellow-coloured fruits (like pawpaw and ripe mangoes); orange vegetables (like carrots and pumpkin fruit and flowers); dark green leafy vegetables such as amaranthus, spinach and moringa leaves; yellow and orange grains; and roots and tubers like orange-flesh sweet potatoes and yellow maize. Liver is also rich in vitamin A. All these foods help prevent vitamin A deficiency.



- Gradually increase food consistency, amount and variety as the child gets older, as per Tables 14, 15 and 16. Give infants puréed foods at 6 months and make the food thicker as the child gets older and develops his/her chewing and swallowing abilities. Avoid giving children foods such as whole grapes, raw carrots or nuts as they can cause choking since they are still learning to chew food properly.
- Give small amounts of food and increase the quantity as the child grows.
  - ◊ Practice responsive feeding which includes feeding infants slowly and patiently whilst talking to them and encouraging them to eat without force. Talk to the child and maintain eye contact.
- Use fortified complementary foods or vitamin-mineral supplements as needed. This ensures adequate intake of vital vitamins and minerals. Otherwise, preparing a complementary feed using a mixture of foods from the six food groups will improve the quality of nutrients in the feed.
- Additional care and feeding during illness is important. During illness, increase fluid intake including more breastfeeding, and offer soft, favourite foods.
- Do not feed babies under 12 months of age cow's milk. This is because they cannot digest cow's milk as completely or as easily as breastmilk or formula. Cow's milk contains high concentrations of protein and minerals, and has a high potential renal solute load, which can stress the baby's immature kidneys. Cow's milk does not have the right amounts of iron, vitamin C and other nutrients for the baby, and neither does it provide healthy fats that an infant needs to support growth. It may even cause iron-deficiency anaemia in some babies, since cow's milk protein can irritate the lining of the digestive system, leading to blood loss in the stools (WHO, 2015b; CDC, 2021a).
- Do not add honey, sugar and salt to complementary foods. A baby's small kidneys cannot handle these foods which make the kidney work extra hard. Sugary food can cause tooth decay and honey has bacteria which can cause illness in babies younger than 12 months of age.
- Follow the general food safety guidelines in Section Two at all times before, during and after food preparation as well as feeding:
  - ◊ Wash hands with soap and clean running water for 20 seconds before preparing and eating food; before feeding young children; after using the toilet or latrine; and after cleaning your baby's bottom.
  - ◊ Wash hands frequently after cleaning your home and compound, after practicing agriculture, and after handling livestock or other animals and especially after blowing your nose, coughing or sneezing.
  - ◊ Cook food thoroughly and do not keep food at room temperature for more than two hours.

17.4 THE RECOMMENDED INTAKE FOR CHILDREN AGED 6 TO 23 MONTHS

Diet must fill up the energy and nutrients gaps left by breastfeeding for children from 6 to 23 months of age. Table 13 and Figure 17, based on the WHO, 2002 report and WHO 2006, show the energy requirements to be met by diet. However, the report warns that it is important not to be overly prescriptive about such guidance, as each child's needs will vary due to differences in body size and growth rate. In addition, children recovering from illness or living in environments where energy expenditure is high may require more energy than the average quantities listed in Table 13.

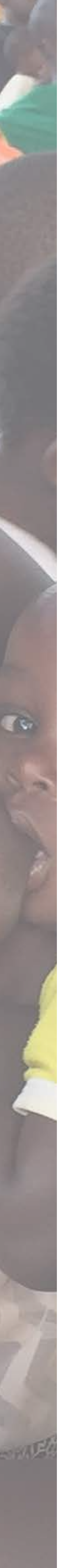
Since in practice, caregivers will not be able to measure the energy content of foods to be offered, the report recommends that the amounts of food to be offered are based on the principles of responsive feeding, while assuring that energy density and meal frequency are adequate to meet the child's needs. Tables 14, 15, 16, 17 and 18 show examples of food combinations and the approximate quantities of foods from the six food groups that would meet the energy and nutrients needs described in Table 13 and Table 28 in Annex 1. The recommended amounts in Tables 14 to 18 are derived from diet modelling through linear programing that optimised various combinations of food items from the six food groups, to come up with a proportion contribution of each food group to meet the calorie and nutrient targets per age group considering affordability of foods in Zambia (GAIN 2021). The recommended amounts are given in number of serving sizes whose serving size equivalents are described in Table 19. Table 20 provides practical guidance on the quality, frequency and amount of food to offer children aged 6 to 23 months.

Table 14: Recommended amounts per food group for 6-8 months

Food group	Recommended amounts		Energy and nutrient values per serving*										
	Number of servings	Total food weight	Energy	Protein	Fat	Carbohydrates	Ca	Fe	Zn	Vit A	Retinol	Folate	Fibre
		(g)	(Kcal)	(g)	(g)	(g)	(mg)	(mg)	(mg)	(mcg RAE)	(mcg)	(mcg)	(g)
Totals	**2**	**216**	**268.9**	**11.3**	**10.7**	**29.5**	**74.8**	**2.8**	**1.3**	**456.1**	**308.6**	**88.6**	**5**
Cereals and tubers	0.25	50	64.4	1.5	0.2	13.7	5.3	0.2	0.1	19	0	4.1	0.8
Dairy products	0	0	0	0	0	0	0	0	0	0	0	0	0
Fats and oil	0.25	4	31.5	0	3.5	0	0	0	0	0	0	0	0
Fruits	0.75	100	79.2	0.9	3.1	10.7	18	0.5	0.2	52.9	0	27.5	2.5
Meat, fish and eggs	0.25	23	36.1	5.3	1.6	0.1	9.3	0.9	0.6	326.2	308.6	29	0.1
Pulses, nuts and seeds	0.25	22	47.4	2.6	2.2	3.8	6	0.6	0.4	0.5	0	18.2	1.2
Vegetables	0.25	18	10.3	0.9	0.1	1.2	36.3	0.6	0.1	57.4	0	9.8	0.4
*Provided by the diet model food combinations													

Table 15: Recommended amounts per food group for 9 -12 months

Food group	Recommended amounts		Energy and nutrient values per serving*										
	Number of servings	Total food weight	Energy	Protein	Fat	Carbohydrates	Ca	Fe	Zn	Vit A	Retinol	Folate	Fibre
		(g)	(Kcal)	(g)	(g)	(g)	(mg)	(mg)	(mg)	(mcg RAE)	(mcg)	(mcg)	(g)
Totals	**-**	**225**	**310.2**	**12.8**	**12.4**	**34.4**	**145.7**	**3.5**	**1.6**	**498.8**	**351.3**	**92.3**	**5**
Cereals and tubers	0.25	50	64.4	1.5	0.2	13.7	5.3	0.2	0.1	19	0	4.1	0.8
Dairy products	0.25	61	41.3	1.5	1.7	4.9	70.9	0.7	0.3	42.7	42.7	3.7	0
Fats and oil	0.25	4	31.5	0	3.5	0	0	0	0	0	0	0	0
Fruits	0.75	100	79.2	0.9	3.1	10.7	18	0.5	0.2	52.9	0	27.5	2.5
Meat, fish and eggs	0.25	23	36.1	5.3	1.6	0.1	9.3	0.9	0.6	326.2	308.6	29	0.1
Pulses, nuts and seeds	0.25	22	47.4	2.6	2.2	3.8	6	0.6	0.4	0.5	0	18.2	1.2
Vegetables	0.25	18	10.3	0.9	0.1	1.2	36.3	0.6	0.1	57.4	0	9.8	0.4
*Provided by the diet model food combinations													



Tables 16, 17 and 18: Recommended amounts per food group for 12-23 months

For children aged 12-23 months, three model options are available to provide some flexibility for those that may not afford animal source of foods or milk. Option 1 suggests more dairy and less of ASF; option 2 suggests similar serving amounts of ASF and dairy. Both options 1 and 2 also suggested more fruit than vegetables. Given the costs of fruit, option 2 was rerun to provide a third option (option 3) with reduced amounts of fruits and increased amounts of vegetables.

Table 16: 12-23 Months -Option 1

Food group	Recommended amounts		Energy and nutrient values per serving*										
	Number of servings	Total food weight	Energy	Protein	Fat	Carbohydrates	Ca	Fe	Zn	Vit A	Retinol	Folate	Fibre
		(g)	(Kcal)	(g)	(g)	(g)	(mg)	(mg)	(mg)	(mcg RAE)	(mcg)	(mcg)	(g)
Totals	**3.75**	**497**	**570.5**	**24**	**21.8**	**66**	**247**	**4.3**	**2.7**	**878.2**	**655.1**	**147.1**	**7.3**
Cereals and tubers	0.75	150	193.3	4.5	0.7	41.2	15.8	0.5	0.3	57	0	12.2	2.3
Dairy products	0.5	122	78.7	4.1	4.5	5.4	146.4	0.1	0.5	40.3	37.8	12.2	0
Fats and oil	0.5	7	63	0	7	0	0	0	0	0	0	0	0
Fruits	1	133	105.6	1.2	4.1	14.2	24	0.7	0.3	70.6	0	36.6	3.3
Meat, fish and eggs	0.5	46	72.2	10.6	3.2	0.2	18.5	1.9	1.1	652.5	617.3	58.1	0.1
Pulses, nuts and seeds	0.25	22	47.4	2.6	2.2	3.8	6	0.6	0.4	0.5	0	18.2	1.2
Vegetables	0.25	18	10.3	0.9	0.1	1.2	36.3	0.6	0.1	57.4	0	9.8	0.4

*Provided by the diet model food combinations

Table 17: 12-23 Months -Option 2

Food group	Recommended amounts		Energy and nutrient values per serving*										
	Number of servings	Total food weight	Energy	Protein	Fat	Carbohy-drates	Ca	Fe	Zn	Vit A	Retinol	Folate	Fibre
		(g)	(Kcal)	(g)	(g)	(g)	(mg)	(mg)	(mg)	(mcg RAE)	(mcg)	(mcg)	(g)
Totals	**3.75**	**546**	**548.6**	**21.4**	**24.5**	**57.5**	**378.9**	**3.2**	**2.5**	**573.3**	**384.3**	**126.2**	**6.5**
Cereals and tubers	0.5	100	128.9	3	0.4	27.4	10.5	0.3	0.2	38	0	8.2	1.5
Dairy products	1	244	157.4	8.3	9	10.7	292.8	0.1	1	80.5	75.6	24.4	0
Fats and oil	0.5	7	63	0	7	0	0	0	0	0	0	0	0
Fruits	1	133	105.6	1.2	4.1	14.2	24	0.7	0.3	70.6	0	36.6	3.3
Meat, fish and eggs	0.25	23	36.1	5.3	1.6	0.1	9.3	0.9	0.6	326.2	308.6	29	0.1
Pulses, nuts and seeds	0.25	22	47.4	2.6	2.2	3.8	6	0.6	0.4	0.5	0	18.2	1.2
Vegetables	0.25	18	10.3	0.9	0.1	1.2	36.3	0.6	0.1	57.4	0	9.8	0.4
*Provided by the diet model food combinations													

Table 18: 12-23 Months -Option 3

Food group	Recommended amounts		Energy and nutrient values per serving*										
	Number of servings	Total food weight	Energy	Protein	Fat	Carbohy-drates	Ca	Fe	Zn	Vit A	Retinol	Folate	Fibre
		(g)	(Kcal)	(g)	(g)	(g)	(mg)	(mg)	(mg)	(mcg RAE)	(mcg)	(mcg)	(g)
Totals	**4**	**456**	**591**	**24.3**	**26.8**	**60**	**271.3**	**4.5**	**2.6**	**900.4**	**655.1**	**138.7**	**6.1**
Cereals and tubers	0.75	150	193.3	4.5	0.7	41.2	15.8	0.5	0.3	57	0	12.2	2.3
Dairy products	0.5	122	78.7	4.1	4.5	5.4	146.4	0.1	0.5	40.3	37.8	12.2	0
Fats and oil	1	14	126	0	14	0	0	0	0	0	0	0	0
Fruits	0.5	66	52.8	0.6	2.1	7.1	12	0.4	0.1	35.3	0	18.3	1.6
Meat, fish and eggs	0.5	46	72.2	10.6	3.2	0.2	18.5	1.9	1.1	652.5	617.3	58.1	0.1
Pulses, nuts and seeds	0.25	22	47.4	2.6	2.2	3.8	6	0.6	0.4	0.5	0	18.2	1.2
Vegetables	0.5	35	20.6	1.9	0.2	2.4	72.6	1.1	0.2	114.8	0	19.7	0.9
*Provided by the diet model food combinations													

17.5 ONE SERVING SIZE EQUIVALENTS OF DIFFERENT FOOD GROUPS

Table 19 provides a serving size which is a standardized amount of food set by the Kcal amount provided. An approximate average food weight amount from the standardised Kcal amount is also provided for each food group. Table 19 also gives one serving equivalent of commonly consumed individual foods for each food group in everyday measures for ease of measurements for the general public.

Table 19: Examples of one serving size equivalents for different food groups

Food group	Energy (Kcal)	Food weight (g)	One serve equivalent (common household measures)
Cereals and tubers*	200	171	• approximately 1 cup of rice, pasta, diced sweet potato and cassava, and ¾ cup cooked nshima
Dairy products	160	-	• one serving 1 cup milk or sour milk (245 g) **or** • one ¾ cup or 1 small tin of yogurt (200g) **or** • four cubes of cheese (30g)
Fats and oil	125	-	• One serving is about a tablespoon of cooking oil
Fruits	80	135	• one medium banana or apple; or one large orange, or peach; or two small tangerines, or peaches, **or** • one cup cut fruit like papaya, mango or small fruit like berries, grapes, masuku **or** • one quarter (1/4) cup baobab pulp
Meat, fish and eggs	135	88	• two eggs (100 g) **or** • two matchbox sized ~60g red meat (beef, goat, sheep) and insects **or** • three matchbox sized ~90g fish (kapenta); or poultry (chicken, quails, duck); or rabbit
Pulses, nuts and seeds	135	84	• one half cup of cooked beans, bambara nuts, soya beans or cowpeas **or** • three tablespoons of peanuts; or seeds like flax, chia, sunflower, pumpkin seeds **or** • one and half teaspoons peanut butter or flour
Vegetables	30	71	• one half cup cooked vegetable** **or** • one cup raw leafy or salad vegetables**
*Select and combine foods from this food group to make the number of servings needed per day. **This is about 70 grams of vegetables.			
Note: Section 2 has detailed food exchange lists for one serving size with Kcal, food weight and household measures.			

DID YOU KNOW?

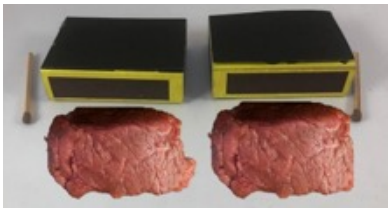
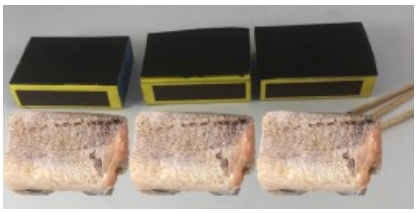
Red meat (~60 g) is the size of two matchboxes	Fish, poultry e.g. chicken and (~90g) is three matchboxes	Cheese (~30g) is about four dice
		

Table 20: Practical guidance on the quality, frequency and amount of food to offer children aged 6 to 23 months

Child age (months)	Texture	Frequency	Amount of food
6-8	Start with thick, well-mashed, semi-solid/blended/pureed foods	2-3 meals per day	Start with 2-3 table-spoons per feed, in-creasing gradually to ½ cup (125ml)
9-11	Finely chopped or mashed foods and foods that baby can pick up	3-4 meals per day*	½ cup (125ml)
12-23	Family foods, chopped or mashed if necessary	3-4 meals per day*	¼ cup (190ml) to 1 cup (250ml)
*Depending on the child's appetite, 1-2 snacks may be offered.			
N.B. If a baby is not breastfed, give an additional 1-2 cups of milk per day, and 1-2 extra meals per day.			

18. Recommendation D: Give a variety of foods from the six food groups to children 2 to 5 years to help them grow to their full potential.

Image Credit: Adapted from UNICEF & URC/CHS

18.1 IMPORTANCE OF OPTIMAL NUTRITION FOR CHILDREN 2 TO 5 YEARS OF AGE

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

From two years of age, children start to choose their own food, can feed themselves, can eat family meals and some can start to eat outside the home (UNICEF, 2020b; FAO, 2004). Families and caregivers should continue to provide a diversified diet from all the six food groups for children in this age group. Children during this age need to be encouraged to eat during meal times especially during sickness (FAO, 2004).

18.2 DIETARY PATTERNS AND NUTRITION STATUS FOR CHILDREN AGED 24 TO 59 MONTHS IN ZAMBIA

According to the Zambia Food Consumption and Micronutrient Status Survey report, (Alaofè *et al*., 2014) children aged 24 to 59 months are mostly fed miscellaneous roots and tubers (>80 percent). A greater proportion also ate beans, nuts and seeds, vegetables (60 percent), and grains (70 percent). Animal source intake was mostly fish and seafood (60 percent), meat and poultry (8.6 percent), milk and dairy products or eggs or beverages (9 to 11 percent), with no insects (8 percent). Of concern was the low intake of fruits (44 percent) and high intake of sugar and sweets (27 percent) (Alaofè *et al*., 2014).

Zambia is endowed with a variety of foods that meet children's nutrient needs, however a lot of households cannot afford these foods to meet dietary requirements especially protein, iron, calcium, folate, and zinc since animal sources are unaffordable.

18.3 THE RECOMMENDED INTAKE FOR CHILDREN AGED 2 TO 5 YEARS

Children aged two to five years should be given family meals that contain a variety of foods from the six food groups to ensure they get all the nutrients they require (FAO, 2004). Children in this age group should be fed three meals and one to two nutritious snacks a day (FAO, 2004).

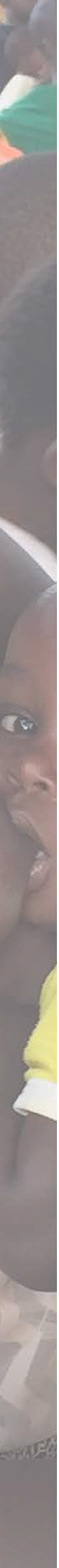
Avoid adding too much spice, sugar and salt to children's food (FAO, 2004). To ensure children eat enough food, they should be served food in their own plate or bowl (FAO, 2004).

Table 21: Diet model-calculated recommended food amounts and serving sizes and the nutrients this eating pattern will provide 2 to 5-year-olds

Food group	Recommended amounts		Energy and nutrient values per serving*							
	Total number of servings	Food weight	Energy**	Protein	Fat	Carbo-hydrates	Ca	Fe	Zn	Vit A
		(g)	(Kcal)	(g)	(g)	(g)	(g)	(g)	(mcg)	(mcg RAE)
Total nutrients provided	**-**	**-**	**1157**	**41.5**	**35.4**	**160**	**405.8**	**8.83**	**4.98**	**908.8**
Cereals and tubers	2.25	385	568.4	13.28	2.3	120.5	46.3	1.9	1.4	145.7
Dairy products	0.5	124	80	4.22	4.59	5.5	148.8	0.06	0.48	40.92
Fats and oil	1	13	117	0	13	0	0	0	0	0
Fruits	1	135	105.6	1.24	4.13	14.23	24.03	0.7	0.27	70.58
Meat, fish and eggs	0.5	44	66.6	9.84	2.89	0.21	17.97	1.78	1.08	419.93
Pulses, nuts and seeds	1	85	177.7	9.14	8.06	14.92	23.5	2.17	1.33	2.01
Vegetables	1	70	41.2	3.75	0.43	4.72	145.2	2.24	0.37	229.63

*Provided by the diet model food combinations
**Protein accounts for 14.34%, fat accounts for 27.54 % and carbohydrates account for 55.34% of the total energy amount

Refer to Table 19 for serving sizes and serving size equivalents for each food group.



18.4 TIPS ON FEEDING CHILDREN AGED 6-59 MONTHS

Helpful Tips quality, frequency and amount of food to offer children aged 6 to 59 months

1. Include fish, insects, or animal source foods like eggs, poultry meat, and milk products to ensure the child gets all the nutrient he/she needs.
2. Give children orange-coloured vegetables, fruits and tubers like paw-paw, ripe mango, pumpkins, pumpkin flowers, orange-fleshed sweet potatoes, whole grain yellow maize, and dark leafy vegetables.
3. Give pulses, nuts and seeds to children. Adding pulse or nut powders is a great way to add nutrients to children meals.
4. Grow and use bio-fortified crops like orange-fleshed sweet potatoes, yellow maize and beans.
5. Add nutrient-rich food powders like insect and moringa powder to children's meals. Adding moringa is a great way to enrich child 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.
6. The need for iron and zinc is sometimes difficult to meet. Reports suggest that a breastfed infant aged 6 to 8 months needs more than eight times as much iron and four times as much zinc per 100 Kcal food as an adult male (Dewey and Vitta, 2013). Therefore, in contexts where nutrient-rich foods are limited or not available or during lean seasons, the use of specialised fortified products, such as fortified blended foods, micronutrient powders, or a small quantity of lipid-based nutrients supplements, may be needed (Michaelsen *et al*., 2017; WHO, 2005).

19. Recommendation E: Adolescents, especially girls, should eat a variety of foods from the six food groups for healthy weight and growth.

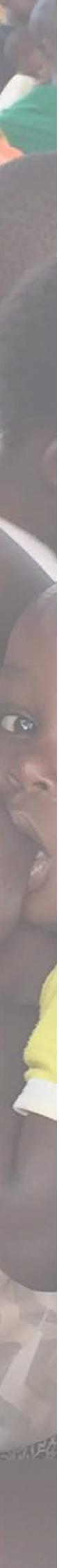
Adolescence is the phase of life between childhood and adulthood during ages 10 to 19 years. During the adolescent stage, there is rapid growth physically including weight, height, neurological and psychosocial development (FAO, 2004; WHO, 2006). Adolescence also marks the beginning of puberty and sexual maturity (FAO, 2004; UNICEF, 2021b).

19.1 NUTRITIONAL NEEDS FOR ADOLESCENTS AGED 10 TO 19 YEARS

The growth spurts and development require additional nutrients (WHO, 2006; UNICEF, 2021b). The adolescence period, also referred to as the 'second window of opportunity', provides an opportunity for growth and cognitive development and makes up for poor childhood nutrition (FAO, 2004; WHO 2021b; WHO, 2006; UNICEF, 2021b). Inadequate nutrition during the adolescent years can slow down physical growth and development. It also affects the attention span, learning and school performance (FAO, 2004; WHO, 2006).

Lack of good nutrition may also lead to micronutrient deficiencies and anaemia (UNICEF, 2021b). Micronutrients are essential for supporting skeletal mass, body size and body density (WHO, 2006).

Adolescents are at risk of overweight and obesity due to lifestyle and food habits which include consuming energy-rich foods which are high in fats, and sugary foods, and too many fizzy drinks, plus a lack of physical activity (FAO, 2004; UNICEF, 2021b). A high intake of foods rich in fats in adolescents and adults is associated with increased risk of heart disease



(WHO, 2006). During the ages between 10 to 19 years, adolescents establish dietary and lifestyle patterns that continue into adulthood (UNICEF, 2021b; FAO, 2004; WHO,2006).

19.1.1 Energy and protein needs for 10 to 19-year-olds

Adolescent boys have high energy needs due to physical activity, which results in them being hungry often and eating large quantities of food (FAO, 2004). In addition to energy needs, protein needs also increase during this stage to support growth including building muscle, especially in boys (WHO, 2006).

19.1.2 Iron needs for 10 to 19-year-olds

Iron needs increase due to the increase in growth, lean body mass, blood volume and red blood cell mass (WHO, 2006). In girls, iron needs increase and almost double during adolescence due to menstruation. They will continue to need additional iron throughout their reproductive ages until menopause (FAO, 2004; WHO, 2006).

19.1.3 Calcium needs for 10 to 19-year-olds

Calcium is needed for muscular, skeletal and endocrine development (WHO, 2006). To prevent osteoporosis later in life, the process of laying down minerals on the bones (bone mineralization) should be maximized during puberty (FAO and WHO, 2004; Lytle, 2002).

19.1.4 Zinc needs for 10 to 19-year-olds

Zinc is important for growth and sexual maturation during puberty (WHO, 2006). In addition, it promotes bone formation and prevents bone loss (WHO, 2006).

19.1.5 Iodine needs for 10 to 19-year-olds

Iodine is important for growth spurts and during pregnancy in adolescence (WHO, 2006).

19.1.6 Vitamins needs for 10 to 19-year-olds

Vitamins, especially thiamine, riboflavin and niacin are needed for the metabolisation of carbohydrates to meet the high energy demands (WHO, 2006). Folic acid and vitamin B12 are needed for increased growth and sexual maturation (Spear, 2002; WHO, 2006). The increased amount of new cell growth in adolescents requires additional vitamins A, C and E (WHO, 2006).

19.2 DIET AND NUTRITION OUTCOMES FOR ADOLESCENTS IN ZAMBIA

A study conducted on adolescent girls aged 15 to 19 years found that dark green leafy vegetables (68.7 percent) were the most commonly consumed food group, while the least consumed food groups were milk and dairy products (15.2 percent,) eggs (14.2 percent) and meat organs (7.3 percent). Further, the study found that 76.6 percent of girls had consumed foods rich in vitamin A, while two-thirds (62.7 percent) consumed animal source iron-rich foods (Bwalya, 2015). The 2020 Global Nutrition Report shows that underweight in children and adolescents aged 5 to 19 years is higher in boys (29.9 percent) compared to girls (17.6 percent). However, overweight and obesity is higher in girls. About 16.7 percent of girls are overweight and 3.4 percent are obese. About 8.4 percent of boys are overweight while 2.1 percent are obese.

Table 22: Diet model-calculated recommended food amount and serving sizes and the nutrients this eating pattern will provide for adolescents girls (10-19 years)

Food group	Recommended amounts		Energy and nutrient values per serving*								
	Total number of servings	Food weight	Energy	Protein	Fat	Carbohydrates	Ca	Fe	Zn	Vit A	Folate
		(g)	(Kcal)	(g)	(g)	(g)	(g)	(g)	(mcg)	(mcg RAE)	(mcg)
Total nutrients provided	-	**1861.275**	**2327.1**	**86.9**	**77.1**	**307.1**	**1208.9**	**18.7**	**10.5**	**2934.8**	**511**
Cereals and tubers	5	712	1051.9	24.6	4.3	222.9	85.7	3.5	2.7	269.6	74.1
Dairy products	2	496	319.9	16.9	18.4	21.8	595.2	0.2	1.9	163.7	49.6
Fats and oil	2	28	252	0	28	0	0	0	0	0	0
Fruits	1.25	118.25	211.2	2.5	8.3	28.5	48.1	1.4	0.5	141.2	73.2
Meat, fish and eggs	1	83.05	141.9	21	5.8	1.3	34.5	4.6	2.5	1785.9	118.3
Pulses, nuts and seeds	1.25	118.25	250.8	12.9	11.4	21.1	33.2	3.1	1.9	2.8	96.7
Vegetables	2.5	158.375	99.4	9.1	1	11.6	412.2	5.8	0.9	571.6	99.1
*Provided by the diet model food combinations											

20. Recommendation F: When pregnant or breastfeeding, enjoy a variety of food including animal source foods, pulses, fruits and vegetables with your meals for your and your baby's health.

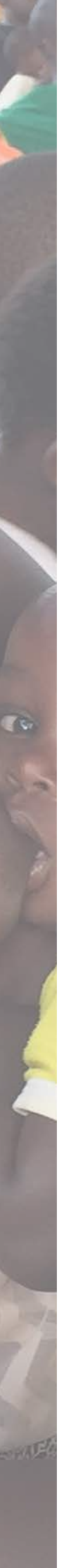
Image Credit: Adapted from UNICEF & URC/CHS

Everybody, young and old, should enjoy eating a variety of foods from six food groups every day to stay healthy and strong. However, three months before and during pregnancy, and after the baby is born, are the times when good nutrition is most important in pregnant and lactating women's lives, as they have special nutrition needs. Eating a variety of foods therefore becomes more important during pregnancy and breastfeeding, as it benefits both the mother and the baby.

The amount of specific nutrients needs vary based on the stage of the pregnancy, the mother's nutritional status, and whether the mother is carrying one or more babies, amongst many other factors. The nutrient requirements also change during breastfeeding, (Table 29 in Annex 1 demonstrates the different nutrient requirements). There is no single food source with all the nutrients necessary to meet the body's needs. It is important therefore to include a variety of foods from all the six food groups to ensure that both the mother and the future baby get the right types of food and amounts of nutrients they need.

20.1 NUTRITIONAL NEEDS FOR PREGNANT WOMEN

Pregnant women are nutritionally vulnerable because of the physiological demands that come with pregnancy (FAO, 2021b). During pregnancy, a woman needs to meet both her and her baby's nutritional needs. Healthy, well-nourished women should gain an average of 12 kg (10 to 14 kg) in weight during pregnancy to increase the probability of delivering a full-term infant with an average birth weight of 3.3 kg, and to reduce the risk of foetal and maternal complications (FAO, 2004b).



Inadequate nutrition during pregnancy risks the mother becoming malnourished. When the mother's nutritional needs are not met, the baby's nutritional needs are prioritised by the body by taking from the mother's nutritional stores, hence causing a reduction in her own stores.

Pregnant women should increase their food intake from the six food groups to cater for the increased energy and nutritional demands. It is important that women eat well before, during and after pregnancy so that they build and rebuild their bodies' nutrient stores (FAO, 2004). Pregnant women are at risk of micronutrient deficiencies especially iron, iodine, calcium, folic acid, and vitamins A.

20.1.1 Importance of Iron during pregnancy

Demands for iron are quite high during pregnancy and iron deficiency anaemia is common among pregnant women globally. Iron deficiency anaemia in women of reproductive ages is highest among pregnant women, affecting almost half (41 percent) of pregnant women in Zambia, compared to those breastfeeding (28 percent) and women who are neither pregnant nor breastfeeding (31 percent) (ZamStats, MOH and IDF, 2019). According to the Zambia Food Consumption and Micronutrient Status Survey Report, Luapula and Northern provinces had more than 86 percent inadequate intake of iron-rich foods (Alaofè *et al*., 2014).

Anaemia increases the risk of maternal blood loss, low birth weight, pre-term delivery and infections during childbirth (WHO, 2003; WHO, 2012a). In addition, anaemia may cause the death of the mother and baby (Fanzo, 2013; WHO, 2012a).

Rich dietary sources of iron include liver, meat, fish, poultry, green leafy vegetables and pulses. However, during pregnancy, diet alone cannot meet iron requirements. Pregnant women need to maintain iron stores of 500 mg during the second and third trimesters, and it is not common for them to achieve this from diet alone (FAO and WHO, 2004). WHO therefore recommends that pregnant women take iron supplements daily as prescribed at their ante-natal clinic or by a doctor. The recommended daily supplementation of iron is equivalent to 60 mg of elemental iron, which is 300 mg ferrous sulphate heptahydrate, 180 mg ferrous fumarate or 500 mg of ferrous gluconate (WHO, 2012a).

20.1.2 Importance of folic acid (folate or vitamin B9) during pregnancy

Folic acid is critical during periods of rapid growth, such as during pregnancy and foetal development, particularly during the first trimester. Women need additional folic acid before and during pregnancy. This is important for preventing neural tube defects where the baby's spinal cord and brain fail to develop properly (WHO and FAO, 2004). Folate also helps to form DNA and RNA and is involved in protein metabolism. Folic acid deficiency during pregnancy increases the risk of maternal anaemia, pre-term delivery and low birth weight (WHO, 2012a).

20.1.3 Importance of vitamin A during pregnancy

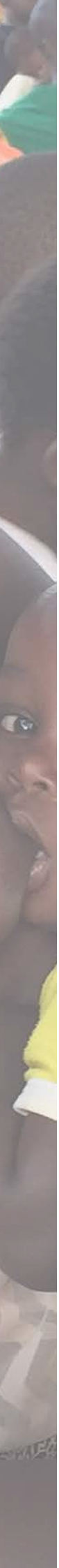
Pregnant women need additional vitamin A, which plays a role in supporting maternal and foetal tissue growth and development (FAO and WHO, 2004) and strengthens the immune function (Fanzo, 2013). Vitamin A is also needed to provide a limited reserve in the foetal liver. In addition, vitamin A is also important for preventing night blindness (FAO and WHO, 2004; WHO,2016).

Pregnant women are more susceptible to vitamin A deficiency during the third trimester (WHO, 2019a; Radhika *et al*., 2002). Deficiency in pregnant women can lead to night blindness (West, 2003; FAO and WHO, 2004; WHO, 2016) and maternal mortality (Christian *et al*., 2000). There is high risk of infant mortality in the first year of life due to a vitamin A deficiency during pregnancy (Christian *et al*., 2001). In addition, Vitamin A deficiency during pregnancy can lead to pre-term delivery and maternal anaemia (Radhika *et al*., 2002).

According to the last survey on vitamin A in 2003, about 13.4 percent of women between 15 to 49 years old have a vitamin A deficiency defined as a serum retinol level < 0.70 mol/L (WHO, 2007). Good sources of vitamin A include organ meats such as liver, kidneys and tripe; orange-coloured fruits and vegetables such as carrots, pumpkins, squash and orange fleshed sweet potatoes; as well as dark green leafy vegetables such as amaranthus, moringa leaves, spinach and cowpea leaves.

20.1.4 Importance of calcium during pregnancy

Women are especially at risk of calcium deficiency in the third trimester (FAO and WHO, 2013). Calcium deficiency in a pregnant woman can



result in complications such as pre-eclampsia (Villar *et al*., 2004; WHO, 2013). Deficiency in calcium can also lead to complications for the unborn baby which include poor mineralisation, retarded foetal growth and low birth weight (Hofmeyer *et al*., 2010).

Calcium needs during pregnancy can be met with foods alone. Such foods include dairy products like milk and yoghurt; dark green leafy vegetables such as moringa leaves, cassava leaves, amaranthus and spinach; small fish eaten with bones such as kapenta, and baobab pulp.

20.1.5 Importance of vitamin D during pregnancy

Pregnant women are prone to vitamin D deficiency which may result in pre-eclampsia, pregnancy induced diabetes mellitus, premature delivery and low birthweight (FAO and WHO, 2004).
Vitamin D is essential for bone metabolism by maintaining the calcium and phosphate balance.

20.1.6 Importance of extra energy during pregnancy

Energy needs increase in pregnancy particularly during the second and third trimesters. Pregnant women require extra energy to support the woman's own changing metabolism and the rapid growth of the foetus, placenta and maternal tissues (Institute of Medicine, 1990). In addition, pregnant women need extra energy to maintain adequate maternal weight, body composition and physical activity during pregnancy (FAO,WHO and UNU, 2001).

During pregnancy, there is great variability in the energy requirements between individuals in accordance to their body size, age, and how active they are. However, on average, pregnant women take an additional 360 Kcal on a daily basis in the second semester and 475 Kcal in the third (FAO, 2004b).

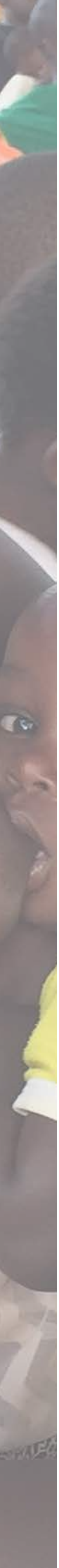
Pregnant women should therefore consume carbohydrate-rich foods like whole grains, roots and tubers, pulses, and nuts and seeds. Not only are these foods rich in carbohydrates, they are also rich in other important nutrients such as vitamins, minerals, fibre and some proteins.

20.2 SPECIAL NUTRIENT NEEDS FOR A PREGNANT ADOLESCENT

Adolescent girls who are pregnant need good nutrition to support their own growth as well as their foetus' (WHO, 2006; WHO, FAO and UNU, 2007). Apart from the additional nutrients required during pregnancy, adolescents need extra nutrients and energy to support their own growth (FAO, WHO and UNU, 2004). To get extra energy and nutrients, they should eat larger and more frequent meals and snacks that are nutrient dense and diverse (FAO, 2004).

Malnutrition among adolescents who are pregnant results in poor pregnancy outcomes (WHO, 2006). Adolescents who become pregnant are at risk of pre-term delivery, giving birth to infants with a low birth weight or small in size for the gestational age, and requiring special obstetrical assistance compared to older women (Gortzak-Uzan *et al*., 2001; FAO, WHO and UNU, 2004; UNICEF, 2021c).

Adolescent mothers are likely to be undernourished and to have undernourished babies because their bodies are still developing, so their nutrient needs during pregnancy are especially high. They are more likely to die during pregnancy and childbirth than older women (FAO, 2004). Adolescents need additional energy, protein, iron, calcium, folic acid, zinc, iodine and vitamins to support their own growth and their baby's.



20.3 RECOMMENDATIONS & GUIDANCE

FOR PREGNANT WOMEN

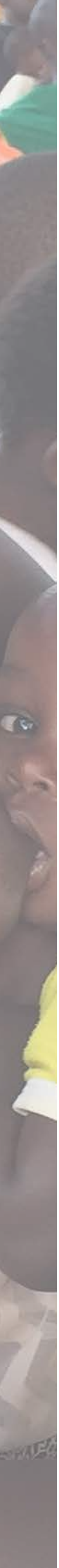
1. Eat a variety of foods from all the six food groups as stated in the dietary guidelines for all the general population with more emphasis on eating additional amounts of fish, insects or animal source foods; additional amounts of pulses like beans, nuts and seeds, fruits and vegetables; and additional amounts of whole grains. This will ensure meeting the key nutrients needed during pregnancy.
2. Eat one additional serving of fish and animal source foods or two servings of pulses, nuts and seeds in order to get the additional 14 g of protein needed during pregnancy. It is important to eat more animal source foods such as liver, meat, chicken, fish, and eggs as they contain more bioavailable iron and zinc. It is easy to obtain the additional nutrients required during pregnancy from animal source foods.
3. Eat dark green vegetables and orange-coloured fruits and vegetables such as pumpkin, amaranthus, sweet potato leaves, pawpaw, mango, orange-flesh sweet potatoes, yellow pumpkins and pumpkin flowers, and carrots for vitamin A and other key micronutrients.
4. Take daily oral iron and folic acid supplementation with 30 mg to 60 mg of elemental iron and 400 g (0.4 mg) of folic acid provided from the clinic or as prescribed by the doctor to prevent maternal anaemia, puerperal sepsis, low birth weight, and pre-term birth (WHO 2016). Where possible, women should take folic acid supplements before conception.
5. Keep physically active during pregnancy to stay healthy and to prevent excessive weight gain during pregnancy (WHO, 2016).

Table 23: Pregnant women

Food group	Recommended amounts		Energy and nutrient values per serving*								
	Total number of servings	Food weight	Energy**	Protein	Fat	Carbohydrates	Ca	Fe	Zn	Vit A	Folate
		(g)	(Kcal)	(g)	(g)	(g)	(g)	(g)	(mcg)	(mcg RAE)	(mcg)
Total nutrients provided	**-**	**1929.75**	**2454.4**	**88.2**	**56.4**	**379.9**	**1060.4**	**24**	**10.9**	**3895.6**	**646.1**
Cereals and tubers	5	745.25	1040.8	23	3.3	223.6	86.7	3.3	2.4	422.9	75.5
Dairy products	1	248	160	8.4	9.2	10.9	297.6	0.1	1	81.8	24.8
Fats and oil	1	14	126	0	14	0	0	0	0	0	0
Fruits	3	436.35	283.2	3.1	4	53.9	77.5	2.6	0.6	424.8	111.5
Meat, fish and eggs	1	85.8	146.9	20.9	6.4	1.4	31.4	5.2	2.7	2243	155.1
Pulses, nuts and seeds	2	189.6	402.1	20.7	18.2	33.8	53.2	4.9	3	4.6	155.1
Vegetables	3	210.75	125.9	11.9	1.3	14.2	509.4	7.6	1.1	718.6	123

*Provided by the diet model food combinations
**Protein accounts for 14%, fat accounts for 21% and carbohydrates account for 62% of the total energy amount

Refer to Table 19 for serving sizes and serving size equivalents for each food group.



20.4 NUTRITION FOR LACTATING WOMEN

Lactating women are nutritionally vulnerable because of the physiological demands of breastfeeding (FAO, 2021b). Breastfeeding mothers require additional calories for producing breastmilk to feed their infants.

While some of the energy will come from the fat that was stored during pregnancy, well-nourished women need an extra 505 Kcal per day from the diet (FAO, WHO and UNU, 2004; CDC, 20201b).

Undernourished women, including those who do not gain adequate weight during pregnancy, should add 675 Kcal per day during the first six months post-delivery (FAO, WHO and UNU, 2004).

Lactating adolescents also need additional energy and nutrients to replace their nutrient stores as well as to meet the demands of milk production.

After six months, energy needs for continued breastfeeding depend on the levels of milk production, baby's milk intake, mothers body size, proportion of fat stored during pregnancy and physical activity level (FAO, WHO and UNU, 2004).

Although the quality of a mother's diet does not affect the quality of breastmilk she produces unless a woman is severely malnourished (Prentice *et al*., 1989; Hartmann *et al*., 1985; Greiner, 1994), breastfeeding mothers should eat a healthy diet which has a variety of foods from the six food groups. A diversified diet is important as the mother will have to replace the amounts of these nutrients lost through breastfeeding. If the nutrient intake is lower than the total demand for both maternal maintenance needs and milk production, the mother's body will mobilise available nutrients from body tissues in order to maintain consistent breastmilk quality and quantity.

Besides energy, breastfeeding mothers also need an extra 20 g of protein and micronutrients. Lactating women need additional vitamin A to replace the lactation losses and to prevent night blindness. (FAO and WHO, 2004). Other nutrients of importance to lactating women are vitamins like B3, B6, B12 and C, folate, and minerals like selenium, calcium and zinc as per Table 29 (FAO, 2004; FAO, WHO and UNU1981).

Breastfeeding mothers should take folic acid and iron supplements three months post-delivery to replenish the stores (WHO, 20134b).

20.5 DIETARY PRACTICES AND NUTRITION STATUS FOR PREGNANT AND LACTATING WOMEN IN ZAMBIA

According to the Food Consumption and Micronutrient Status Survey conducted in two provinces (Alaofè *et al*., 2014), all lactating women had low intake of vitamin A, iron and Zinc in all the surveyed provinces. The proportions varied between provinces; about 50 percent had low intake of iron in Luapula and 32 percent in Northern, while 64 percent had low zinc intake in Luapula and 45 percent in Northern (Alaofè *et al*., 2014). However, the 2018 Demographic and Health Survey found that the prevalence of anaemia was lower among breastfeeding women (28 percent) than among pregnant women (41 percent) and women who are neither pregnant nor breastfeeding (31 percent).

20.6 RECOMMENDATIONS & GUIDANCE FOR LACTATING WOMEN

1. Follow the dietary recommendations by eating a variety of foods from all the six food groups as stated in the guidelines for the general population under Section Two.
2. Eat an extra meal to get the additional energy (505 Kcal) and requirements as well as the additional 20 g protein. Simply eating more than the usual amount and variety of foods from all the six groups will allow the mothers to meet the additional energy, protein, vitamin and mineral requirements and support the women's health and wellbeing during lactation.
3. Lactating women should take iron and folic acid supplementation for at least three months after delivery (WHO, 2014b).

20.7 TIPS FOR LACTATING WOMEN

Helpful Tips ensure successful breastfeeding

1. Avoid caffeine intake.
2. Avoid alcohol and smoking. They can affect the baby in many ways such as make the baby feel sleepy, nervous and irritable.
3. Avoid harmful drugs.
4. Do not take medication without consulting a doctor.

Table 24: Breastfeeding women

Food group	Recommended amounts		Energy and nutrient values per serving*								
	Total number of servings	Food weight	Energy**	Protein	Fat	Carbohydrates	Ca	Fe	Zn	Vit A	Folate
		(g)	(Kcal)	(g)	(g)	(g)	(g)	(g)	(mcg)	(mcg RAE)	(mcg)
Total nutrients provided	**-**	**2092.8**	**2619.1**	**92.6**	**71.1**	**382.5**	**1073.1**	**24.4**	**11.2**	**3980.2**	**660.1**
Cereals and tubers	6	894.3	1249	27.5	4	268.3	104	4	2.9	507.5	90.6
Dairy products	1	248	160	8.4	9.2	10.9	297.6	0.1	1	81.8	24.8
Fats and oil	2	28	252	0	28	0	0	0	0	0	0
Fruits	3	436.35	283.2	3.1	4	53.9	77.5	2.6	0.6	424.8	111.5
Meat, fish and eggs	1	85.8	146.9	20.9	6.4	1.4	31.4	5.2	2.7	2243	155.1
Pulses, nuts and seeds	2	189.6	402.1	20.7	18.2	33.8	53.2	4.9	3	4.6	155.1
Vegetables	3	210.75	125.9	11.9	1.3	14.2	509.4	7.6	1.1	718.6	123

*Provided by the diet model food combinations
**Percent energy contribution: 58% carbohydrate; 24% for protein, and 14% for fat
Refer to Table 19 for serving sizes and serving size equivalents for each food group

SECTION 4

Annexes and References

21. ANNEXES

21.1 ANNEX 1: DIET MODEL OUTPUTS

21.1.1 The standardised amounts defining a serving in Kilocalories and approximate food weights per food group for the diet models used or the FBDG technical Recomenation

Table 25: Standardised amounts defining a serving in Kilocalories and approximate food weights per food group

Food Group	Energy target per food group serving	One serving size
	(Kcal)	(g)
IN TOTAL		
Cereals and tubers	200	149.05
Dairy products	160	245
Fats and oil	125	14
Fruits	80	145.45
Meat, fish and eggs	135	98.9
Pulses, nuts and seeds	135	90.5
Vegetables	30	74
Miscellaneous and beverages	170	52

21.1.2 Lowest cost diet model for the general population at ZMW 12/person/day

The cheaper model, setting energy as 2 100 kcal and changing the weightings of some of the foods used for the FBDG model to favour the cheaper foods, based on prices provided by WFP:

21.1.3 How the K12 Kwacha model meets energy and nutrient requirements

Table 26: How the K12 Kwacha model meets energy and nutrient requirements

Food group	Recommended amounts		Energy and nutrient values per serving												
	Total number of servings	Food weight	Energy	Protein	Fat	Carbohydrates	Ca	Fe	Zn	Cu	Vit A	Retinol	Folate	Fibre	Cost
		(g)	(Kcal)	(g)	(g)	(g)	(g)	(g)	(mcg)	(mcg)	(mcg RAE)	(mcg)	(mcg)	(g)	(Kwacha)
Total nutrients provided	**14**	**1631**	**1977.1**	**73.8**	**50.5**	**290.5**	**926.7**	**20.1**	**8.9**	**1.7**	**1895.9**	**446.9**	**485.2**	**32.6**	**12**
Cereals and tubers	4	711	993.3	21.9	3.1	213.4	82.7	3.2	2.3	0.5	403.6	0	72.1	11.9	2.2
Dairy products	2.5	219	89.5	4.7	5.1	6.1	166.5	0.1	0.5	0	45.8	43	13.9	0	2.5
Fats and oil	1.5	20	175.5	0	19.5	0	0	0	0	0	0	0	0	0	0.7
Fruits	1	136	80	0.8	1.7	12.4	17.9	0.6	0.2	0.1	96	0	26.7	2.3	0.9
Meat, fish and eggs	0.5	44	66.5	9	3.2	0.2	19.9	1.8	1.1	0.1	426.4	403.9	39.7	0.2	1.5
Pulses, nuts and seeds	2.5	219	414.9	22.3	16.1	39.5	58.9	5.5	3.4	0.7	5.7	0	175.5	11.2	2.9
Vegetables	4	283	164.8	15	1.7	18.9	580.8	9	1.5	0.4	918.5	0	157.4	6.9	1.4

21.1.4 The foods and food weights used in the diet models

Table 27: Foods and food weights used in the diet models

Food group	Food	K12 model weighting
Cereals and tubers	Maize, white, stiff porridge (without salt)	**55.00**
	Rice, brown, boiled (without salt)	**15.00**
	Cassava, tuber, boiled (without salt)	**10.00**
	Bread/rolls, white	**5.00**
	Sweet potato, deep yellow, boiled (without salt)	**15.00**
Dairy products	Milk, cow, whole, 3.5% fat*	**100.00**
Fats and oil	Vegetable oil	**100.00**
Fruits	Papaya, fruit, ripe, raw	**20.00**
	Banana, white flesh, raw	**15.00**
	Mango, orange flesh, raw	**45.00**
	Avocado, pulp, raw	**10.00**
	Orange, raw	**10.00**
Meat, fish and eggs	Beef, meat, 15-20% fat, boiled (without salt)	**10.00**
	Tilapia, steamed*(without salt)	**10.00**
	Chicken, light meat, flesh, boiled (without salt)	**10.00**
	Egg, chicken, boiled (without salt)	**30.00**
	Mopane worm, canned	**20.00**
	Chicken liver, braised (without salt)	**10.00**
	Beef liver boiled (without salt)	**0.00**
	Anchovy, fillet, grilled (without salt and fat)	**10.00**
Pulses, beans, nuts and seeds	Cowpea, brown, boiled (without salt)	**42.00**
	Beans, white, boiled (without salt)	**43.00**
	Groundnut, shelled, dried, raw	**15.00**
Vegetables	Pumpkin leaves, boiled (without salt)	**20.00**
	Cassava, leaves, boiled (without salt)	**20.00**
	Tomato, red, ripe, boiled (without salt)	**15.00**
	Amaranth leaves, boiled (without salt)	**10.00**
	Spinach, boiled* (without salt)	**10.00**
	Drumstick leaves, boiled (without salt)	**20.00**
	Sweet potato leaves, boiled (without salt)	**5.00**
*Includes pasteurised, sterilised and ultra-high temperature (UHT) processed milk		
Note: Similar foods were used for all models with few modifications of children 6-12 months. The food weighting for the lowest cost diet above differs from the weighting for other models since the other models used common food combinations and portions, unlike the lowest cost model which put more weighting on the lowest cost foods.		

Table 28: Nutrient requirements per day for 7-12 month, and children aged 1-3; 4-6; and 10-18 years

Recommended intake per day per age group*						
Nutrients		**6-12 months**	**1-3 years**	**4-6 years**	**10-18 years (girls)**	**10-18 years (boys)**
Energy (Kcal/day)		703	1036 (boys) 956 (girls)	1333 (boys) 1223 (girls)	2344.5 (34.7-56.7 kg)	2838.6 (33.3-67.8 kg)
Protein (g/day)		10.9 (boys)	12.1 (boys)	17.1 (boys)	41 (11-14 yrs)	40.5 (11-14yrs, 45 kg)
		10.1 (girls)	11.5 (girls)	16.2 (girls)	47.4 (15-18 yrs)	57.9 (15-18 yrs, 66.5 kg)
Vitamin A** (ug RE/day)		400	400	450	600	600
Iron (mg/day)	15% bio-availability	6.2***	3.9	4.2	9.3 (11-14 yrs)**	9.7 (11-14 yrs)
					21.8 (11-14 yrs)	
					20.7 (15-17 yrs)	12.5 (15-17 yrs)
	12% bio-availability	7.7***	4.8	5.3	11.7 (11-14 yrs)**	12.2 (11-14yrs)
					27.7 (11-14 yrs)	
					25.8 (15-17 yrs)	15.7 (15-17 yrs)
	10% bioavailability	9.3***	5.8	6.3	14 (11-14 yrs)**	14.6 (11-14 yrs)
					32.7 (11-14 yrs)	
					31 (15-17 yrs)	18.8 (15-17 yrs)
	5% bioavailability	18.6***	11.6	12.6	28 (11-14 yrs)**	29.2 (11-14 yrs)
					65.4 (11-14 yrs)	
					62 (15-17 yrs)	37.6 (15-17 yrs)
Folate (µg/day)		80	150	200	400	400
Zinc (mg/day)	High bioavailability	0.8†	2.4	2.9	4.3	5.1
		2.5††				
	Moderate bioavailability	4.1	4.1	4.8	7.2	8.6
	Low bioavailability	8.4	8.3	9.6	14.4	17.1

Recommended intake per day per age group*					
Nutrients	**6-12 months**	**1-3 years**	**4-6 years**	**10-18 years (girls)**	**10-18 years (boys)**
Calcium (mg/day)	400	500	600	1300^	1300^
Vitamin C (mg/day)	30	30	30	40	40
Selenium (µg/day)	10	17	22	26	32
Magnesium (mg/day)	54	60	76	220	230
Iodine (µg/day)	90^^	90^^	90^^	150 (13-18 yrs)	150 (13-18 yrs)
Thiamine (mg/day)	0.3	0.5	0.6	1.1	1.2
Riboflavin (mg/day)	0.4	0.5	0.6	1.0	1.3
Niacin (mg NE/day)	4	6	8	16	16
Vitamin B6 (mg/day)	0.3	0.5	0.6	1.2	1.3

*Age divisions are based on those used in FAO and WHO (2004) unless otherwise stated. Energy requirements from FAO/WHO/UNU (2004) were specifically re-calculated to suit the WHO and FAO (2004) age group divisions.
**Vitamin A levels are based on safe intake levels not on recommended nutrient intake (RNI). Conversion factors for carotenoids are under review, with the pending conclusion that servings of green leafy vegetables needed to meet vitamin A requirements probably need to be at least doubled. In view of this uncertainty, only "recommended safe intakes" rather than RNIs are provided for this vitamin.
***Bioavailability of dietary iron during this period varies greatly
†Breastfed
††Not applicable to infants exclusively breastfed
^ Particularly during the growth spurt
^^Recommendation for the age group 0–4.9 years

Note:
Energy and all other nutrients listed above can be met by simply eating a variety of foods.
The FAO and WHO breakdown of age for vitamin and mineral requirements is from 7- 12 months; 1-3 years; 4-6 years, 10-18yr girls.

Sources: FAO and WHO (2004); FAO, WHO and UNU (2004); FAO, WHO and UNU (2007).

Table 29: Nutrient requirements per day for non-pregnant, pregnant and lactating women and women aged 19 to 50 years)

Nutrients		19-50 years non-pregnant women	Pregnant women			Lactating women		
			1st trimester	2nd trimester	3rd trimester	0-3 months	4-6 months	7-12 months
Energy (Kcal/day)		2100	-	2460	2575	2605	2605	2560
Average energy [rounded] (Kcal/day)		2100	2460			2600		
Protein* (g/day)		41.3	42.3	50.3	72.3	60.3		54.3
Vitamin A** (ug RE/day)		500	800			850		
Iron (mg/day)	15% bio-availability	20	n , s, d			10		
	12% bio-availability	25	n , s, d			12		
	10% bioavailability	29	n , s, d			15		
	5% bioavailability	59	n , s, d			30		
Folate (µg/day)		400	600 + s^			500		
Zinc (mg/day)	High bioavailability	3	3.4	4.2	6	5.8	5.3	4.3
	Moderate bioavailability	4.9	5.5	7	10	9.5	8.8	7.2
	Low availability	9.8	11	14	20	19	17.5	14.4
Calcium† (mg/day)		1000	1000	1000	1200	1000	1000	1000
Vitamin C (mg/day)		45	55			70		

Nutrients	19-50 years non-pregnant women	Pregnant women			Lactating women		
		1st trimester	2nd trimester	3rd trimester	0-3 months	4-6 months	7-12 months
Seleniumtt (µg/day)	26	26	28	30	35	35	42
Magnesium (mg/day)	220	220	220	220	270	270	270
Iodine (µg/day)	150	200	200	200	200	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		
Vitamin B6 (mg/day)	1.3	1.9			2.0		

*Protein calculated based on pre-pregnancy weight of 55 kg; protein requirement based on 0.75 g/kg; increase in requirements based on FAO/WHO/UNU (2007); calculations correspond with FAO/WHO/UNU (1981) recommendations
**Vitamin A levels are based on safe intake levels not on recommended nutrient intake (RNI). Conversion factors for carotenoids are under review, on servings of green leafy vegetables needed to meet vitamin A requirements.
^Pregnant women take daily oral folic acid supplementation and where possible, before conception
†No calcium levels for 1st and 2nd trimester given, hence pre-pregnancy levels are assumed
††No selenium levels for 1st trimester given, hence pre-pregnancy levels are assumed

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.
d: Dietary sources
s: The increased iron requirement cannot be obtained from the diet and thus daily supplemental iron and folic acid is recommended during pregnancy and for at least three months after delivery (WHO, 2013).

Note:
Energy and all other nutrients listed above can be met by simply eating a variety of foods.

Sources: FAO and WHO (2004); FAO, WHO and UNU (2004); FAO, WHO and UNU (2007).

21.2 ANNEX 2: LIST OF TWG AND ATTENDANCE DURING THE FBDG DEVELOPMENT PROCESS

	Name	Institution	*11 - 17 Feb 2018* Launch and first training of FBDGs	*22 - 25 May 2018* Training	*29 Oct - 2 Nov 2018* Validation workshop/ situation analysis	*22 - 26 July 2019* Message creation	*3 - 8 Novem-ber 2019* Pre-test	*2020* Pre-test	*May 2021* TWG validation	Editori-als	*4 - 5 August 2021* Valida-tion list
1	Nancy Chella*	MoA	X	X	X	X	X	X			
2	Rose Silyato*	MoA	X	X		X	X				X
3	Sibeso Mulele*	MoA						X		X	X
4	Rita Syafunko*	MoA							X	X	X
5	Moses Mwale	MoA									X
6	Penelope Malilwe	MoA									X
7	Yotam Nyirenda	MoA									X
8	Clara Hamayuwa	MoA				X					
9	Mabula Chriginoe	MoA				X					
10	Conrad Busiku	MoA				X					
11	Mwitwa Mambwe	ACF									X
12	Dorothy Namuchimba	CARE	X								
13	Wila Zambezi*	CDH		X	X		X	X	X		X
14	Mathews Mhuru	CSO-SUN			X						
15	Jessica Mayenda	CSO-SUN			X		X	X			
16	Nsungwe Mulende*	CSO-SUN							X	X	
17	Malumo Nawa	DoA									X
18	Zyangam Chirambo*	DoF/MFL		X	X						
19	Pamela Munjoma	FAO (in SFS)									X
20	Celestina Lwatula*	FAO (in Zambia)	X	X	X	X	X	X	X		X
21	Dr. Mercy Chikoko*	FAO (in SFS)	X	X	X	X	X	X	X	X	X
22	Veronica Mwaba	FAO (in Zambia)									X
23	Mukaba Mukaba	FAO (in Zambia)									X
24	Patrick Chilumba	FAO (in Zambia)									X
25	Elizabeth Mcunu	FAO (in SFS) / Admin									X

	Name	Institution	*11 - 17 Feb 2018* Launch and first training of FBDGs	*22 - 25 May 2018* Training	*29 Oct - 2 Nov 2018* Validation workshop/ situation analysis	*22 - 26 July 2019* Message creation	*3 - 8 November 2019* Pre-test	*2020* Pre-test	*May 2021* TWG valida-tion	Edito-rials	*4 - 5 August 2021* Valida-tion list
26	William Chilufya*	HIVOS	X	X	X	X	X	X			
27	Mary Lubungu	IAPRI									X
28	Dr. Rhoda Mofya Muku-ka*	IAPRI/FAO (in Zambia)	X							X	X
29	Beauty Mweene	K/Mission				X					
30	Selina Phiri	Kafue				X					
31	Charity Mwawo	Kasaka camp				X					
32	Dr. Luke Mugode*	LAMU			X	X	X	X	X	X	X
33	Precious Nzala*	MCDSS		X		X					
34	Luwindi Kabondo*	MCDSS	X		X						
35	Weka Banda*	MCDSS					X	X			X
36	Wilbroad Zimba*	MCDSS							X	X	X
37	Dr. Venantious Mulenga Musonda*	MFL	X				X	X	X		X
38	Ephraim Luhanga	MFL									X
39	Christine Inambao	MFL									X
40	Ellison Musimuko	MFL									X
41	Bwalya Tembo	MFL									X
42	Chileshe Kaoma	MFL									X
43	Adrene Banda	MFL									X
44	Tresphore Chanda*	MOGE	X		X		X	X			
45	Maybin Luulu	MOGE									X
46	Chilekwa Mibenge	MoH		X							
47	Martin Mzumara	MoH		X							
48	Purity Simasiku	MoH					X	X			
49	Chola S. Chileshe	MoH			X						
50	Doreen Sakala	MoH			X						
51	Yaled Sichvula*	MoH			X		X				

	Name	Institution	*11 - 17 Feb 2018* Launch and first training of FBDGs	*22 - 25 May 2018* Training	*29 Oct - 2 Nov 2018* Validation workshop/ situation analysis	*22 - 26 July 2019* Message creation	*3 - 8 November 2019* Pre-test	*2020* Pre-test	*May 2021* TWG valida-tion	Editori-als	*4 - 5 August 2021* Valida-tion list
52	Davies Chutu*	MoH			X		X			X	X
53	Rachel Malambo	MoH				X					
54	Mary Ngulube	MoH				X					
55	Wilson Kapenda*	MoH			X	X					X
56	Casper Miti	MoH									X
57	Agnes Aongola*	MoH	X	X			X			X	X
58	Dorothy Sikazwe	MoH									X
59	Natasha Mhango*	NAIS/MoA	X	X	X						
60	Chris Kakunta (late)*	NAIS/MoA	X	X	X						
61	Lilian Mumba	NAIS/MoA					X	X	X		
62	Lemana Washington	NAIS/MoA					X	X	X		X
63	Rose Musumali Lungu*	NAZ		X	X	X					
64	Rose Shangala Silyato	NAZ									X
65	Gloria Chola*	NAZ/LIUTEBM	X	X	X		X	X			
66	Belinda T. Tembo*	NFNC	X		X						X
67	Chisela Kauwile*	NFNC			X						X
68	Albertina Mweemba*	NFNC				X	X	X	X		X
69	Freddie Mubanga	NFNC									
70	Patricia Sakala*	NFNC/SUNLE	X	X	X						X
71	Dr. Hilda Nyambe Si-lovwe*	NISIR	X	X	X		X	X	X		X
72	Brenda Sinonge*	NRDC	X	X	X			X	X		X
73	James Shabiti Mukomb-we*	PAM	X	X	X						
74	Betty Thewo	PAM	X								
75	Maureen Chitundu*	PAM	X							X	X
76	Catherine Mkanjama*	PEP II/MoA/ MFL	X		X		X				
77	Richard Chanda	SCCI									X

	Name	Institution	*11 - 17 Feb 2018* Launch and first training of FBDGs	*22 - 25 May 2018* Training	*29 Oct - 2 Nov 2018* Validation workshop/ situation analysis	*22 - 26 July 2019* Message creation	*3 - 8 November 2019* Pre-test	*2020* Pre-test	*May 2021* TWG validation	Editorials	*4 - 5 August 2021* Validation list
78	Kelly Mwaba	SUNTA/USAID									X
79	Vanessa Zimba	Sylva Food Solutions									X
80	Ruth Siyandi	UNICEF	X							X	X
81	Josephine Ippe	UNICEF								X	X
82	Beatrice Nyambe	UNICEF									X
83	Dr. Chiza Kumwenda *	UNZA	X	X	X	X	X	X			X
84	Lukonde M. Zgambo*	UNZA			X		X		X	X	X
85	Murambiwa Nyala*	UNZA			X						
86	Kabunga Nchiyunme	UNZA			X						
87	Dorothy Nyami Nthani (late)*	UNZA			X	X	X		X		
88	Emily Heneghan Kasoma	WFP	X								
89	Emma Gondelach	WFP	X								
90	Marjolein Mwanamuenge	WFP	X								
91	Phililo Nambeye	WFP									X
92	Chipo Mwelwa	WHO	X								
93	Chiboola Milimo	ZARI								X	X
94	Mwila Chongwe										X
*FBDG TWG members											

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