



MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES

FOOD AND NUTRITION HANDBOOK FOR EXTENSION WORKERS

Enhancing Nutrition Service Delivery in Uganda



2ND EDITION, OCTOBER 2020

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FOREWORD

The backbone of Uganda's economy is hinged to agriculture, with more than two-thirds of households relying on agriculture for their livelihood and survival. The Sector is also an entry-point for various programmes targeting socio-economic transformation including ensuring food and nutrition security and overall sustainable development.

This Food and Nutrition Handbook for the Extension Workers is well aligned to the overall objective of the National Agriculture Policy whose aim is to achieve food and nutrition security and improve household incomes. The first edition of 2015 was extensively distributed and used across the country. It was also a vital training tool for stakeholders in the Sector in addition to supporting implementation of the Uganda Multisectoral Food Security and Nutrition Project (UMFSNP), a largescale flagship UNAP I operationalization project implemented with support of the Global Agriculture and Food Security Programme (GAFSP) and the World Bank.

This Handbook is part of explicit commitments by the Ministry of Agriculture, Animal Industries and Fishers (MAAIF) towards food and nutrition security aspirations in the Uganda Vision 2040, the National Development Plans (NDPs), as well as the Continental commitments in Agenda 2063 of the African Union on Africa We Want and the Global Sustainable Development Goals (SDGs), specifically SDGs 2 on ending hunger, food insecurity, all forms of malnutrition and improvements in sustainable agriculture.

In this connection, the MAAIF supports households and communities to increase access to and consumption of safe, diversified foods from their production or purchase throughout the year. Also, the Ministry plays an important role in reducing post-harvest losses and addressing issues related to women's workload within households. All this is aimed at improving nutrition among households and communities and in line with the overall objective of the National Agriculture Policy, 2013.

Despite the milestones achieved in poverty reduction and wealth creation, malnutrition remains one of the main health and economic problems facing

our country and impacting negative consequences on productivity and the economy. A Cost of Hunger in Africa study by the African Union in 2013 indicated that up to 5% of the annual GDP in Uganda is lost due to malnutrition. Stunting, an indicator of chronic undernutrition is still moderately high at 29% in children under 5 years of age, while anaemia is a serious public health concern affecting 53% of children and 32% of women of reproductive age.

This updated Handbook is designed to help extension workers and other service providers in the delivery of agricultural extension and advisory services in communities to understand the link between agriculture, food, nutrition and health. General guidelines on the proper selection of foods to achieve an adequate and balanced diet, maternal and child care as well as issues about food safety and quality assurance have been emphasized among others. The information presented and knowledge that will be gained from this Handbook will help extension workers integrate nutrition in their day-to-day delivery of extension services.

I call upon all stakeholders in the Sector to use this Handbook to mainstream food and nutrition security in their work plans and routine activities. In all that we do, we should appreciate that while agriculture is very important in improving nutrition, malnutrition equally has negative implications on the development of agriculture. Let us all use the information provided to promote optimal nutritional practices at all levels of society for the sustainable transformation of Uganda.

For God and My Country.



Hon. Vincent Bamulangaki Ssempijja (MP)

Minister of Agriculture, Animal Industry and Fisheries

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Special appreciation goes to the Food Rights Alliance (FRA) fraternity and their partner Hivos, for the financial and technical support towards the 2nd Edition of the Food and Nutrition Handbook. We also thank the consultant, Dr. Rukundo Peter Milton and his team for facilitating the review and updating process.

The MAAIF is grateful to all other individuals and organizations who have not been mentioned but in one way or the other had a hand in the process of developing and updating this Food and Nutrition Handbook for Extension Workers.

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ACRONYMS

BMI	Body Mass Index
COVID-19	Corona Virus Disease 2019
CSA	Climate Smart Agriculture
DDS	Diet Diversity Score
DGLV	Dark Green Leafy Vegetables
ENA	Essential Nutrition Actions
EP	Edible Portion
FAO	Food and Agriculture Organization of the United Nations
FRA	Food Rights Alliance
GMP	Growth Monitoring and Promotion
IFA	Iron Folic Acid
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MOES	Ministry of Education and Sports
MOH	Ministry of Health
NARO	National Agricultural Research Organisation
NDP	National Development Plan
OFSP	Orange Fleshed Sweet Potato
OPM	Office of the Prime Minister
RDA	Recommended Dietary Allowance
SDGs	Sustainable Development Goals
UBOS	Uganda Bureau of Statistics
UDHS	Uganda Demographic and Health Survey
UFNP	Uganda Food and Nutrition Policy
UMFSNP	Uganda Multi-sectoral Food Security and Nutrition Project
UNAP	Uganda Nutrition Action Plan
UNICEF	United Nations Children’s Fund
WASH	Water, Sanitation and Hygiene
WFP	World Food Programme
WHO	World Health Organization

GLOSSARY OF KEY WORDS

Adequate diet	A diet that supplies all the nutrients needed for the normal functioning of the body.
Aflatoxin	Naturally occurring toxins generally called mycotoxins, produced by moulds in the food chain right from the garden and continue throughout the food value chain with potential to cause cancers, liver damage and stunted growth in humans.
Balanced diet	A diet with the right proportions of nutrients needed to jointly support normal body functions.
Body building (“GROW”) foods	Foods rich in protein are called bodybuilding foods or “Grow” foods that help to maintain life and promote growth, repair worn-out and damaged body tissues.
Complementary feeding	An infant and young child feeding practice that involves the gradual introduction of other foods in addition to breast milk at six (6) completed months of the infant's age and continue to at least 2 years old or even beyond because breast milk is an important source of nutrients and protective factors needed by the growing child.
COVID-19	Corona Virus Disease 2019, a viral respiratory disease caused by the latest discovered coronavirus (SARS-CoV-2) and declared a global pandemic by the World Health Organisation (WHO) in March 2020 following a rapid spread of an outbreak from Wuhan City in China to all parts of the world.
Diet	A collection of meals eaten over a day or more assessed by dietary diversity score OR comparing actual nutrient supply from the diet and the Recommended Dietary Allowance (RDA).

Dietary diversity	The number of food group varieties provided in the diet of the individual, household or population group; the more food group varieties, the more diverse the diet and the closer it is to adequate and balanced.
DGLV	Dark Green Leafy Vegetables, a main source of vitamins, minerals, dietary fibre and immune-boosting phytochemicals in the diet.
Economic access to food	The ability to source and afford the food supplied on the market using incomes or other means of trade.
ENA	Actions targeting different causes of malnutrition that a sector, community or a nation must undertake through appropriate interventions leading to rapid nutrition improvement at all levels.
Energy giving (“GO”) foods	Foods rich in carbohydrates and fats are called energy giving foods or “GO” foods and provide energy essential for physical activity and body functioning.
Food	Anything liquid, semi-solid or solid which contains nutrients and when taken or eaten nourishes the body.
Food and nutrition security	A concept that integrates food security and nutrition to facilitate holistic programming against malnutrition and its consequences; the situation when all people at all times have physical, social and economic access to food, which is consumed in sufficient quantity and quality to meet dietary needs and food preferences, supported by an environment of adequate sanitation, health services and care for a healthy and active life.
Food security	A situation which exists when all people at all times have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active, healthy and productive life throughout the year.

Food safety	The protection of consumers from injury or adverse health effects caused by consuming or handling spoilt, adulterated, contaminated or badly stored foods; it encompasses the production, handling, preparation and storage of food in a way that prevents foodborne illnesses.
Food self-sufficiency	Being able to meet food consumption needs at a national level, particularly for staple food crops, from own production rather than by buying or importing.
Hydrocephalus	A condition that occurs when fluid builds up in the skull and causes the brain to swell due to pressure. It means “water on the brain”.
Immunity boosting (“GLOW”) foods	Foods rich in minerals and vitamins are known as protective, locally known as “GLOW” foods and providing essential nutrients for promoting body immunity and regulate body functions.
Indigenous food	These are foods that are native or were introduced a long time ago, whether locally produced or accessed from the wild; and foods that may be purchased but are recognized as part of a country’s traditional food culture.
Macronutrient	Macronutrients are nutrients required by the body in large amounts and include carbohydrates, proteins and fat.
Micronutrient	Micronutrients are nutrients required by the body in small amounts and include vitamins and minerals.
Nutritious diets	Consumption of a diversity of foods that supply all the daily body nutritional requirements.
Nutrition	Process of providing or obtaining the food, nutrients and care necessary for sustaining health, growth and development; broadly encompasses all actions necessary for obtaining, handling, preparing, serving,

	eating and utilization of food and its nourishing of the body.
Nutrients	Chemical substances found in food and extracted from food as it passes through our digestive system for use by the body to perform its functions.
Quality	Quality is the degree to which a process, product, or service satisfies a specified set of attributes or requirements.
Spina bifida	A birth defect in which a developing baby's spinal cord and surrounding membranes fail to develop properly mainly due to deficiency of folic acid and B-vitamins.
Sustainable food system	A food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases for generating food security and nutrition for future generations are not compromised
WASH practices	Water, sanitation, and hygiene practices involve access to water and considerations of safe handling and disposal of waste including human excreta (for example faeces, urine), management of waste (including trash, wastewater, stormwater, sewage and hazardous wastes), control of disease vectors (such as mosquitoes and flies) and handwashing with soap.
Wasting	A gross reduction or loss of body weight, it can be moderate or severe (gross loss of muscle bulk, redundant skin and prominence of bones).
Waterborne diseases	Diseases caused by micro-organisms in untreated or contaminated water e.g. cholera and dysentery

Water vector-borne diseases	Diseases transmitted by vectors that inhabit the water. The most common include malaria, filariasis, yellow fever, and river blindness.
Water-washed diseases	Disease conditions especially of the skin and eyes caused by lack of clean water for washing e.g. skin and eye infections and schistosomiasis.
Zoonotic diseases	Diseases which are transmitted from animals to human beings and vice versa either through direct contact with animals or animal products or through consumption of raw or poorly prepared or poorly stored animal products.

CHAPTER ONE: INTRODUCTION

1.1 Background

Agriculture is the backbone of Uganda's economy. It supports livelihoods of over two-thirds of the population, half of its exports and one-quarter of GDP¹. The agriculture sector, therefore, shoulders the heaviest responsibility in ensuring food and nutrition security for all. It guarantees a stable food supply, a healthy food system, and skills transfer across generations.

Despite Uganda's natural endowment with a rich agrobiodiversity and relatively good climate that favours agriculture production in most parts of the country, malnutrition is still a problem. The country is still ranked among the countries that are highly burdened by hunger and undernutrition². The Uganda Demographic and Health Survey (UDHS) report of 2016 indicated that stunting and anaemia affect 29% and 53% respectively of the children under 5 years. Stunting is an indicator of chronic undernutrition while anaemia is largely attributed to poor diets that are low in sources of iron, which is abundantly supplied in meat and fish and most indigenous foods such as millet, sorghum, beans, peas and dark green leafy vegetables among others³.

Diet-related non-communicable diseases are also increasing. An estimated 5% of the population is obese, 24% have raised blood pressure, while diabetes is estimated at over 5% in urban areas⁴. This challenge is likely to increase given the global nutrition transition characterised by the undesirable shift in dietary habits and patterns from foods rich in dietary fibre, low in fat and sugars, towards more convenient processed foods rich in refined sugars, salts, fats and oils.

This Handbook equips extension workers with the information required to enhance nutrition service delivery. It points out the key concepts, recommended practices and actions to promote food and nutrition security at all levels.

¹MAAIF (2020). Ministerial Policy Statement for FY 2020/2021. Kampala: GOU.

²Development Initiatives (2019). *Global Nutrition Report*. Sussex: Development Initiatives

³World Health Organization (2017). *Nutritional anaemias: tools for effective prevention and control*. Geneva: World Health Organization.

⁴Ministry of Health (2014). *Non-Communicable Risk Baseline Survey Report*. Kampala. MOH.

1.2 Rationale for updating the Food and Nutrition Handbook

The 2015 Food and Nutrition Handbook for extension workers was an important and comprehensive material on food and nutrition in the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). However, given new developments, emerging lessons and knowledge relevant to the sector in food and nutrition security, it was desirable to update the Handbook to fit in the current food and nutrition policy environment and extension systems across Government.

Reduction of malnutrition indicators in Uganda, especially stunting, has been slow while in some cases, indicators such as anaemia have increased to levels that are of a serious public health concern in the vulnerable groups. This Handbook, therefore, is targeting extension workers with a view of strengthening the integration of food and nutrition security in extension services, to ultimately facilitate the sustained reduction of malnutrition.

1.3 Purpose of the Handbook

The purpose of this Handbook is to equip extension workers with essential food and nutrition information to enable them to effectively contribute to the prevention and control of malnutrition and its consequences in Uganda.

1.4 Objectives of the Handbook

The objectives of this Handbook are to:

- (i) Enhance the food and nutrition knowledge and skills of extension workers.
- (ii) Re-orient extension workers to mainstream key food and nutrition security actions in their routine extension services.
- (iii) Build the capacity of extension workers to effectively participate in food and nutrition security programming.

1.5 Target users of the Handbook

Agricultural extension workers are the primary target of this Handbook. Other targeted users include:

- (i) Extension workers in health, education, trade and nutrition.
- (ii) Social and community development workers.
- (iii) Development partners and civil society in food and nutrition security.
- (iv) Mass media, farmers and relevant private sector entities.
- (v) Educational and research institutions.

CHAPTER TWO: KEY CONCEPTS OF FOOD AND NUTRITION

This chapter provides simplified information on the food and its components, as well as the understanding of diet and nutrition. It brings forward key issues in food and nutrition that the extension workers should be aware of and use in their routine activities.

2.1 Understanding food and nutrients

a) What is food?

- ⇒ Food is anything liquid, semi-solid or solid which, when eaten or taken will nourish the body.
- ⇒ The nourishment from food is mostly attributed to chemical compounds called **nutrients**.
- ⇒ When food is broken down through digestion, it generates energy for body functions, support growth and development, maintain health and boosts immunity against diseases.

Examples of **nutrients** include:

- | | | |
|-------------------|---------------|--------------|
| (i) Carbohydrates | (iii) Fats | (v) Minerals |
| (ii) Proteins | (iv) Vitamins | |

b) Food classification based on body their functions







- ⇒ Most food supply diverse nutrients however they are richer in particular nutrients and not others.
- ⇒ Food is commonly classified according to the main nutrients they contain and their functions in the body. The three functional classifications include:
 - i) Energy giving foods rich in carbohydrates and fats.
 - ii) Body building foods rich in proteins.
 - iii) Immunity boosting foods rich in vitamins and minerals.

(i) Energy-giving foods (“Go” foods)





- ⇒ These foods provide a relatively high amount of energy and usually have a high composition of carbohydrates, fats and oils.

- ⇒ They are also called “Go” foods because they supply energy to support movement (“going”), physical activities and other body functions requiring energy.
- ⇒ Examples of high energy giving foods include cereals, starchy roots, tubers, plantain (*Matooke*), fats and oils are good energy sources.

Table 1: Energy-giving foods and kilocalories supplied in 100 g of Edible Portion (EP)

Cereals	Whole maize	Maize flour (60%)	Finger millet	Rice	Wheat	Sorghum
						
Energy Kcal/100 g EP	363	354	363	352	344	335

Starchy roots, tubers and plantains

Food	Cassava flour	cassava	Matooke	Potatoes
				
Energy Kcal/100g EP	342	153	128	114

Source: West, Pepping and Temalilwa (1988)⁵ and Lukmanji *et al.*⁶

(ii) Body-building foods (“Grow” foods)

- ⇒ These are foods that support the physical growth and development, body maintenance and repair of worn-out and damaged body tissues.
- ⇒ They are also called body-building foods or “Grow” foods.
- ⇒ Body building foods mostly comprise meats and fish, as well as legumes, nuts and pulses.







⁵West, C. E., Pepping, F., & Temalilwa, C. R. (1988). *The composition of foods commonly eaten in East Africa*. Wageningen Agricultural University.

⁶Lukmanji, Z., Hertzmark, E., Mlingi, N., Assey, V., Ndossi, G., & Fawzi, W. (2008). *Tanzania food composition tables*. MUHAS-TFNC, HSPH, Dar Es Salaam Tanzania.





⇒ Animal protein sources are considered to be of high quality in body building compared to plant sources. However, soybean is considered to be a good body building food comparable to beef.

Table 2: Body building foods and their proteins (g) supply per 100 g EP

Animal sources

Food	Rabbit meat	Chicken	Fish	Goat meat	Eggs	Milk
						
Protein (g)/100 g EP	20	19	18	16	13	3.4

Plant sources

Foods	Soya beans	Groundnuts	Green peas	Beans
				
Protein (g) /100g EP	36	27	25	24

Key message

- Animal meats, eggs and fish are a rich source of body building food compared to plant sources.
- Extension workers should endeavour to promote production and consumption of resource-poor friendly animal products particularly small pelagic fish (*mukene*), small animals such as rabbits, goats, poultry and edible insects among others.

(iii) Immunity boosting foods (“Glow” foods)

⇒ These are foods rich in vitamins, minerals and other protective chemical compounds (phytochemicals) that boost immunity from disease and support the functioning of other nutrients.

- ⇒ They are also known as protective or “Glow” foods as they are essential for boosting immunity and controlling/regulating body functions.
- ⇒ Fruits and vegetables are the main sources of vitamins, minerals and other protective chemical compounds.

Intake of immunity-boosting foods is a key recommendation in the management of the **COVID-19 pandemic** and Non-Communicable Diseases (NCDs) such as diabetes, cancer and hypertension. Prevention and control of these diseases require integration of nutrition messages especially promoting foods rich in vitamins and minerals with antioxidant properties and other immune-boosting phytochemicals.

Table 3: Fruits and vegetables that are rich immune-boosting properties

















Food	Citrus	Pineapple	Mangoes	Passion fruits	Bananas
					
Vitamin C (mg) /100g EP	53	48	36	30	8.7
Foods	Carrots	<i>Dodo</i>	<i>Sukuma wiki</i>	Watermelon	Pawpaw
					
Vitamin A (International Units)/100g EP	3000	3000	3000	569	42

Table 4: Wholesome foods that also boost immunity through supplying dietary iron

Foods	Liver	Pumpkin seeds	Sesame seeds	Beans	Poultry	Beef
						
Iron (mg) /100g EP	10	10	10	8	1.6	1.2

2.2 Nutrient requirements

- ⇒ Nutrients are chemical substances in food utilised by the body to provide energy to perform routine activities, and support other body functions.
- ⇒ Nutrients are broadly categorised as macronutrients and micronutrients.

2.2.1 Macronutrients

These are nutrients required by the body in relatively large amounts. They include Carbohydrates, Proteins, Fats and Oils.

(i) Carbohydrates

- ⇒ These are the primary source of energy in the diet. They include starches, dietary fibre and sugars.
- ⇒ Sources include cereals, roots, tubers, plantains or refined sources such as high-grade milled flours (refined), sugary foods and sweetened drinks.
- ⇒ Refined sources should be consumed minimally. They may increase the risk of overweight, obesity and diet-related non-communicable diseases.
- ⇒ Individual carbohydrate requirements vary according to age, sex, physical activity level and physiological status.
- ⇒ The World Health Organisation recommends that daily carbohydrate intake should supply 45% to 65% of the total body energy requirements of 2000–3000 kilocalories (Kcals) or 30-50 Kcals/Kg of Bodyweight depending on age, sex, activity levels, and physiological status.

Table 5: Energy requirements for different physical activity levels

Weight level	Sedentary activity (Kcal/Kg BW)	Moderate activity (Kcal/Kg BW)	Active (Kcal/Kg BW)
Overweight	20-25	30	35
Normal	30	35	40
Underweight	35	40	40-50
Children (1-9yrs)	90	Varies	
Adolescents and young adults	55	Varies	

Source: FAO and WHO (1998)⁷

- ⇒ Pregnant and breastfeeding women also require more energy; about 500 additional kilocalories.

⁷FAO/WHO (1998). *Preparation and Use of Food-Based Dietary Guidelines*. Report of a joint FAO/WHO Consultation Technical Series 880. Geneva: World Health Organization.

⇒ One gram of carbohydrates provides 4 kilocalories (Kcals) of energy hence 100g will supply 400 Kcals.

(ii) Proteins

⇒ Proteins are body-building foods required for growth and development, maintenance and repair of tissues, production of enzymes and hormones, and the formation of body cells and tissues. They include all meats, insects, milk, legumes such as beans, soybeans, common beans, groundnuts and peas.

⇒ The recommended intake of protein each day for an adult is about 0.8g to 1 gram per kilogramme of body weight. For example, if a person is 60 kilograms, he/she will require about 60 grams of protein each day. This is equivalent to the size of an egg or an ear-piece size of boneless meat.

⇒ Children, teenagers, pregnant and lactating mothers require more protein of up to 2 grams per Kilogramme of body weight per day equivalent to the ranges indicated below:

- Children: 30–50 g
- Teenagers: 60–75 g
- Adults: 60–70 g
- Pregnant/lactating women: 90 g.

Key message

Extra protein is required during illness, recovery, physical growth and development, and after surgery, because the body has extra demand for protein to build new tissue, replace and repair worn out tissues.

(iii) Fats and oils

⇒ They are broadly called lipids. They are found in animals and some plants.

⇒ The main distinction between fats and oils is that fats are solid at room temperature while oils are lipids that are liquid at room temperature.

⇒ Fats and oils are a rich source of energy and support the building of body cells, brain development of infants, and facilitate the absorption and use of fat-soluble vitamins A, D, E, and K.

⇒ The major component of lipids is glycerol and fatty acids. According to their chemical properties, fatty acids can be divided into saturated and unsaturated fatty acids.

Lipids containing saturated fatty acids include butter, ghee and tropical oil palm, coconut, palm kernel. Lipids made of unsaturated fatty acids include fish (with scales) oils, vegetable oils from sunflower, corn, soybean, sesame, groundnuts, canola and olive oils. Replacing saturated fats with unsaturated fats in the diet lowers the risk of heart related diseases.

- ⇒ Fat provides high amounts of energy; 1 g of fat produces over 9 kcals.
- ⇒ In adults, a daily intake of fats/oils should not exceed 30% of total kcals.
- ⇒ Intake of saturated fats should be 10% or less of the total fat intake per day. Cholesterol intake should not exceed 300 mg.

Sources of fats/lipids/oils

- ⇒ Animal sources include meat, bacon, oilfish, cheese, butter, lard, milk, and egg yolk among others.
- ⇒ Plant sources include groundnuts, soya, cocoa, sim-sim, maize, avocado, margarine, wheat germ, corn, sunflower, and palm oil.

Table 6: Examples of fats and oils

Vegetable oil	Cheese	Shear butter
		
<i>Trans fat sources</i>		
Margarine	Blue band	Butter
		

Key messages

- Excessive consumption of fat, especially saturated fat, increases the risk of heart diseases. The moderate use of oils from plant sources and fish reduces the risk.
- Fat should be consumed in small quantities by adolescents and adults to minimise the risk of overweight, obesity and diet-related non-communicable diseases.
- Trans fat obtained from the hydrogenation of unsaturated fat are also a risk for excess fat accumulation, overweight, obesity and diet-related chronic diseases.

(iv) Dietary fibre

- ⇒ This is a form of complex carbohydrate that is part of the non-digestible portion of the food.
- ⇒ Dietary fibre increases the body's sense of satisfaction thus preventing overeating.
- ⇒ Diets high in fibre protect against constipation.
- ⇒ Fibre can slow the body's absorption of sugar and cholesterol protecting the body from diseases of the heart and diabetes.
- ⇒ Dietary fibre adds bulk to the faeces.
- ⇒ Dietary fibre slows down the breakdown of starch and supports the decomposition of cholesterol.

Main sources of dietary fibre:

- Whole grains of cereals, for example, oats, millet, and maize bran.
- Vegetables like *dodo*, *nakati*, *malakwang*, cabbage, and pumpkin leaves.
- Legumes such as beans, peas, and pigeon peas, among others.
- Fruits such as mangoes, oranges, and pineapples, among others.

Some of the foods that are a rich source of fibre:



Cabbage



Amaranthus sp (dodo)



Whole maize



Finger millet



African Spider plant (Jobo)



Pineapple

2.2.2 Micronutrients

- ⇒ These comprise vitamins and minerals.
- ⇒ They are required by the body in relatively small amounts and include

- ⇒ These are required in relatively small amounts by the body.
- ⇒ They play a crucial role in boosting body immunity and supporting the functionality of macronutrients.

(i) Vitamins

These are organic compounds that perform specific metabolic functions in the body. There are two forms of vitamins:

a) Fat-soluble vitamins

- ⇒ They include Vitamins A, D, E and K. They are stored by the body and require dietary fat to be absorbed.
- ⇒ Fat-soluble vitamins are necessary for development and maintenance of body tissues and their functions, for example, eyes (vitamin A), bones (vitamin D), muscles and blood clotting (vitamin K), protection of cells (vitamin E), synthesis of enzymes and absorption of nutrients.
- ⇒ Dietary sources of fat-soluble vitamins include carrots, tomatoes, offal, milk and milk products and leafy vegetables.

b) Water-soluble vitamins

- ⇒ These are vitamins that are not stored by the body and must be consumed regularly in the diet.
- ⇒ They include vitamins C (ascorbic acid) and the vitamin B complex group. Their functions include supporting the release of energy, utilization of macronutrients and synthesizing red blood cells.
- ⇒ Dietary sources of water-soluble vitamins include fruits, dark leafy vegetables, whole grains, meat, fish, poultry and fortified cereals.
- ⇒ Citrus fruits are a good source of vitamin C which boosts immunity and is crucial for improving iron absorption and blood formation.

Vitamins requirements

- ⇒ Water-soluble vitamins are not stored in the body and must be consumed daily in the diet.
- ⇒ Fat-soluble vitamins are stored in the liver and may not have to be taken daily; excessive intake of these vitamins is toxic.

Key messages

- Promote production and consumption of fruits in all households as part of the broad iron deficiency anaemia prevention strategy.
- Promote daily intake of vitamins C and B complex group food sources.
- Be aware of excessive intake of vitamins A, D, E and K especially in this era of aggressive promotion of food supplements.

(ii) Minerals

- ⇒ These are micronutrients required for the normal functioning of body processes, including growth, development, controlling water and fluid balance and supporting neurological processes.

Minerals of public health importance

Iron: An essential component of blood and helps transfer oxygen to various body tissues. Dietary sources include red meat, fish, poultry (easily absorbed), legumes, green leafy vegetables (less easily absorbed, but absorption increases if eaten with animal source iron or vitamin C).

Calcium: A key component of bones and teeth. It is needed for a strong skeleton and blood clotting. The major source of calcium is milk and milk products. Other sources are fish, whole grains and green leafy vegetables.

Iodine: This important for thyroid function and mental development of children. The most important dietary source is iodized salt.

Zinc: It enhances and strengthens the immune system, helps wound healing, facilitates digestion and is an important component of skeletal muscle. Sources include beef, seafood, liver, nuts, beans and whole grains.

Other minerals involved in various body functions: chromium, copper, fluoride, magnesium, manganese, molybdenum, nickel, potassium, phosphorus, sodium and selenium.

- ⇒ The following minerals are required by the body in relatively large amounts and should be supplied in the diet: calcium, iron, phosphorus, potassium, sulphur, chlorine, sodium and magnesium.
- ⇒ Trace mineral elements like iodine copper, manganese, fluorine, cobalt, nickel, zinc, chromium and selenium are needed in relatively

small amounts and the body is unlikely to be deficient in them when one consumes a balanced diet.



Figure 1: Food rich in micronutrients and anti-oxidant properties good for boosting immunity

Micronutrient levels in food can be deliberately improved through a process called **fortification**; the deliberate addition of micronutrients to food during processing (**industrial fortification**), during crop breeding (**biofortification**), directly to food during eating (**point of use fortification**) or through advanced techniques involving micro-organisms (microbial fortification).

Fortified foods include iodized salt, edible oils, wheat flour and other cereal flours such as maize. Biofortified foods include the orange-fleshed sweet potato, high iron beans, vitamin A-rich maize and vitamin A rich matooke among others. Biofortification is still an evolving technology so more biofortified crops may continue to be released.

Key messages

- Promote the consumption of animal and plant protein foods since minerals from plant sources are poorly absorbed.
- Use iodized salt for cooking since it is fortified with iodine needed to support growth and development.
- Consumption of animal source foods is necessary to achieve a balanced diet.
- Animal food products are a good source of good quality protein.
- Animal source foods are easily absorbable and an efficient source of micronutrients (calcium and B12 from milk, iron, zinc and vitamin A).
- Milk should especially be emphasized for production and consumption because it is nearly a complete food as well as a high-quality animal protein source and can be conveniently used

2.3 Water and its role in the functioning of the body

- ⇒ Water is an inorganic, transparent, tasteless, odourless, and nearly colourless chemical substance, which is the main constituent of Earth's hydrosphere and the fluids of all known living organisms.
- ⇒ It is vital for all known forms of life, even though it provides no calories or organic nutrients.
- ⇒ It forms part of the body cells and fluids, such as blood and digestive juices and is required to maintain the fluid balance, cell turgidity, and all reactions in the body, including removal of excreta and keeping body parts moist.

Water requirements

- ⇒ It is recommended to drink water every day, especially in hot weather when much is lost through sweating to avoid dehydration.
- ⇒ Depending on an individual's age and physiological requirement, over one litre of water per day is recommended for an adult person.
- ⇒ All drinks such as tea, coffee, fruit juice contribute towards the water update in the body. Children should drink all the time as they need.

The body requires water for many functions that include:

- (i) Transporting nutrients around the body.
- (ii) Supporting the formation of blood, saliva, tears and sweat.
- (iii) Enabling body processes such as digestion and hormone function.
- (iv) Keeping the mouth and lungs moist, and the skin moist and cool.
- (v) Producing breast milk, which is also a source of water for the breastfeeding infant and young child.

Extra water is needed:

- (i) During illness when a raised temperature results in increased sweating.
- (ii) If vomiting or diarrhoea has occurred, both of which can cause dehydration especially in babies.
- (iii) In lactation when extra water is required for milk production.
- (iv) After intensive activity such as sport.

2.4 The concept of Nutrition

What is nutrition?

- ⇒ The integrated process of providing or obtaining the food, nutrients care, awareness and enabling environment necessary for sustaining health, growth and development.
- ⇒ It broadly encompasses all actions necessary for obtaining, handling, preparing, serving, eating and utilization of food and its nourishing of the body.

Good nutrition refers to a situation when the diet provides the recommended amounts of nutrients for the body to perform all its physiological activities and functions. It is synonymous with:

- ⇒ Eating the right food that is safe for human consumption.
- ⇒ Eating at the right time with minimum skipping of meals.
- ⇒ Eating the right amounts in terms of frequency, quality and quantity to ensure an adequate and balanced diet.
- ⇒ Preparing meals correctly and in an appropriate environment.
- ⇒ Addressing the nutrition needs depending on one's age, sex, physiological status and physical activity level.

Good nutrition should be consistently practised throughout the life cycle; right from pre-conception, conception, pregnancy, infancy, childhood, adolescence and adulthood. Poor nutrition can result in intergenerational consequences.

Good nutrition is important because it:

- ✓ Enhances physical and cognitive development.
- ✓ Enhances breast milk production for the mother to adequately breastfeed her child.
- ✓ Enhances good education outcomes.
- ✓ Builds and boosts body immunity reducing susceptibility to disease.
- ✓ Reduces costs involved in disease management and control
- ✓ Enhances productivity.

A person with poor nutrition is at high risk of:

- ✓ Poor growth and development of the body and the brain (especially in young children).
- ✓ Frequent illness, infections and prolonged (delayed) recovery.
- ✓ Reduced ability to learn or perform in school.
- ✓ Reduced ability to work and earn a living.
- ✓ Early death or disability from persistent debilitating disease.

Key message

- When individuals or communities do not feed appropriately, they face the possibility of becoming malnourished (poor nutrition outcomes) and can face serious health problems.
- Extension workers should promote good nutrition practices in the community to prevent outcomes of poor nutrition and related consequences.
- Good nutrition is key for good health and development at all levels: household, community, district and national level.
- It is better and cheaper to ensure better nutrition at all levels than spend on the consequences of malnutrition including diseases, poor education etc.

2.5 Planning an adequate and balanced diet

2.5.1 Key terminologies and considerations

- ⇒ **A meal** is a selection of foods prepared, served and eaten at a particular point in time for example at breakfast, mid-morning, lunch and dinner.
- ⇒ **Diet** is a collection of meals eaten over a day or more.
- ⇒ **Diet planning** is a process of determining, selecting and preparing meals through a well thought out process that takes into account nutritional needs, foods available and cost.
- ⇒ It is important to **distinguish a meal from the diet**. It is very common for people to misrepresent a meal to mean diet and vice-versa yet there is a clear distinction between the two words.
- ⇒ **Snacks** which are small food portions like *yellow bananas, fruit salads, biscuits, juice, tea, coffee, samosa, chapatti and mandazi* among others, usually eaten between main meals, are also considered as small meals.

A serving is that quantity of food suitable for or given to one person in one meal.

- ⇒ Diet can be assessed and reported using **dietary diversity scores (DDS)** or actual levels of nutrient intake compared with what is recommended for a day; the **Recommended Dietary Allowances (RDA)**.
- ⇒ **Diet diversity** is the number of food groups eaten over one day or more. It is different from the variety which means individual food type. For example, maize and rice are 2 varieties but one diversity (cereals).

Foods groups that are commonly used in Uganda include:

1. Cereals and grains (maize flour, wheat flour, millet flour and rice).
2. Legumes and nuts (beans, peas and groundnuts).
3. Starchy roots, tubers and plantain (potatoes, cassava, yam, matooke).
4. Fruits (pawpaw, watermelon, mango, yellow bananas, pineapple, etc).
5. Vegetables (cabbage, dodo/amaranth, spinach, Sukuma wiki, etc).
6. Meats, fish, poultry and eggs.
7. Milk and milk products.
8. Edible cooking oils and fats, preferably fortified options.
9. Non-alcoholic beverages (*soda, safi, eshande obushera, ekitiribita, etc*)
10. Baked products and confectionaries.

A diversity score of at least 5 food groups per day inclusive of fruits and vegetables is considered desirable.

- ⇒ Diet planning aims to achieve an adequate and balanced diet for target groups or individuals.
- ⇒ The dietary needs of an individual for a day or more depends upon age, physiological status, health status, and physical activity level.
- ⇒ Children eat small portions of meals in the daily diet because their stomachs are small. However, they have increased nutrient requirements for growth and development and thus require more frequent feeding compared to adults.
- ⇒ People will always want to eat acceptable food, therefore knowing the consumers' characteristics, food preferences and location is important in proper meal planning.

- ⇒ It is important to know the complementarities of foods and supplementary roles of food in the supply of adequate quality protein for resource-poor households. Legumes and cereal food sources when consumed together in one meal generally complement each other and result in a near complete protein. Baby food manufactures use this principle of protein complementation to design some cereal – legume based weaning food formulas. Animal protein such as milk, small fish (*mukene*) and eggs which can be taken daily (either of these in a day), will supplement resource-poor household diets which are based more on legume protein as a daily supply of most of their protein needs.

A good diet should be **adequate** and **balanced** by supplying a diverse variety of foods that contain all the nutrients in their right amounts required for the body to perform its daily functions normally.

- ⇒ Attaining an adequate and balanced diet in a day requires eating *at least three balanced meals for adults and up to five meals for children*.
- ⇒ A balanced diet should also include various food groups and varieties in a day, and the right proportions and quality as required by the body.

2.5.2 Points to consider while planning a meal

- (i) Family incomes, lifestyles, individual habits and preferences.
- (ii) Nutritional and health status, and related needs.
- (iii) Daily routines of family members such as work and school.
- (iv) Availability of storage, cooking facilities and fuel.
- (v) The occasion for which meals are required and time of serving.
- (vi) Food availability and season.
- (vii) Time available for cooking.
- (viii) Balance and variety in making food choices.
- (ix) Meals are attractive and enjoyable.
- (x) Meals satisfy their appetite.

It is recommended that the last meal of the day (dinner/supper) is taken at least 2 hours before bed-time. This allows for optimal digestion and energy use and minimizes the risk of fat deposition from converted excess calories.

2.5.3 Principles in diet planning

- (i) Maintaining adequate levels of energy, nutrients, movement and rest for optimal health.
- (ii) Balancing different food groups, and consuming foods in their right proportions relative to one another.
- (iii) Consuming the appropriate number of calories to maintain a healthy weight depending on your metabolism and exercise levels
- (iv) Moderation by keeping servings reasonable especially of foods with negative effects on health if eaten in excess. This requires self-control to minimise foods that are higher in fat or sugar.
- (v) Diet plans should be nutrient-dense without exceeding calorie limits.
- (vi) A diverse diet that provides all the nutrients necessary for good health.



Figure 2: An example of a mixed meal guide to achieving a balanced diet

2.5.4 Cost reduction in diet and meal planning

Important issues to be considered:

- (i) Plan several meals in advance considering foods available in season.
- (ii) Take off time to look for affordable places to buy food at a low cost.
- (iii) If possible, purchase in bulk as it reduces expenditure.
- (iv) Avoid foods which are of poor value such as those containing only energy, e.g., sweets, sweetened beverages like sodas and soft drinks.
- (v) Make use of special market days/opportunities when the food supply is plentiful and cheap.

2.5.5 An envisioned food pyramid for Uganda

- ⇒ A food pyramid⁸ is a guide showing how different categories of foods should be utilized to achieve optimal nutrition and health status.
- ⇒ Foods at the base of the pyramid should be eaten in larger portions and frequency followed by those in the middle, while those at the top should be eaten in small amounts or sparingly.

⁸The United States Departments of Agriculture (USDA) adopted a food pyramid in 1992 with a base of energy-dense cereals which was changed to a healthy plate after 2005. See: Meredith, M (2016). "The USDA Ditches the Food Pyramid for a Plate". Time. ISSN 0040-781X.



Figure 3: An envisioned healthy food pyramid for Uganda

- ✓ Eat more portions of fruits and vegetables to boost the body's immunity.
- ✓ Foods that supply high levels of energy/calories and unsaturated fat should be eaten moderately to prevent overweight, obesity and diet related non-communicable diseases (NCDs) such as diabetes, hypertension and cancer.
- ✓ Be physically active and lead a healthy lifestyle:
 - ⇒ Participate in sports and walk for at least 45 minutes every day.
 - ⇒ Engage in gardening and other home-related activities that increase energy expenditure and keep the body active.
 - ⇒ Take adequate water, avoid abuse of alcohol, tobacco and drugs.
 - ⇒ Avoid unhealthy dietary habits like over-snacking and skipping meals.

⇒ Avoid stressful situations in the home, workplace and in relationships.



Figure 4: A plate-like educational illustration of food portions that constitute a balanced diet

Key message

- Eat a variety of foods from the main three groups (energy-giving, body building and protective foods) at a very meal.
- Dominate every meal with immune-boosting foods, mostly fruits and vegetables.
- Emphasize wholesome foods of cereals and beans or legumes.
- Avoid eating too much salt, sugar, alcohol and fatty red meat to avoid diseases such as high blood pressure, diabetes, overweight, obesity.
- Promote production and consumption of animal protein foods such as milk, small fish, eggs and small animals that most households can afford to access regularly.

CHAPTER THREE: MALNUTRITION, ITS FORMS AND CAUSES

This chapter explores the concept of malnutrition, its forms/manifestations and consequences on agriculture and overall development.

3.1 The meaning of malnutrition

- ⇒ Malnutrition is a condition that develops when the body does not get the right amount of energy and the nutrients it needs to maintain healthy tissues and organ function.
- ⇒ It manifests as undernutrition when the body gets less nutrients leading to macronutrient and micronutrient deficiencies, and on the upper side, overweight, obesity and diet-related non-communicable diseases such as hypertension, diabetes and cancer when nutrient supplies exceed the physiological need.

Malnutrition affects mostly people of the following categories:

- (i) Pregnant women and the unborn child/growing foetus leading to intrauterine growth restriction and low birth weight.
- (ii) Infants and children from pregnancy.
- (iii) Non-breastfed children.
- (iv) Pregnant and lactating women.
- (v) People suffering from chronic or infectious disease.
- (vi) People who are food insecure.

3.2 Types of malnutrition

a) *Undernutrition*

- ⇒ This is a consequence of consuming too few essential nutrients, using or excreting them more rapidly than they can be replaced, or not being able to absorb the nutrients consumed often due to illness or infection.
- ⇒ Undernutrition is the most common and easily observable type of malnutrition in Uganda. Undernutrition often presents itself in two forms: acute and chronic.

- ⇒ **Acute malnutrition** takes place within a short time and can present the loss of muscles and body weight. Over severe days an acute condition moves into a severe state and this presents with visible wasting (prominence of bones) and/or symmetrical swelling of the body starting from both feet.
- ⇒ **Stunting** is an example of chronic undernutrition in children under five years. A stunted child is too short for his or her age. This arises from long-term or repeated food deprivation or illness that fails proper growth and development.
- ⇒ Children are at the highest risk for stunting from conception to five years of age. It can be irreversible and therefore must be prevented.
- ⇒ Stunting negatively affects cognitive development and leads to poor education performance and outcomes. Stunting children have a high risk of dropping out of schools and failure.

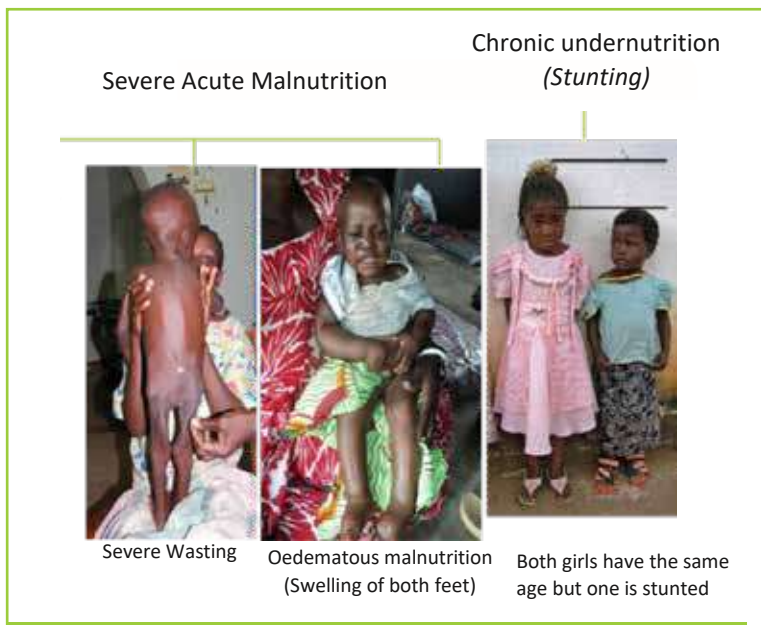


Figure 5: Common Forms of Severe and Chronic Undernutrition

b) Micronutrient deficiencies (lack of vitamins and minerals)

- ⇒ This type of malnutrition is called “hidden hunger;” and is due to inadequate intake of dietary mineral salts and vitamins leading to vitamin-mineral deficiencies (VMDs).
- ⇒ This form of malnutrition cannot be identified easily except in advanced stages when clinical signs appear.
- ⇒ Minerals and vitamins are required by the body in very small quantities. Usually, their absence in the diet does not cause a person to “feel hungry”, hence referred to as hidden hunger.

Micronutrient deficiency disorders are a public health concern in Uganda. By 2016, anaemia was affecting more than half of children under five years and one-third of women of reproductive age. Vitamin A deficiency has also been considerably reduced in children from 33% in 2011 to 9% in 2016

c) Overweight, obesity and diet-related chronic diseases

- ⇒ These conditions arise from excessive intake of nutrients especially fats and carbohydrates, over a relatively long period coupled with low physical activity and undesirable lifestyles like alcohol and tobacco use and over-snacking, increasing chronic disease risk.
- ⇒ Overweight and obesity are assessed in adults using the Body Mass Index (**BMI**). It is calculated by dividing the weight (in kilogrammes) by the height (in metres) squared. A BMI score (in Kg/M²) below 18.5 is underweight, 18.5 to 24.9 is a normal or healthy weight, 25.0 to 29.9 is overweight, while 30.0 and above is obese.
- ⇒ Overweight, obesity and diet-related chronic diseases may be caused by any of the following factors:
 - (i) Eating habits (overeating).
 - (ii) Health conditions that affect hormonal balance.
 - (iii) Overuse of medications and dietary supplements.
 - (iv) Lack of physical activity (sedentary lifestyle).
 - (v) Genetic (hereditary) and psychological factors (stress).
 - (vi) Environmental factors (unsafe foods e.g., heavy metals in food, aflatoxins, peer pressure).

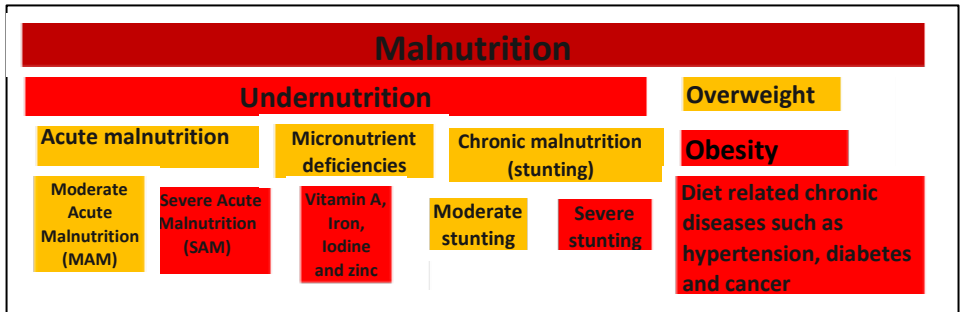


Figure 6: Malnutrition and its forms

3.3 Causes of malnutrition

The causes of malnutrition are commonly categorized into immediate causes, underlying cause and basic causes.

Immediate causes include:

- (i) Inadequate dietary intake including poor quality and quantity of food in the diet; poor dietary diversity and low intake of foods rich in appropriate nutrients.
- (ii) Infections and diseases such as malaria, diarrhoeal diseases, acute respiratory infections, measles and worm infestations.
- (iii) High intake of anti-nutrient factors like phytates and tannins that inhibit nutrient absorption.

Underlying causes include:

- (i) Household food insecurity including poor access to a diverse diet, inadequate quantity of food available and accessible, and seasonal fluctuations in food availability.
- (ii) Inadequate maternal and childcare, including suboptimal maternal nutrition and infant feeding practices, often a result of heavy workloads for women and frequent births.
- (iii) Poor access to healthcare and inadequate water and sanitation, leading to increased illness.
- (iv) Inadequate caring capacity for example inadequate time, inadequate knowledge.

- (v) Low levels of nutrition, awareness, knowledge and motivation.
- (vi) Intra-household maldistribution of food, health services and care.
- (vii) Poor food preparation, poor food handling practices including storage, preservation and processing practices at household levels and in the market channel.
- (viii) Beliefs and practices that restrict access to certain foods for some family members (food taboos).
- (ix) Poor health services and/or agricultural infrastructure.
- (x) Low production of diversified nutritious foods.
- (xi) Insufficient marketing infrastructure for key foods.
- (xii) Seasonality of food availability.
- (xiii) Inadequate educational opportunities.
- (xiv) Lack of access to safe water for drinking, hygiene and/or irrigation.
- (xv) Poorly developed commercial food processing industry.

Basic causes include:

- (i) Limited livelihood opportunities and unequal economic structure.
- (ii) Lack of institutional capacity in nutrition and/or personnel trained in the various components of community nutrition programmes.
- (iii) Inadequate budget and financing to food and nutrition security.
- (iv) Quality of social and political leadership, e.g., poor economic or physical access to markets.
- (v) Little or no productive land and other sources of livelihood.
- (vi) The low status of and lack of resource control by women.
- (vii) Inadequate policies and laws on food and nutrition security.
- (viii) Failure to consider food and nutrition needs in agriculture and health policy-making.
- (ix) Poor economic or physical access to markets.
- (x) Inadequate exploitation of natural resources for improved nutrition.

Conceptual Framework: Determinants of Malnutrition

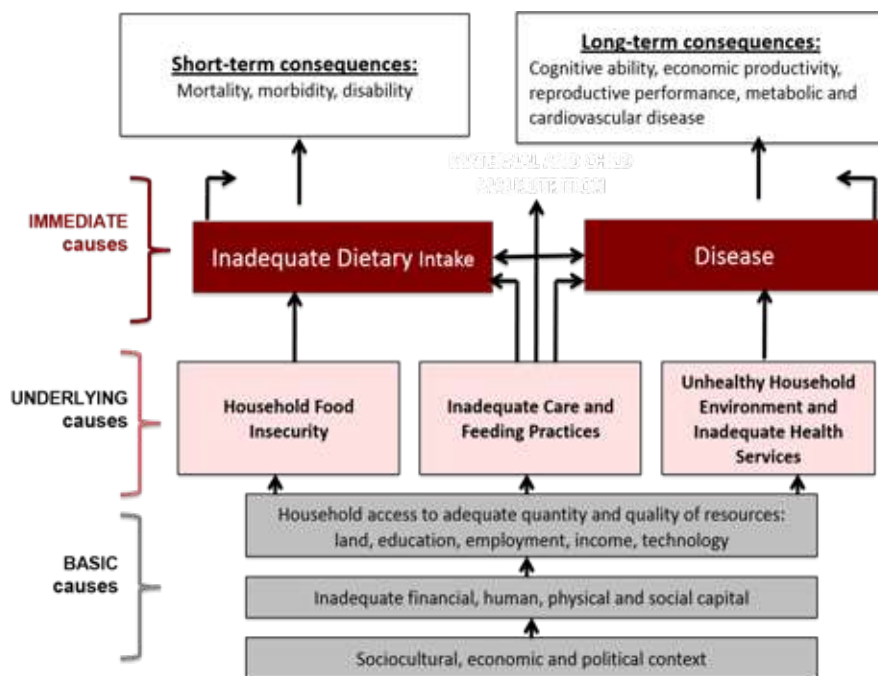


Figure 7: Conceptual framework on the causes of malnutrition

(Source: Adopted from the UNICEF conceptual framework 1990)

Using the framework on the causes of malnutrition, extension workers can design specific interventions to improve the food and nutrition security in the community by addressing the specific determinants that are commonly prevailing in the area.

3.4 Consequences of malnutrition

a) Child deaths, diseases and disability

- (i) New-borns who are born small (low birth weight, that is less than 2.5 kg) for their gestational age are more likely to die than children born with a healthy weight.

- (ii) A severely stunted child is four times more likely to die than a healthy child.
- (iii) A severely wasted child is nine times more likely to die than a healthy child.
- (iv) Micronutrient deficiencies—including vitamin A, zinc and iron—impair the immune system, increasing the risk of illness and death.
- (v) Anaemia increases the risk of maternal and perinatal deaths (death of an infant in the womb and during the first 6 weeks of birth).
- (vi) Vitamin A deficiency causes blindness, poor development of the brain, poor skin development, reduced immunity to disease and poor education outcomes among others.

b) Malnutrition weakens brain development and the nervous system

- (i) Impaired brain development, poor school achievement, absenteeism (stunting, iron deficiency, anaemia, iodine deficiency).
- (ii) Neural tube defects: undeveloped backbone and the nervous system (folic acid deficiency).
- (iii) Impaired foetal brain development, brain damage, severe mental retardation, or congenital abnormalities (iodine deficiency in pregnancy).
- (iv) Diminished income: earning capacity in adulthood.

c) Malnutrition decreases productivity and economic growth

- (i) Malnutrition has a negative consequence on physical productivity, health, education, and socioeconomic development outcomes.
- (ii) When malnourished individuals are sick, they are weak and cannot perform their daily work, for example, sick farmers.
- (iii) Individuals with iron deficiency anaemia (particularly women) become tired easily and cannot work for longer hours.
- (iv) Shortage of iodine decreases IQ and causes a productivity loss.
- (v) Farmers with low literacy levels are less likely to adopt improved agricultural practices hence leading to poor agricultural production and productivity.

- (vi) People with low literacy levels are bound to have poor health-seeking behaviours and access to quality health services.
- (vii) Mothers with low education are likely to follow poor feeding practices hence affecting the health and nutrition status of family members.
- (viii) Contributes to poverty.
- (ix) Cost of treating illnesses attributable to malnutrition.
- (x) Cost of caring for sick.
- (xi) Lost care for others (not sick) household members.

d) Consequences of overweight, obesity and diet-related diseases

Malnutrition can lead to multiple medical conditions including:

- (i) Overweight and Obesity.
- (ii) Coronary heart disease (heart attack) and Hypertension (sustained high blood pressure).
- (iii) Diabetes (sustained high blood sugar).
- (iv) Gout (swollen painful joints).
- (v) Early death.

Globally, non-communicable diseases (NCDs) account for 41 million deaths annually, equivalent to 71% of all deaths. In Uganda, they account for 33% of all deaths. In 2016, there were an estimated 97,600 NCD deaths in the country⁹ while 2014 statistics indicated that about one in four people (24%) had a raised blood pressure and raised fasting glucose including diabetes was at 3%¹⁰.

Key message

- Malnutrition can be due to low intake of nutrients (undernutrition) or excess intake of nutrients (overweight, obesity and diet-related chronic diseases).
- Malnutrition occurs across the life cycle and can pass from one generation to another.
- It is important to break this cycle through interventions to promote the nutritional status of adolescent girls and women of reproductive age and from pregnancy through 24 months of age.

⁹WHO (2018). *Non-communicable Diseases Country Profiles*. Geneva: World Health Organization. <https://www.who.int/nmh/publications/ncd-profiles-2018/en>.

¹⁰MOH (2014). *Ugandan Non-communicable Disease Risk Factor Baseline Survey*. Kampala: Ministry of Health.

CHAPTER FOUR: ESSENTIAL NUTRITION ACTIONS (ENA) IN MATERNAL AND CHILD CARE

This chapter highlights the main essential actions to be considered by extension workers as part of promoting optimal maternal and child care for improved health and nutrition.

4.1 Nutrition considerations before and during pregnancy

- ⇒ A woman should be well-nourished before pregnancy so that by the time she conceives, the body has sufficient nutrient stores to meet both her and the baby's needs.
- ⇒ A malnourished woman may fail to deliver a baby alive or if she does, the baby is likely to have a low birth weight (less than 2.5 kg at birth).
- ⇒ During pregnancy, women have high nutrient needs because they have to build foetus tissue, build reserves for breast milk and also cater for their own nutritional needs. On average women should gain 5-12 kilogrammes in the course of pregnancy.

The following nutrition-related facts are important during pregnancy. Pregnant women need to eat:

- (i) Routine meals on time and avoid skipping any meal.
- (ii) More food by providing an additional meal to the routine meals or small but frequent meals to address the additional needs.
- (iii) Nutritious snacks in between meals to meet the additional energy and nutrient requirements e.g. Simsim, pumpkins seeds, desert banana, dairy products etc.
- (iv) A balanced diet comprising of foods from the three food groups; energy-giving foods, body-building foods and protective foods.
- (v) Foods that are rich in iron and folate e.g. kidney beans, spinach, nuts, cooked liver from livestock and small animals, millet porridge or bread, pumpkin seeds, etc.
- (vi) Foods that are rich in calcium, e.g., milk and small pelagic fish (*mukene*) partly to take care of the increased requirement for building the foetus skeletal structure.

Also, pregnant women should be educated to strictly observe the following:

- (i) Take the required amounts of iron and folic acid (IFA) supplements to prevent anaemia.
- (ii) Sleep under an insecticide-treated mosquito net.
- (iii) Visit the nearest health facility for antenatal care as early as when the pregnancy is detected; at least once every month equivalent to about 8 visits in 9 months to prevent anaemia and congenital abnormalities like spina bifida and hydrocephalus. This also enables access to other services needed to have a healthy baby.
- (iv) Deliver in a health facility with the help of a skilled health worker.
- (v) Get dewormed at least once during the pregnancy.
- (vi) Take antimalarial preventive medicine every month and 2-3 shots of tetanus vaccine during the 9 months of pregnancy.
- (vii) Avoid heavy workloads that negatively affect pregnancy. Such includes long hours of digging, lifting heavy items and long hours of walking.
- (viii) Avoid alcohol and tobacco use as these cause negative effects on the developing foetus in the mother's womb.
- (ix) Avoid taking unprescribed drugs as some of them are potentially harmful to the unborn child.
- (x) Avoid negative cultural practices that reduce the intake of nutritious foods or impact negatively on their health such as:
 - The falsehood that pregnant women should not eat chicken and eggs to avoid children with feathers.
 - The myth that eating fish leads to a child with fish scales.
 - The myth that pregnant women should not use toilets/pit latrines to avoid pushing out the baby before term.

Key messages

- Pregnant women have more nutrient needs so they should have adequate and balanced diets and an extra meal to cater for increased physiological needs.
- Pregnant women should take iron and folate tablets daily as prescribed by the health worker, in addition to foods rich in other essential nutrients.
- Pregnant women should get care and support from male partners, have enough rest and attend antenatal care at least once a month from when pregnancy is detected.

4.2 Nutrition considerations during breastfeeding

Nutritional requirements during breastfeeding are higher than during pregnancy because the mother has to produce enough milk to sustain a baby (bigger than the foetus) for the first six months and beyond. Breastfeeding women need;

- ⇒ To eat a wide variety of foods.
- ⇒ Should also take an extra meal to cater for increased demand from breastfeeding and a lot of juice and fluids to cater for the high amounts of water used to make breast milk. They should avoid self-medication, smoking and alcohol to prevent intoxicating the baby.
- ⇒ Should avoid stress and have enough rest.

Key messages

- Like a pregnant woman, a breast-feeding mother also has increased nutrient needs than the rest of the family members. Ensure that a breastfeeding mother take a balanced diet and in addition to 3 meals daily receives 2 extra meals a day to maintain her health and that of her baby.
- A pregnant woman and breastfeeding mother should eat a variety of foods from the main food groups daily.
- Give breastfeeding women good psychosocial care and rest



Figure 8: Male partner support is key for a healthy pregnancy and breastfeeding

4.3 Nutrition considerations in infant and young child care

- ⇒ Breastfeeding and complementary feeding behaviours are important predictors of infant and child nutrition, health and survival.
- ⇒ Breast milk is the best food for babies and it is all that the baby needs up to six months of age.
- ⇒ An infant should be initiated onto the mother's **breast milk** within one hour of birth; a practice referred to as "**early initiation of breastfeeding**". It ensures that the infant receives the colostrum, or "first milk", which is rich in protective factors.
- ⇒ Children from birth to six months of age should be **exclusively breastfed**. Exclusive breastfeeding refers to feeding a child on breast milk only for the first six months.
- ⇒ If you introduce any food before six months you will potentially expose the baby to unsafe and poor-quality meals.
- ⇒ Mothers are advised to breastfeed their babies as many times as the baby demands to be fed (at least 8 times a day, every 2–3 hours). This will help maintain milk production.
- ⇒ Even when the child is ill, continue breastfeeding.



Figure 9: A mother breastfeeding her baby and hand expressing her milk to leave for the baby when she is away.

Advantages of breastfeeding

- (i) Breast milk is the best nutritionally balanced food for the baby. It contains all the nutrients required by the baby in the correct proportions. The nutrients are in forms that are easy for the baby to digest and absorb.
- (ii) Breast milk contains substances that help the baby to fight infections and stay healthy. Most of these substances are found in the yellowish milk (colostrum) that is produced in the first few days after birth.
- (iii) Breast milk is released at a correct temperature suitable for baby.
- (iv) Breast milk is safe, there is no danger of contamination during preparation.
- (v) Breastfeeding is relatively cheap compared to other alternatives.
- (vi) Breastfeeding promotes bonding between mother and baby.
- (vii) Delays return of menstruation and delay the next pregnancy thereby spacing the children.
- (viii) Helps the mother to shrink the uterus back to its normal size.
- (ix) Exclusive breastfeeding for the first six months helps a child's mental (brain) development.

Key message

- Initiate breastfeeding within 1 hour of giving birth
- Exclusive breastfeeding (no giving any other food including water) is the safest and healthiest way to feed a baby for the first 6 months.
- Babies need to be breastfed 8–12 times a day after every 2–3 hours or more as needed, in the first six months.

4.4 Complementary feeding practices

- ⇒ Complementary feeding is also commonly referred to as weaning. It is the gradual introduction of food into the diet of the child alongside breast milk at the age of six months.
- ⇒ Beyond 6 months, breast milk alone is not enough to meet the child's increased nutritional needs for proper growth and development.

- ⇒ During complementary feeding, there are six principles to follow:
- ⇒ Meal frequency, amount, thickness, variety, active feeding and hygiene. This is commonly referred to as the FATVAH.
- ✓ **Frequency of meals** refers to the number of meals eaten in a day. To meet the child's body's needs, for growth, development, and activity, we must feed them frequent meals, meaning 3 meals and 2 snacks each day.
- ✓ **Amount of foods** refers to how much food is eaten at each meal. It is important to eat foods in the appropriate amounts, again to ensure that we are not getting too little or too much food. For example, the youngest child needs less while the eldest child needs more amount of food for each meal.
- ✓ **The thickness of foods/consistency** (not too thick as to have difficulty chewing or swallowing, not too watery). The thickness of foods/ consistency is an important factor in eating well because if food is too thick, it might make it difficult to chew and swallow. However, if food is too watery, the energy value of the food is reduced.
- ✓ **Variety of different foods** from each food group. It is important to have a variety of foods from each food group to eat well. Use fortified foods, when available; give vitamin/ mineral supplements when animal products, fortified foods, or micronutrient (vitamin A, Fe & Zn) rich foods are not readily available.
- ✓ **Active feeding** is important for the child during complementary feeding. Children need to be supported and encouraged to feed by feeding them with a small spoon, cup and plate. They should also be encouraged and promised with rewards so that they eat the desired amounts of food per meal.
- ✓ **Food Hygiene.** Proper hygiene practices will prevent disease occurrences and hence ensure good child growth and development: washing hands before eating and handling foods for the child, clean utensils and clean water are important and reduce the risk of diseases.

Table 7: Frequency, amount, thickness and variety of foods by child age-group

Age	Texture	Frequency	Amount
6–9 months	Start with thick porridge, well-mashed foods. Continue with mashed family foods.	2–3 meals per day plus frequent breastfeeding. Based on the child’s appetite, 1–2 snacks may be offered.	Start with 2–3 tablespoons per feed increasing gradually to half of a 250 ml cup.
9–12 months	Finely chopped or mashed food and foods that the baby can pick with fingers.	3–4 meals per day and 1–2 snack.	Half a cup at each meal.
12–24 months	Family foods; chopped or mashed if necessary.	3–4 meals plus frequent breastfeeding, based on a child’s appetite. 1–2 snacks may be offered.	Half of a 250 ml cup/bowl.



Figure 10: A mother feeds a 6–8 months old baby; breastfeeds and feeds thick complementary foods made from a variety of foods that are made soft or mashed



Figure 11: A mother breastfeeds and actively feeds the child soft, thick foods prepared from a variety of foods from the food groups.



Figure 12: A mother encourages and supervises her child's feeding following the six principles of complementary feeding practice from the age of 12–24 months.

Key messages

- From 6 months and beyond, children should be fed on other foods on top of the mother's breast milk. Breastmilk should form the foundation of the child's diet between the ages of 0 to 2 years.
- Use bio-fortified and/or fortified foods, when available; give vitamin/mineral supplements when animal products, fortified foods, or micronutrient (vitamin A, iron and zinc) rich foods are not readily available.
- Mothers should continue to breastfeed their babies up to the age of 2 years or more even after introducing complementary feeding (weaning). Give food daily according to age, for example 6–8 months feed 2–3 times a day; 9–11 months feed 3–4 times a day; 12–24 months: feed 4–5 meals a day.

CHAPTER FIVE: NON-COMMUNICABLE DISEASE PREVENTION AND HEALTHY LIFESTYLE

This chapter brings out key dietary, physical activity and lifestyle concerns and linkages to non-communicable diseases prevention and control.

5.1 Non-communicable diseases

- ⇒ Non-communicable diseases (NCD) are diseases that are ***not transmissible directly from one person to another***.
- ⇒ They may be chronic (onset is slow and gradual) or acute (immediate onset).
- ⇒ Some of the most common NCDs include most heart diseases, most cancers, diabetes, strokes, chronic kidney disease, osteoarthritis, osteoporosis, Parkinson's disease, autoimmune diseases, Alzheimer's disease, cataracts, and others.

In **Uganda**, 33% of annual deaths are attributed to the five leading **NCDs**; notably cardiovascular diseases, cancers, diabetes among others. An estimated 5% of the adult population are obese while up to 24% have a raised blood pressure ¹¹.

5.2 Risk factors of non-communicable diseases

- ⇒ The risk factors of non-communicable diseases can be grouped under modifiable risk factors and non-modifiable risk factors.

Modifiable risk factors

- ⇒ Modifiable risk factors are behaviours and exposures that can increase a person's risk of non-communicable diseases. They are modifiable because they can be changed depending on an individual's compliance.
 - (i) **Unhealthy diets:** These are diets that are not balanced and not safe leading to disease and conditions such as raised blood pressure, increased blood glucose, elevated blood lipids, overweight, obesity and related consequences.
 - (ii) **Physical inactivity:** Sedentary lifestyle or lack of physical activity in adults increases the risk of heart disease, stroke, diabetes, and breast and colon

¹¹World Health Organisation (2018). *Non-communicable diseases country profile – Uganda*. Geneva: WHO.

cancer since physical inactivity is also linked to raised blood pressure, increased blood glucose, elevated blood lipids and obesity.

- (iii) **Lifestyle:** Poor lifestyles habits like tobacco use and alcohol abuse can also increase an individual's risk of developing non-communicable diseases. Smokers have more than twice the risk of developing cardiovascular disease. Passive smoking also increases the risk even for non-smokers.

Non-modifiable risk factors

Modifiable risk factors are conditions that can increase a person's risk of non-communicable diseases. They are non-modifiable because they cannot be changed.

- (i) **Age:** Increase in age increases the risk of developing NCDs due to increased wear and tyre, the decline in hormonal function, and increased deposition of fat among others.
- (ii) **Gender:** Heart disease has long been considered to be primarily a men's disease. Although women tend to develop cardiovascular disease about 10 years later in life than men, the outcome for women is often worse.
- (iii) **Family history:** An individual's risk for developing non-communicable disease increases if they have a relative who developed it early, before age 55. If a parent developed a non-communicable later in life, it may be age-related rather than genetic.

5.3 Prevention of non-communicable diseases

An important way to control NCDs is to focus on reducing the risk factors associated with these diseases.

- (i) Exercise regularly; at least 30 minutes of moderate physical activity daily for at least 5 days a week. In school and communities, physical exercise and related activities should be deliberately promoted. In schools, physical exercise can be innovatively stepped up by integrating school garden practices geared towards the production of fruits and vegetables, targeted towards the supply of immune-boosting foods to the learners.
- (ii) Avoid alcohol abuse for example not more than two 330mls of standard beer a day for males and one for females.

- (iii) Ensure healthy food choices. Eat healthy foods (safe and nutritious) with wholesome foods that have less fat, less sugar and less salt. Deliberately eat plenty of immune-boosting foods especially vegetables and fresh fruits. Avoid adding raw salt in food.
- (iv) Have a health check at least once a year. Visit your health worker even if you have no complaint about a medical check-up.
- (v) Avoid tobacco use in any form (smoking, chewing or mixing with shisha).
- (vi) Minimize salt intake especially the addition of raw salt to food.



Figure 13: Illustration of physical activities and habit to avoid to reduce NCD risk

Key message

- NCDs are increasingly becoming common and stressing many families in Uganda. The most cost-effective approach to prevention, especially for a resource-poor community, is through using healthy diets, physical activity and desirable lifestyles.
- Prioritize production and consumption of immune-boosting foods especially fruits and vegetables in the community
- Innovatively step up physical activities in homes, schools and other institutions.

CHAPTER SIX: WATER, SANITATION AND HYGIENE PRACTICES (WASH)

Water, sanitation and hygiene practices are very important for addressing malnutrition. This chapter highlights the importance of; safe water for domestic use, improved toilet facilities and waste disposal, handwashing and handwashing facilities, use of sanitizers and good hygiene practices. WASH practices benefit everyone, and integrating these practices into nutrition care programmes provides additional opportunities and resources to improve overall health outcomes.

6.1 Why is WASH important?

- ⇒ Poor environmental and personal hygiene is a breeding ground for infectious diseases that compromise immunity and results in lack of proper utilisation of food by the body.
- ⇒ **Environmental hygiene** entails promoting health through the prevention of human contact with the hazards associated with the lack of healthy food, clean water and healthful housing, the control of vectors (living organisms that transmit diseases), and a clean environment. On the other hand, **Personal hygiene** is how to care for the body. It includes practices like bathing, hand washing, laundry and brushing teeth among others. Good WASH practices protect household members from contracting water-related, water-borne and water vector-borne diseases.
- ⇒ A healthier and stronger household is more economically viable and resilient in the face of nutritional challenges.

6.2 How do we ensure that water for domestic use is safe?

- ⇒ To ensure that water for domestic use is safe, extension workers should support households to put the following measures in place:
 - (i) Domestic water sources should be protected from contamination.
 - (ii) Ensure simple and low-cost technologies are used for treating and safely storing water at the household level: chlorination; use of aqua safe and water guard, use of various types of filters; proper boiling.

- (iii) All drinking water should be boiled to boiling point (with boiling bubbles), including harvested rain and spring water.
- (iv) Drinking water should be kept in clean containers and covered at all times to avoid contamination.

6.3 Handwashing

- ⇒ Hand washing is an act of cleaning hands with clean water and soap or other detergents to prevent the spread of germs, viruses.
- ⇒ If done properly and at critical times, handwashing is effective in preventing diarrhoeal diseases and other undesirable health consequences linked to poor hygiene.
- ⇒ It is recommended to wash hands with soap before and after touching food, including milk, meat, ghee, cream and crop-based food.
- ⇒ The following are the key steps in proper handwashing:
 - (i) Wet your hands with clean — preferably running — water.
 - (ii) Apply enough soap to cover all surfaces of your hands and wrists.
 - (iii) Lather and rub your hands together briskly and thoroughly.
 - (iv) Scrub your hands and wrists for at least 20 seconds.
 - (v) Rinse your hands and wrists under clean running water.



Figure 14: Illustrations of handwashing and hygiene practices

6.4 Hand sanitizer and prevention of germs and viruses

- ⇒ Sanitizers are a formulation in the form of liquid, gel or foam generally used to decrease infectious agents on the hands.
- ⇒ They became popular in the recent times of the COVID-19 global pandemic.
- ⇒ Some versions contain fragrances; however, these are discouraged due to the risk of allergic reactions.
- ⇒ Alcohol-based versions are more effective than non-alcohol-based. They protect against a wide variety of microorganisms. They contain 60% to 95% alcohol and are flammable; need to be used with caution.

⇒ Emphasis should be handwashing with soap given the costs of sanitizers.



Figure 15: Examples of common sanitizers in Uganda



Figure 16: Messages on sanitizer use against COVID 19 diseases by the Ministry of Health in 2020

6.5 Food hygiene

- ⇒ Food hygiene encompasses all processes that ensure food is fit for human consumption.
- ⇒ Food can be contaminated at any point during slaughtering or harvesting, processing, storage, distribution, transportation and preparation. Extension workers should ensure that at all these stages, food is hygienic.



Figure 17: Illustration of food and kitchen hygiene practices. Advisable to wash fruits and vegetables under running water

Good practices to ensure food hygiene

- (i) Wash hands properly before handling, preparing and eating food.
- (ii) Wash the knives, chopping boards and all surfaces thoroughly with clean water and soap before and after use.
- (iii) Prepare and serve food when hot.
- (iv) Always boil/reheat leftover food thoroughly before eating. Cover well all the foods in the house away from flies and other pests.
- (v) Keep the kitchen clean at all times.
- (vi) Keep cooked food away from contact with raw food.
- (vii) Avoid eating mouldy or rotten food.
- (viii) Wash vegetables and fruits with clean water at least three times before cutting them for further utilisation.
- (ix) Avoid taking raw or partially cooked foods of animal origin.
- (x) All food grains and seeds such as maize and groundnuts should be properly dried and stored following recommended practices.



Figure 18: Good hygiene practices in cleaning utensils and safeguarding drinking water

Key message

- During food handling and utilisation, always refer to food hygiene and safety standards from the competent authorities of government or international organization.
- Extension workers should develop and disseminate messages on personal hygiene, food hygiene and environmental hygiene during WASH-related activities.

6.6 Ensuring good kitchen hygiene, safety and housekeeping

- (i) The kitchen and house should be kept clean because it can be a serious cause of food contamination if it is not well tended to.
- (ii) The inside of the house should be kept neat and invitingly well-organized/arranged to allow thorough cleaning.
- (iii) The kitchen should have a door for the safety of the items kept there.
- (iv) Keep the inside of the house tidy by regular cleaning.
- (v) Kitchens should have good ventilation to avoid the growth of fungi and mould.
- (vi) There should be a simple rubbish bin for putting in refuse before disposal into the compost pit. The rubbish bin should have a cover.
- (vii) Use fuel-saving stoves.

6.7 Proper refuse disposal

- ⇒ Wastes and kitchen refuse should not be littered everywhere in the compound lest flies will be invited.

- (i) Use a garbage bin/pit for the disposal of wastes generated in the home.
- (ii) A compost pit should be dug in the kitchen's vicinity to accommodate kitchen and house refuse.
- (iii) Garbage should be burnt or buried in garbage pits to avoid breeding grounds of pests and rodents.
- (iv) Before disposal, to the compost pit, non-degradable garbage such as polythene bags should be separated out and preferably recycled in the appropriate facility.
- (v) Innovative re-use of polythene bags for instance in small scale vegetable production is a good option to reduce their potential stress on the environment.
- (vi) Compost manure from these pits can be used for agricultural purposes to improve soil fertility. This in turn is nutrition enhancing.

6.8 Sanitation facilities

- ⇒ Sanitation is the process of keeping public places clean and healthy.
- ⇒ To ensure sanitation, the public should have the following sanitation facilities: Latrines/ toilets, hand washing facilities, storage facilities, waste disposal facilities, transportation facilities and tools and equipment such as blades, nail cutters etc.
- ⇒ If these sanitation facilities and sanitation tools and equipment are properly put to use, the rate of contaminated food is reduced. The absence of the same leads to the spread of germs, viruses, diarrhoea plus other related diseases.
- ⇒ Some of the ways on how to make use of the sanitation facilities include:
 - (i) Latrine should be located at least 10 metres (30 feet) from the main house and routinely maintained and roofed:
 - (ii) Kept clean and free from flies by routine sweeping and smoking, or by applying used car oil.
 - (iii) Have a door and a cover for the latrine hole. Improved latrines, e.g., Ventilated Improved Pit (VIP) latrines are recommended.

- (iv) A handwashing facility such as a tap with running water or locally fabricated handwashing facility (tippy tap) should be strategically positioned near the latrine for hand wash water and soap/ash after visiting the latrine.
- (vii) Institutions such as schools should put in place persons and activities that promote hygiene and sanitation such as sanitation clubs, prefects and integrating with co-curricular activities such as drama competitions.

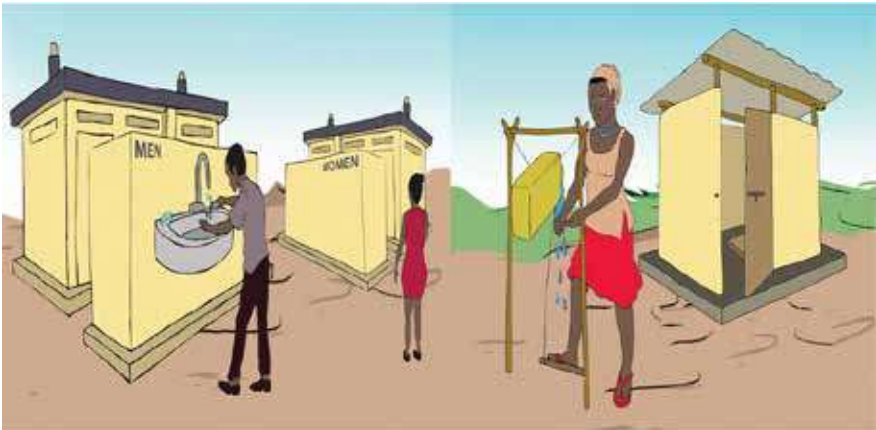


Figure 19: Illustration emphasising handwashing after visiting the toilet

6.9 Clean home and environment

- ⇒ A clean, organized home environment prevents us from diseases, keeps us comfortable and adds beauty and scenic appeal to our homes.
- ⇒ It is possible to attain good standards of hygiene and sanitation regardless of where we live and under what conditions we live in.
- ⇒ By maintaining a clean environment through practising proper sanitation and hygiene, we prevent many infections and therefore save on resources; money, energy and time for treatment.
- ⇒ It is important to emphasize the following practices:
 - (i) Ensure good personal hygiene by regularly bathing, washing your clothes, trimming hair and nails.
 - (ii) The home surrounding should be kept clean by:

- (iii) Sweeping the compound every day and keeping the compound grass shortened/trimmed (avoid bushy compounds).
- (iv) Draining all stagnant water around the house to keep away the mosquitoes.
- (v) Building animal houses.
- (vi) Authorities responsible for physical planning should ensure that waste management facilities such as drainage systems are in place.



Figure 20: An organized home environment.

Key message

- In addition to the balanced diet, ensure an organized, clean health environment at household and consumption of safe food for all household members.
- Without proper WASH practices, there is exposure to infections and diseases and food consumed even if nutritious will be poorly utilized.
- Wash hands appropriately as frequently as possible as a means of reducing the prevalence of many diseases.
- An organised home environment should have a rubbish pit, a separate kitchen, a separate house for animals, place for hanging washed clothes, plates drying rack, latrine and water to wash after visiting latrine.

CHAPTER SEVEN: NUTRITION-SENSITIVE ACTIONS IN AGRICULTURE

This chapter highlights key nutrition-sensitive actions in agriculture that are vital for achieving food and nutrition security.

7.1 Agriculture and nutrition linkages in Uganda

- ⇒ Uganda is generally food self-sufficient and has more than two-thirds of its population depending on agriculture for their employment and livelihoods.
- ⇒ The Agriculture Sector, therefore, plays a central role and carries the heaviest burden in promoting and ensuring food and nutrition security in the country.
- ⇒ Nutritional well-being requires access to enough nutritious and safe food to meet the dietary needs of all members of the household throughout the year.
- ⇒ Attaining better food supplies and nutritional well-being is more than just producing enough food locally. It also requires sufficient resources (such as land and labour), tools, skills and knowledge.
- ⇒ Marketing infrastructure is necessary so that food and other essentials can reach users.
- ⇒ Through agriculture, household members can find employment, create disposal income as well as have access to other commercial and government services that improve their livelihoods.

7.2 Planning nutrition-sensitive agriculture: needs identification

The process of identification of consumer (farmers & market actors) needs is the first entry point for the integration of nutrition services.

Keys considerations relevant to nutrition in needs identification:

- (i) **Quality of food:** Encourage farmer group to plan for diversified food which is nutrient-rich including fruits and vegetables; bio-fortified foods; animal source products.

- (ii) **Ensure male and female involvement in participatory planning:** In Uganda, women provide the majority of the labour force in agriculture and are the main caregivers in homes. Therefore, they need to be deliberately targeted to increase farm productivity and adaptation of positive childcare practices.
- (iii) **Involvement of the most vulnerable farming households:** Traditional extension has focussed on well-to-do households who have land and other means for food production, and ignored the vulnerable poor because they don't easily adopt the practices and technologies being promoted. Ending malnutrition requires affirmative action programmes targeting the most vulnerable poor.
- (iv) **Labour saving technologies:** Provision of agriculture labour has a direct effect on childcare practices within agricultural households. Planning should focus on adoption of labour-saving technologies to free time for the provision of child care.
- (v) **Involvement of the youth:** Uganda has a predominantly young population and the youth are the majority in most communities. They typically avoid careers in the agriculture and food systems especially those involving heavy workload and longer-term revenue flows. Involvement of the youth is critical in building the next generation of agricultural leaders and creating sustainable change.
- (vi) **Information sharing:** During planning ensure that farmer groups provide a forum to discuss nutrition issues. Extension workers should enable farmers to identify and articulate their food and nutrition needs.
- (vii) **Selection of enterprise mixes that have high nutritional value:** There is a tendency to focus on high yielding and profitable products in farming as a business. Extension workers should encourage and ensure farmer enterprise selection provides for both nutrition and income generation benefits.
- (viii) **A multi-sectoral and multi-disciplinary approach** is also vital given the cross-cutting nature of food and nutrition security.

Key message

- Encourage equitable male and female in the selection of agriculture needs
- Ensure the diversification of farm needs to include both animal and crop products.
- Integrate child care considerations in the enterprise mix design.
- Select enterprises that maximize both income and nutrition.
- Emphasize quality and safe food for improved nutrition.
- Involve vulnerable farming households in agricultural development activities.
- Integrate nutrition awareness campaigns in the agricultural extension system.

Agriculture-based interventions to prevent malnutrition

- Promoting the production and consumption of nutrient-rich foods, biofortified foods and animals.
- Encouraging proper food preparation and feeding practices.
- Promoting nutrition education and good child-caring practices.
- Supporting and promoting labour and cost-saving technologies to reduce women's workload such as the establishment of woodlots, water harvesting technologies and various energy-saving technologies.
- Promoting household and community-level food processing technologies that are efficient.
- Promoting good post-harvest handling practices and food safety along the value chain.
- Promoting water, sanitation and hygiene (WASH) practices.
- Promoting community-based food and nutrition information system to track vulnerable households and communities for corrective action.
- Integrating appropriate essential nutrition actions in the agricultural extension system.
- Mainstreaming gender considerations in agriculture programmes.
- Integrate nutrition along the strategic agricultural value chains by promoting the production of bio-fortified food varieties for the selected strategic enterprises, e.g., vitamin A and protein-rich maize, iron-rich beans, vitamin A-rich bananas and cassava.

7.3 Nutrition-sensitive agriculture production practices

There are at least 6 nutrition-sensitive agriculture production practices:

- (i) Production of a diversity of crop and animal source foods for a nutrient-dense diet.
- (ii) Promotion of inclusive farming systems or agricultural value chains that conserve the environment and promote nutrition.
- (iii) Promote the use of labour and cost-saving technologies.
- (iv) Ensuring food safety through appropriate food handling practices, control of diseases, agricultural chemical and veterinary drug residues associated with food production systems.
- (v) Integrate gender consideration in agricultural production practices.
- (vi) Design enterprise mixes or mixed farming systems to mitigate food and nutrition insecurity risk especially for the vulnerable groups.

7.3.1 Production of diverse crop and animal source foods for nutrient-dense diets

- ⇒ Farmers should be encouraged to develop an integrated farm plan that provides land for rearing animals/small livestock, growing edible insects and for crop production especially fruits and vegetables which are high in nutrients yet require limited agriculture inputs or land.
- ⇒ The focus should be on:
 - (i) Food should be grown on fertile soils that are rich in nutrients.
 - (ii) Follow good agronomic practices.
 - (iii) Foods that are rich in essential nutrients especially vitamins, minerals and proteins.
 - (iv) Encourage kitchen gardens and growing of fruits.

7.3.2 Adoption of farming systems that conserve the environment and promote nutrition

- ⇒ Intercropping or crop rotation is one of the farming systems that have soil health and nutrition benefits.

- ⇒ Legumes are ideal for mixed cropping with other crops because they fix nitrogen in the soil resulting in improved soil health and high yields.
- ⇒ Others climate-smart agriculture interventions would include:
 - (i) Agroforestry.
 - (ii) Integrated farming systems (animal & plants).
 - (iii) Soil and water conservation practices.
 - (iv) Organic/sustainable agriculture.

7.3.3 Promote use of labour and cost-saving technologies

- ⇒ The use of labour and cost-saving technologies such as rainwater harvesting.
- ⇒ Use of animal traction (ploughing, carrying manure/mulch, water, firewood and harvest).
- ⇒ Improved cooking stoves to conserve energy, save labour and the environment.
- ⇒ Planting of woodlots.
- ⇒ Minimum tillage (use of pesticides and herbicides) will reduce women workload and allow ample time for child care.
- ⇒ Sustainable land use and management practices.



Figure 21: Energy saving stove and briquettes used as environmentally friendly fuel

7.3.4 Controlling diseases, agricultural chemical and veterinary drug residues associated with food production systems

These diseases can be broadly classified as follows:

- (i) *Water-associated/waterborne diseases* caused by use of contaminated water with faecal material (cholera) and chemical intoxication. In addition to this category are the diseases caused by vectors living in stagnant water and or storage systems (Malaria, River blindness and Schistosomiasis/Bilharzia worms among others).
- (ii) *Zoonotic diseases* transmitted from animals to human beings and vice versa include Tuberculosis, Brucellosis, Salmonellosis, Rabies, SARS/Avian Influenza, Anthrax, Trypanosomiasis, COVID-19 and Ebola among others. Control of these diseases is important because they impose poor health and attendant undesirable nutrition-related effects including the disease burden.
- (iii) *Occupational disease* as a result of exposure due to improper handling of agricultural chemicals and drug resistance as a result of exposure to antibiotics or continuous use of drugs of the same formulation in animals for a long time or wrong use of drugs / antibiotics i.e. over or under dose.
- (iv) *Foodborne diseases* such as cholera, typhoid and brucellosis are also health threats that can be prevented by the farm-level interventions.

7.3.5 Integrated farming systems with in-built risk mitigation

- ⇒ Agriculture enterprises should be oriented towards mitigation of food insecurity and malnutrition risks in addition to focusing on on-farm and off-farm incomes.
- ⇒ The risk should also cushion from effects of market and natural/environment risk, especially for the vulnerable groups.
- ⇒ Requires enterprise diversification that produces a product that has value in domestic, regional and if possible international markets:
 - (i) Promotion of crops and animals that are resilient to the adverse effects of climate change.
 - (ii) Promotion of urban farming systems for the vulnerable poor in towns.

- (iii) Establishment of school, home orchards and gardens.
- (iv) Integrating community-based food security information system as part of agricultural extension.
- (v) Design integrated agricultural enterprise mixes or value chains that ensure stable food supply all year, active participation of the vulnerable groups and with the more frequent flow of incomes. Of particular importance is the need to have year-round production systems through the promotion of irrigation technologies tailored for resource-poor settings.

Key message

- Promote the production of a variety of crop and animal source foods to ensure a diversified diet.
- Control diseases associated with the agriculture systems.
- Promote the use of labour and energy-saving technologies.
- Integrate gender consideration in agricultural production.
- Adoption of farming systems that conserve the environment and promote nutrition.
- Design integrated farming systems or agricultural value chains with inbuilt risk mitigation (market and natural/environment risk).

7.4 Nutrition considerations in the harvest and postharvest practices

7.4.1 The challenge of harvest and post-harvest losses

Agricultural produce in Uganda can be classified into three categories based on their degree of perishability:

- (i) Non-perishable/Durable produce that takes longer to deteriorate e.g. cereals, legumes, honey and oils
- (ii) Semi-perishable e.g. roots, tubers, bulbs and rhizomes.
- (iii) Perishable produce e.g. meat, milk, fruits and vegetables.

Harvest and postharvest handling practices for cereals, legumes, fruits and vegetables in Uganda are characterized by traditional practices that result in considerable deterioration in the physical and nutritional qualities of the harvested produce resulting in high losses.

Losses in food quality and quantity are mainly attributable to the absence of adequate processing and preservation among farming households; poor handling during loading and unloading at market points; bruising, puncturing, and crushing; absence of grading especially for fruits and vegetables and inadequate knowledge on processing among farmers.

7.4.2 Promote harvesting at the correct maturity stage

- (i) Harvest food at the right stage of maturity to ensure maximum nutrient availability. For example, most fruits and vegetables have greater vitamin content if they are picked ripe from the plant, rather than being picked before they have fully ripened.
- (ii) Avoid physical and mechanical damages during harvesting to ensure longer storage and safe food following the harvest.

7.4.3 Drying food after harvesting

- (i) Drying of produce should be done on a clean and dry surface such as tarpaulins to reduce the risk of contamination.
- (ii) Where possible, drying can be done on a raised platform above the ground to reduce contamination.

7.4.4 Discourage processing practices that contaminate the harvest

- (i) Ensure crop is not left on the ground or bare soil during drying, shelling and threshing, where fungal spores develop.
- (ii) The practice of moistening the unshelled nuts to make them easier to shell results in higher contamination from aflatoxin and should therefore be strictly discouraged.
- (iii) Clean and sort to remove broken kernels, foreign matter, and diseased and rotten foods (grains, nuts, fruits, vegetables); these attract moisture and pests leading to spoilage and/or fungal growth.
- (iv) Ensure crops are properly dried immediately after harvesting; however, drying will not reverse the effect of poison in the already

contaminated foods, but it may inhibit further growth of moulds and other microbes.

7.4.5 Promote storage to protect the nutrient content of the foods

- (i) Proper storage spaces should have pathways to allow good airflow.
- (ii) Ensure timely pest control interventions.
- (iii) Ensure that grains are bagged in natural clean bags for storage (not plastic).
- (iv) Improved storage and storage techniques can increase the availability of nutritious foods during the lean season, reduce food safety concerns such as aflatoxin and increase marketability and trade of nutritious foods.

7.4.6 Distribution

- ⇒ Distribution should ensure that the risks of contamination are minimized. For example, containers should be clean, dry and protected from rain and extreme weather conditions.



Figure 22: Depicting poor food storage (left) and distribution (2nd left) and a simple traditional food storage unit or granary (2nd right) and an improved hermetic storage bag (right)

7.4.7 Household agro-processing and value addition

- ⇒ Household or on-farm processing gives food security and nutrition benefits including higher, potentially stable, regular disposable incomes, nutritious and easy to handle or use products (convenient).



Figure 23: A ground nuts thresher at home is a good value addition and labour-saving equipment

- ⇒ Many foods that are transported to the urban centres and other markets in fresh form result in considerable soil nutrient mining of the production areas and burdening of the waste disposal systems in the target markets. On-farm value-addition is thus a key component of sustainable farming systems.
- ⇒ Household level value-addition potentially enhances quality, safety, market value, household participation in the market and control, bargaining power and ultimately improved incomes.

Key message

- Use recommended good agricultural or handling practices at all stages of the value chain to minimise postharvest food losses.
- Harvest food at the right stage of maturity. Avoid harvesting immature or over-mature crops. For fruits, don't harvest under-ripe or overripe ones).
- Follow recommended storage practices for perishables (fresh fruits, vegetables, meat, fish, poultry and eggs) and non-perishables (cereals and legumes).
- Maintain hygienic environment wherever food is produced and handled.
- Practice appropriate food preservation at home such as drying, smoking or salting of meat and fish and preservation of fruits and vegetables using solar drying.
- Always strike a balance between food for the home and that for the market.
- Deliberately promote household level value addition & recycling of by-products on the farm for other production activities.
- Use food-grade equipment and materials for food processing.

7.5 Food safety in agriculture

7.5.1 What is food safety?

- ⇒ Food safety describes the production, handling, preparation and storage of food in ways that prevent foodborne illnesses. This includes routine activities that should be followed to avoid potential health hazards.

Food safety is the protection of consumers from injury or adverse health effects caused by consuming or handling spoilt, contaminated, adulterated or badly stored foods.

7.5.2 Key issues around food safety

- ⇒ Issues of food safety are gaining prominence every day worldwide because of their negative consequences on human health and distortion of trading systems.
- ⇒ Microorganisms (bacteria, fungi, viruses) are the leading cause of food poisoning in the world.
- ⇒ Food is unsafe for human consumption when the concentrations of the following (referred to as hazards) are above tolerance levels:
 - (i) Microorganisms (bacteria, fungi, viruses), parasites.
 - (ii) Biological toxins such as mycotoxins.
 - (iii) Physical materials like metal chips, sand, faecal material, stones
 - (iv) Chemical fertilizer residues, veterinary drug residues, pesticide residues and heavy metals contaminants such as Lead, Cadmium, Arsenic, Mercury, Copper and others.
- ⇒ Physical aspects of food items affected by microbial activity with potential toxin formation include the following:
 - (i) Discolouration.
 - (ii) Mouldy and other unpleasant tastes.
 - (iii) Production of off odour.

7.5.3 Importance of food safety in Uganda

- ⇒ As the country develops, an increasing percentage of the population is eating food prepared from outside the home or at least processed away from home.
- ⇒ Most of the current practices of food production, postharvest handling, processing, packaging, transportation, retailing and food preparation in the homes, street food vending and some restaurants may lead to food becoming unsafe for consumption.
- ⇒ Food safety-related illnesses and problems such as cancer prevalence are now a common occurrence in Uganda.
- ⇒ Much of this burden of illness results from basic sanitation failures that occur in food production, processing, storage, transportation, retailing and handling in the home or streets, restaurants and hotels.

7.5.4 Potential hazards associated with food in Uganda

- (i) **Microbial pathogens** for example salmonella, campylobacter and *Escherichia coli* (*E. coli*) are associated with Diarrhoea diseases.
- (ii) **Zoonotic diseases** transmitted from animals to humans through food products, for example, tuberculosis and brucellosis.
- (iii) **Parasitic organisms**, in particular cysticercosis, tapeworms and other intestinal worms from poorly cooked pork or beef.
- (iv) **Naturally occurring toxicants**, for example, mycotoxins like aflatoxin.
- (v) **Agrochemical and veterinary drug residues** arising from improper use of agrochemicals (Fertilizers and Pesticides) on crops in the field and storage; and improper use of veterinary drugs on livestock and fish.
- (vi) **Heavy metals contaminants** such as lead and mercury that cause neurological damage in infants and children. Cadmium leads to Cancer and organ system toxicity.
- (vii) **Physical contaminants and adulterants** for example glass, metal, animal faecal materials, sand, soil, stones, grass.

7.5.5 Food safety issues of concern in Uganda

- (i) **Cereals & pulses:** Groundnuts, Maize, sorghum contamination by Aflatoxin and Fusarium (*fumonisins*), this is highly prevalent but is not checked neither is there any regulation or control measures in place.
- (ii) **Dairy products:** *Brucella abortus*, *E. coli*, Coliforms, Tuberculosis are of interest. The Dairy Development Authority (DDA) and Uganda National Bureau of Standards (UNBS) laboratories carry tests for coliforms, *Escherichia coli*, total plate count, salmonella and staphylococcus.
- (iii) **Fish:** Contamination of freshwater bodies and poor fishing methods such as the use of explosives is a common source of contamination in fish. They expose fish to harmful microorganisms such as *Vibrio cholerae*, *Salmonella*, and poisoning by chemicals especially lead, mercury, pesticides, *Escherichia coli*, *Salmonella* and *Campylobacter*.
- (iv) **Beef and Pork:** Anthrax, Tuberculosis, Brucellosis are the zoonoses of interest. Cysticercosis and trichinosis are diseases arising from the consumption of meat infested with parasitic cysts.
- (v) **Water:** Water quality testing is done by the National Water laboratory under Ministry of Water and Environment on microbes (*Escherichia coli*, *Vibrio cholera*, *Staphylococcus aureus*, coliforms and plate counts) and nutrient/organic matter. However, contamination usually arises from the water distribution (pipes) network which is mostly old and might need to be replaced and adequately maintained.
- (vi) **Methanol poisoning:** methanol content exceeding acceptable levels is now a common problem in the country due to inadequate regulation of local distilleries.
- (vii) **Street vending:** Various microbial contaminants, dust, physical contaminants and chemical abuse adulterations e.g. the alleged use of Paracetamol (Panadol) in beans are common with street food vending. *The alleged application of glyphosate on green bean pods to turn yellow and on maize so that it dries faster are very wrong practices. Glyphosate is a weed killer and not to be used on food for human or animal use.*

- (viii) **Fertilizers and pesticides** contaminate water sources when applied in close proximity with them. Farmers who clean the knapsack sprayers very close to the wells will contaminate the water wells through drainage. Drinking water with high levels of Nitrates from the chemical fertilizers causes blue baby syndrome in infants. Nitrates and Nitrites in food cause cancer, decreased oxygen-carrying capacity of blood and Vitamin A deficiency.



Figure 24: Pesticide runoff in a water well. Water sources are one of the sensitive areas that should be protected from direct pesticide contact.

7.5.6 Effects of foodborne diseases

- (i) Foodborne diseases cause acute illnesses, disability and even early death.
- (ii) Increase the risk of chronic diseases such as cancer.
- (iii) Mostly affects vulnerable populations including children, pregnant women, the elderly, and people already affected by other diseases.

- (iv) Foodborne diseases significantly affect people's health and wellbeing, reduce economic productivity resulting in a substantial burden on healthcare systems.
- (v) Economic consequences for individuals, families, communities and businesses.

7.5.7 Aflatoxin/mycotoxin effects on health and agriculture

- ⇒ Mycotoxins are toxins produced by moulds when they contaminate food
- ⇒ Aflatoxins are a type of mycotoxins caused by the moulds *Aspergillus spp* and are especially associated with foodstuffs commonly dried, for example, maize, groundnuts, sorghum and cassava among others. They also occur in animal feeds made from contaminated raw materials. They are of health and economic significance because:
 - (i) Aflatoxins can cause acute toxicity leading to death or chronic toxicity leading to liver cancers, immune suppression, Kwashiorkor and stunted growth. They can also enhance the effects of hepatitis B-virus
 - (ii) Aflatoxins are also harmful to animals for instance, in poultry production, it reduces feed intake, reduces egg production, has carryover in eggs and meat and causes death.



Figure 25: Typical mould infected maize and nuts due to poor post-harvest handling: Could also be contaminated with aflatoxins



Figure 26: Aflatoxin toxicity can lead to liver jaundice (yellow eyes and skin) due to liver disease and even death, including animals and birds that eat contaminated feed

7.5.8 Recommendations for aflatoxin prevention and control

- (i) Timely harvesting of produce and avoid drying products in the field. For example, drying maize in the field promotes mould, insect and aflatoxin contamination.
- (ii) After harvest, the produce should not be dried on bare ground. Farmers should use clean drying materials especially tarpaulins.
- (iii) The produce should be dried to a moisture content between 12% to 14% for safe storage with minimum deterioration.
- (iv) Farmers should ensure good agricultural practices (GAP).
- (v) The produce should be dried rapidly to limit mould proliferation that may lead to aflatoxin production.
- (vi) The produce should be stored in clean, sound bags (interwoven polypropylene or fibre bags) off the floor. This can be made possible by putting the bags on pallets or logs.
- (vii) Storage of produce in hermetic bags and use of insecticides can help improve the quality of produce and reduce levels of aflatoxins.
- (viii) The store should be clean and well-ventilated and should not allow rewetting of produce due to moisture from the environment.

- (ix) Integrated pre- and post-harvesting interventions should be put into consideration because aflatoxins are heat stable, even dry roasting does not remove aflatoxin contamination.
- (x) Hand sorting at the household level helps to remove the worst grain. The sorted-out grain should not be consumed or given to animals as these have high chances of being contaminated with aflatoxins.
- (xi) There is need for mass education and awareness at all levels on aflatoxin risk minimization and screening of critical control points.
- (xii) Quality assurance of animal feeds should be done to minimise aflatoxin spread and effects in the food value chain.

Taking responsibility for food safety

- (i) Extension workers should to train and sensitize farmers, consumers and all stakeholders in the food value chain, on the need for good handling practices.
- (ii) Application of agrochemical should be done strictly following recommended practices and with a deliberate intention to ensure safe levels of chemical residues in the marketed products. It is important to avoid harvesting newly sprayed crops i.e. observe the post-harvest interval (PHI) and do not use herbicides to dry crops such as maize in the field
- (iii) When farmers in animal and fisheries production have treated their stocks, the drug withdrawal period for each drug should be observed before the animals or fish are sold for food or the by-products for consumption.
- (iv) Animal and fisheries products are highly perishable so they should be properly handled and cooked before consumption.

Key message

Agriculture interventions cannot ensure food security and nutrition without considering food safety along the agriculture value chain.

7.6 Nutrition consideration in agricultural trade and marketing

- (i) Marketing is key to agricultural production because without it there is no financial return on investment in agriculture.
- (ii) Marketing stimulates and sustains production. Farmers should be guided to seek a market for their products since it makes business sense.

- (iii) However, marketing should not compromise household food security and nutrition for the producer and consumer: Marketing should consider the nutrition needs of the end-user/consumer.
- (iv) Income from the sale of farm produce can be spent on several priority areas but food and nutrition should not be compromised.
- (v) Integration of positive gender relations along the whole agricultural value chain is critical to ensure improved nutrition outcomes from agriculture activities including marketing.

Key message

- Agricultural marketing should ensure food and nutrition security for the producer and consumer.
- Gender relations are very critical in nutrition-sensitive marketing.

7.7 Gender dimensions in agriculture and nutrition

7.7.1 What is gender?

- ⇒ Gender describes the socially constructed roles, activities and responsibilities assigned to women and men in a given culture, location and time.
- ⇒ Gender roles and expectations vary from society to society and from time to time and impact on agricultural production and nutrition.

7.7.2 Implications of uneven role expectations

- (i) Women are overwhelmed with productive and reproductive work.
- (ii) Women's workload impacts on their capacity to pay adequate attention to nutrition issues.
- (iii) Household food allocation expectations traditionally and culturally favour men and this adversely affects the nutrition of women and children contributing to child malnutrition, child and maternal mortality and bad pregnancy outcomes such as obstructed labour, premature birth and low weight babies.
- (iv) Men usually dominate the marketing of farm produce and control farm incomes. They are also more likely to buy non-food items.

7.7.3 Integrating gender considerations in agriculture systems and food security programmes

Both men and women of working age, including youth and persons with disabilities, must participate in agricultural processes to ensure.

- (i) Both men and women should participate in agriculture information and technology transfer.
- (ii) The community selects enterprises that are gender-sensitive.
- (iii) Production decisions are inclusive and selection of enterprises addresses both commercial and nutrition needs.
- (iv) Both men and women should participate in marketing farm produce.
- (v) Women should also be allowed to have control and access to the incomes accrued from their participation in the marketing of foods. It is highly likely that women will use the incomes they have got from food sales to buy other nutritious foods for the whole household.
- (vi) Women should be given the power to access information related to agriculture and health to help them care for the children and produce more food for the household.
- (vii) Energy-saving technologies should be adopted to free women from workloads so that they pay attention to nutrition issues.
- (viii) Women should be encouraged to take part in leadership roles and be part of the decision-making process, even if it begins at the village level. This will enable them to articulate issues that promote food and nutrition security.
- (ix) Women should be encouraged to form or join savings and credit associations as this will ease their access to affordable credit to invest in agricultural production.
- (x) Equitable sharing of roles to ensure women are freed from overburdening workload.
- (xi) Men should actively support women in child care activities and other reproductive roles including family planning decisions, antenatal care, when they are in labour and follow up social support (after labour).

- (xii) Discourage negative food habits and cultural beliefs that inhibit women from taking nutritious foods or result in unfavourable distribution of food within a household

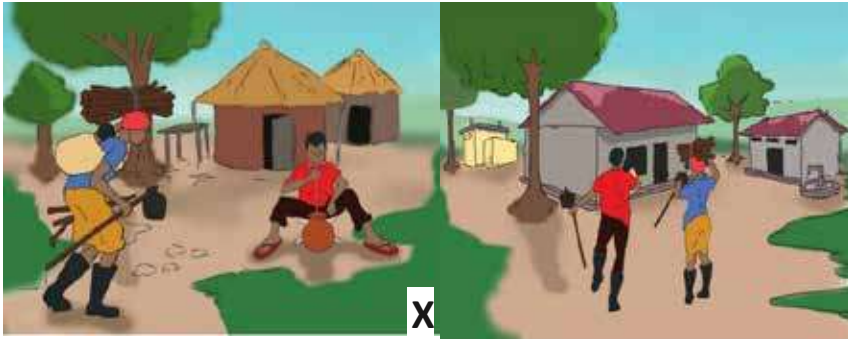


Figure 27: The burden women face; excessive workload and lack of support from partner

Key message

- Women are important gatekeepers for food and nutrition security and should be engaged by extension workers at all level.
- Male involvement in food and nutrition activities should aim at reducing gender disparities and workloads so that women can fully participate in the nutrition and care of children.
- Food habits & cultural beliefs that negatively affect intrahousehold food distribution should be prohibited

CHAPTER EIGHT: SUSTAINABLE FOOD SYSTEMS AND HEALTHY DIETS

This chapter highlights issues on sustainable agriculture, food systems for health diets along the agriculture value chain and underutilized food resources.

8.1 Sustainable food systems for healthy diets

- ⇒ A food system encompasses all of the processes and people involved in taking food from agricultural production through to consumption.
- ⇒ It encompasses the entire range of activities involved in the production, processing, marketing, consumption and disposal of goods that originate from agriculture, forestry or fisheries, including the inputs needed and the outputs generated at each of these steps¹².
- ⇒ A food systems approach to healthy diets focuses on using entry points within the food systems to influence the consumption of healthy diets by populations to attain optimal nutritional status¹³.



According to the World Health Organization, a healthy diet contains fruits and vegetables, whole grains, fibres, nuts and seeds, and with limited free sugars, sugary snacks and beverages, processed meat and salt. In a healthy diet, saturated and industrial trans-fats are replaced with unsaturated fats.

Figure 28: FAO Illustration of the food system in linkage with consumers

¹²FAO. (2017). *Nutrition-sensitive agriculture and food systems in practice: options for intervention*. Rome. FAO. Available at www.fao.org/3/a-i7848e.pdf.

¹³ FAO (2018). *Strengthening sector policies for better food security and nutrition results. Food systems for healthy diets*. Policy Guidance Note 12. Rome: FAO

- ⇒ As shown in the figure, the constituents of a food system involve the people and institutions that initiate or inhibit change as well as the socio-political, economic and technological environment in which these activities take place: food production; food handling, storage and processing; food trade and marketing; consumer demand, food preparation and preferences.

Strategies to promote sustainable food systems for healthy diets

- (i) Enhancing the supply of nutritious food (e.g. increasing production, improving processing, storage and transport capacities)
- (ii) Enhancing the demand for safe, nutritious food with social marketing and behaviour change campaign
- (iii) Adding nutritional value (e.g. ensuring food safety, minimizing food and nutrient loss and waste, applying nutrition-sensitive processing methods such as reformulation and fortification.
- (iv) Promoting pro-resource-poor enterprises and/or value chain activities
- (v) Promoting climate-smart and/or environment-friendly production and consumption practices including the production and utilisation of indigenous foods.

8.2 Promoting indigenous and underutilized food resources

- ⇒ Indigenous foods are foods that are native or were introduced a long time ago, whether locally produced or accessed from the wild; and foods that may be purchased but are recognized as part of a country's traditional food culture.
- ⇒ Indigenous foods are sometimes referred to as underutilized foods resources because of the inadequate exploitation of their potential. Underutilized food resources can also include some parts of other commonly used foods that have potential dietary, nutraceutical and other use beyond food but (that part) is currently poorly utilized e.g. the male flower of bananas, cassava and sweet potato leaves. Indigenous foods are gradually facing extinction or decline in supply and availability. They are thus also called orphan foods.
- ⇒ They have been proven to be of high nutritive value and their contribution to improved health and nutrition is significant. For example, most

indigenous vegetables are higher in micronutrients than exotic vegetables and thus an inexpensive source of a balanced diet.

- ⇒ Indigenous foods are also resilient, being tolerant to stress such as drought and pests and hold great potential to contribute to communities' nutrition and food security.
- ⇒ They are an integral part of the cultural identity of indigenous peoples and are used for various cultural practices and nutritional functions.
- ⇒ Consumption of indigenous fruit and vegetables is known to contribute vital antioxidants, which prevent chronic diseases such as diabetes and hypertension.

8.3 Indigenous foods and food system in Uganda

- ⇒ Uganda ranks among the ten most biodiverse countries in the world with an estimated 1,400 indigenous plant species¹⁴.
- ⇒ The main groups of indigenous and traditional plant and animal foods found in Uganda include:
 - ✓ Cereals: millet, sorghum, traditional maize varieties.
 - ✓ Roots and tubers: yams (a range of varieties), Livingstone potatoes, cocoyam, tania, cassava, sweet potatoes.
 - ✓ Legumes and pulses: climbing beans, bambara nuts, groundnuts and wild cowpea.
 - ✓ Vegetables: amaranth (a range of varieties), African spider plant, African eggplant, black nightshade, bitter berries, local cherry tomatoes, cho-cho etc.
 - ✓ Fruit: guavas, carandas plums, cape gooseberries, jack fruits, sour soup, African breadfruit, and dessert dates.
 - ✓ Animals: cattle: Ankole, Nganda, Zebu; goats: Small East Africa (SEA), Mubende, Kigezi, Karamoja goats; sheep: the Masai, the East African Blackhead, and the East African long-tailed; turkeys: indigenous Ugandan Turkey etc¹⁵.

¹⁴ Bioversity International-Uganda (2019). *Our Biodiversity, Our Food, Our Health*. Kampala: Bioversity International.

¹⁵ FAO (2004). *Uganda: State of the World's Animal Genetic Resources*. Kampala and Rome: Food and Agriculture Organization of the United Nations.

8.4 Threats to indigenous foods in Uganda

- ⇒ Replacement of local crop varieties by introducing competitive commercial varieties with disease resistance and other desired values.
- ⇒ Poverty, which forces people to sell the best animals (most of which are indigenous); few are conserved.
- ⇒ Increasing problems of invasive crop weeds.
- ⇒ Climatic change, leading to drought, diseases, pests and crop failure.
- ⇒ The information gap on traditional and indigenous foods threatens their extinction as it limits their use and further action to promote them.
- ⇒ The unrecognized role of women in indigenous food systems, coupled with marginalization faced by women in many rural areas, have exacerbated the loss of indigenous plant and animal varieties.
- ⇒ The marginalization of indigenous foods as the current formal education systems in Uganda rarely incorporate indigenous knowledge.
- ⇒ The focus of research and development efforts on promoting the cultivation and use of improved plant varieties at the expense of indigenous food crops and their improvement.

In different parts of Uganda, many indigenous food crops and parts are underutilized, these include; *sombe* (cassava leaves), bean leaves, pumpkin leaves, amaranth, *malakwang*, *boo*, *gobe* and wild fruits commonly consumed in northern Uganda. In eastern Uganda, foods like Bamboo shoot “*malewa*” and some wild fruits are underutilized yet their production provides little strain on the environment and they are nutritious. In western and central Uganda, millet, sorghum and wild berries are a rich of vital nutrients yet they have been underutilized.

Some of the indigenous underutilized foods in Uganda:

Wild berries



Mushroom



Bamboo shoot



Banana flower



White ants



Grasshoppers



Pumpkin leaves



Malewa



Rabbit



Dodo (Amaranthus Spp)



Bugga (Amaranthus blitum)



Nsujju (Pumpkin)



Cow pea leaves (gobe)



Malakwang



Nsuga/Nswiga (African Night Shade)



Nakati



Ntula/njagi (African Egg Plant)



Jobyo (African spider plant)

Table 8: Nutritional values of selected indigenous and exotic vegetables (per 100g of EP)

Selected nutrients	Indigenous vegetables			Exotic vegetables		
	Amaranth leaves, raw	Spider plant raw leaves	Black (African) night shade leaves, raw	Cabbage leaf head, white, raw	Spinach leaves, raw	Kale leaves, raw
Energy (kcal)	36	43	31	76	27	29
Protein (g)	3.7	4.8	3.8	1.1	2.8	3
Fibre (g)	7.2	4.3	4.3	2.2	4.1	4.7
Calcium (mg)	280	189	100	47	131	402
Iron (mg)	6.8	2.6	8.6	0.5	1.7	2.8
Zinc (mg)	0.92	0.76	0.65	0.2	1	0.5
Vit A (RAE)	326	186	2	Trace	189	177
Vit B12 (mg)	0	0	0	0	0	0
Food folate (mcg)	64	165	404	15	110	62

Source: West, Pepping and Temalilwa (1988)¹⁶ and Lukmanji *et al.*¹⁷

Key message

- Encourage and support community efforts to protect and revitalize indigenous foods and local biodiversity as part of sustainable food systems for healthy diets.
- Improve market access for indigenous food producers.
- Promote indigenous methods of food production, processing and preservation and marketing to improve market access and utilization.
- Enhance recognition of the importance of indigenous peoples' food cultures
- Deliberately research, document and disseminate the nutritional and other benefits of indigenous and underutilized food resources.

¹⁶West, C. E., Pepping, F., & Temalilwa, C. R. (1988). *The composition of foods commonly eaten in East Africa*. Wageningen Agricultural University.

¹⁷Lukmanji, Z., Hertzmark, E., Mlingi, N., Assey, V., Ndossi, G., & Fawzi, W. (2008). *Tanzania food composition tables*. MUHAS-TFNC, HSPH, Dar Es Salaam Tanzania.

ANNEXES

Annex 1: Classification of food types according to their functions

Energy-giving foods (carbohydrates and lipids) “GO” foods			
Food rich in Carbohydrates			
Cereals		Starchy roots and tubers	Starchy fruits and vegetables
Whole grains Millet Sorghum flour Whole wheat flour (brown) Whole maize meal (brown)	Whole grains Cornflakes, White wheat flour White maize meal White rice White bread	Cassava Irish potatoes Sweet potatoes Yams	Matooke Gonja (plantain) Pumpkin
Fats (solids) saturated food sources		Oils (liquids) unsaturated sources	
Animal source Milk fat (ghee), butter, beef fat, chicken fat, pork fat (lard) Plant source Shea nut butter, margarine, kimbo, cowboy, coconut		Plant source Sunflower, soybean, corn/maize, cottonseed, sesame, groundnut, olive, sunflower and palm oil	
Body-building foods (proteins) “Grow” foods			
Animal protein sources		Plant protein source	
Meats: Beef, ox-tail, cow hoves (mulokony), lamb, pork, veal and game meat (e.g., rabbit, squirrel) Organ meats: Liver, giblets, offal, kidney Poultry: Chicken, duck, goose, quails, pigeons, rabbits, guinea fowl (domesticated and wild/game) and turkey, eggs Fish: Silverfish (mukene), Nkejje, Nile perch, tilapia, mudfish, catfish, lungfish		Beans and peas (pulses): chickpeas, pigeon peas, common beans, iron-rich beans, French beans, lentils, soybeans, white beans, peas Processed soy products: soy milk, soy flour, roasted/fried soy snacks Nuts and seeds: groundnuts, sesame seeds, cashew nuts	

<p>Dairy products: Milk, cheese, sour milk, yoghurt</p> <p>Edible insects: Grasshoppers, termites, white ants, crickets, bee larvae</p>	
<p>Immunity boosting or protective (“Glow”) foods rich in vitamins and minerals</p>	
<p>Vegetables</p>	<p>Fruits</p>
<p>Dark green leafy vegetables: Spinach, Dodo/amarantha, sukumawiki, cow pea leaves, pumpkin leaves, cassava leaves, field pea leaves, immature corn, green pea leaves, yam leaves, sweet potato leaves, broccoli, lettuce, hibiscus leaves (Malakwang)</p> <p>Red and orange vegetables: Carrots, pumpkin, red peppers, sweet potatoes, tomatoes, red amaranths, red hibiscus</p> <p>Other vegetables: Beet roots, cabbage, eggplant, cucumbers, cauliflower, green beans, green peppers, mushrooms, okra, onions, beans sprouts, celery, nswiga (Solanum species)</p>	<p>Bananas, pineapples, papaya (Paw paw), mangoes, guavas, oranges, jack fruit, tangerines, apples, Soursop/custard fruit (Kitaferi), avocado, passion, orange, apple, melon, grapefruit</p> <p>Wild fruits: Tamarinds, berries, wild grapefruits</p>

Annex 2. Vitamins and mineral sources and deficiencies

Nutrient	Dietary Sources	Functions/Role(s) in the body	Signs and symptoms of Deficiency
Water-soluble vitamins			
Vitamin B₁ (Thiamine)	Whole grain cereals such as maize, millet, sorghum, legumes and oil seeds, fish, liver, milk and egg	Producing energy for the body, supports appetite and central nervous system functions	<ul style="list-style-type: none"> • Failure to grow/thrive in children • Weak muscles • Painful and inflamed nerves • Depression, irritability • Beriberi
Vitamin B₂ (Riboflavin)	Fish, liver, milk, meat and eggs, whole grain cereals, legumes	Contributes to energy production	<ul style="list-style-type: none"> • Failure to grow • Skin lesions • Dermatitis • Conjunctivitis • Sore lips, swollen tongue

Water-soluble vitamins (continued)			
Vitamin B₃ (Niacin)	Fish, meat, chicken, eggs, whole grain cereals	Enables energy production in the body, supports appetite and central nervous system functions	<ul style="list-style-type: none"> • Dermatitis • Dementia • Diarrhoea
Vitamin B₆ (pyridoxine)	Legumes, avocado, dark green leafy vegetables (DGLV), whole grains, nuts and seeds, cabbage, banana, liver, chicken, meat, fish, potatoes,	Facilitates metabolism and absorption of fats and proteins, promotes red blood cells formation, production of protein and nerve	Tiredness, anaemia, irritability, depression, sore tongue, nausea, muscle twitching, dizziness, dermatitis (skin problem), neuropathy (nerve problem)

	water melon, sun flowers seeds	transmitters, antioxidants	
Vitamin B₁₂ (cyanocobalamin)	Seafood, liver, kidney, heart, whole grains, tuna, yoghurt, eggs, cheese, meat, chicken	Formation of red blood cells affects white blood cells, maintains nerve and gastrointestinal tissue	Tiredness, anaemia, confusion, numbness, nerve problems, ringing in ears, dementia, memory problems
Folic acid	Kidney, liver, nuts, legumes, eggs, green vegetables, whole grains, avocado, oranges, fish	Contributes to the synthesis of new red blood cells and gastrointestinal cells, aids cell division and growth	Diarrhoea, sore red tongue, anaemia, heartburn, fatigue, confusion, depression and dementia
Vitamin C	Guavas, sweet pepper, leafy green vegetables, oranges, lemons, tomatoes, most fruits	Builds healthy bones, teeth and gums, helps fight infection, helps non-haem iron absorption, serves as an antioxidant, helps in protein metabolism	Bleeding gums, bruise easily, slow heal, anaemia, muscle and joint pain, frequent colds

Fat-soluble vitamins

Vitamin A (Retinol)	Yellow/orange fruits and vegetables, DGLV, egg yolk, liver, milk, blue-band/margarine	Supports the immune system and provides resistance to infections, ensures good vision, healthy skin, teeth and bone development, promotes maintenance of epithelial cells and mucous membranes	Eye problems and night blindness, sensitivity to light, scaly and skin and hair, poor teeth and nails, colds
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Vitamin D	Produced by the skin on exposure to sunlight Milk, cheese, butter, blue band margarine, fatty fish eggs, liver	Required for proper formation of bone and teeth Helps the body to absorb calcium and phosphorus	Poor absorption of iron and phosphorus will lead to the formation of weak bones and teeth, growth of children is retarded severe deficiency leads to rickets and osteomalacia in adults/elderly
Vitamin E	Vegetable oils, nuts and seeds, whole grains, eggs, legumes, DGLV	Increases disease resistance, protects fats and vitamins A and C from oxidation, prevents ageing	Tiredness, dry hair, leg cramps, infertility, muscle weakness, impotence, nerve problems and heart disorders
Vitamin K	Vegetables such as spinach, lettuce, cauliflower, and cabbage, broccoli, fish, liver, meat, eggs	Helps with blood clotting, tissue formation and wound healing	Bleeding that takes long to stop/clot, poorly formed tissues and delay in wound healing among others

Mineral	Sources	Functions	Signs and symptoms of deficiency
Zinc	DGLV, seafood, meat, pumpkin seeds, milk, liver, whole grain, egg yolk, garlic, chicken, fish, legumes	Protects the immune system, needed for digestive and immune system enzymes, wound healing, Vitamin A metabolism, and antioxidant effects	Slow growth, loss of senses of smell and taste, loss of appetite, diarrhoea, prostate gland problems, poor wound healing, skin problems and ringing in ears
Selenium	Brown rice, nuts, liver, egg yolk, onions, garlic, meat, whole grains, milk	Serves as an antioxidant, prevents the breakdown of fat and other body cells.	Weakness, pancreas damage, impaired growth, hears problems

Magnesium	Legumes, nuts, whole grains, avocado, DGLV	Assists nerve and muscle function and release of energy from fats, proteins and carbohydrates.	Spasms, cramps, tremors, constipation (strained bowel movements)
Iodine	Breast milk from mothers with good iodine status, iodized salt, sea fish, milk from animals with good iodine status, seaweeds, plants from soils rich in iodine	it makes the brain and body function properly it is essential for the healthy development of unborn babies and young children. It helps pregnant women.	Impaired mental and physical development, deaf-mutism (child cannot speak), cretinism, spontaneous abortion, stillbirth and birth defects, swelling of the front neck (goitre)
Iron	Meat, liver, eggs, DGLV, seeds, wholegrain, legumes, fish, seafood	Needed for oxygen exchange in the blood, it strengthens the blood. It builds muscles and brain. It helps the body.	Headaches, tiredness, irritability, pale colour, dizziness, anaemia
Calcium	Milk, cheese and other dairy foods, green leafy vegetables, such as cabbage and okra	Helps build strong bones and teeth, and muscles and nerves function normally. Helps to ensure blood clots normally.	Myalgia, bone thinness, teeth breakage, bleeding

Annex 3: Composition of key nutrients in commonly eaten foods in Uganda

Nutrients/100g of Edible Portion (EP) of food						
No	Food	Energy (Kcals)	Protein (g)	Iron (mg)	Vitamin A (IU)	Dietary fibre (mg)
1. Cereals and grains						
1.1	Maize (Whole)	363	10	2.5	0	2
1.2	Rice (White, highly milled)	352	7	1	0	0.2
1.3	Millet (Finger whole)	336	6	5	0	3
1.4	Sorghum (Whole grain)	335	10.4	4.5	0	2
1.5	Wheat (85% extraction)	344	11.5	3.5	0	2
2. Legumes						
2.1	Beans (Kidney beans)	339	24	8	0	4
2.2	Peas	337	25	5	100	4.5
2.3	Ground nuts (Dry)	579	27	2.5	0	3
2.4	Simsim	592	20	10	20	5
3. Starchy roots, tubers and plantains						
3.1	Sweet potatoes	114	1.5	1	100	1
3.2	Irish/Solanum potatoes	75	2	0.7	0	0.4
3.3	Cassava	153	0.7	1	0	1
3.4	Matooke	128	1	0.5	100	0.3
4. Vegetables						
4.1	Cabbage	23	1.5	0.5	30	0.8
4.2	Carrots	33	1	0.7	3000	0.8
4.3	Tomatoes	20	1	0.4	250	0.6
4.4	Onions	48	1.5	0.5	0	0.5
4.5	Egg plants	22	1	1	0	1
4.6	Sukumawiki	48	5	4	3000	1.5
4.7	Nakati	48	5	4	3000	1.5
4.8	Ddodo	48	5	4	3000	1.5
5. Fruits						
5.1	Mangoes	63	0.5	0.5	600	0.8
5.2	Citrus	53	0.8	0.5	30	0.3
5.3	Avocado	165	1.5	1	200	1.5
5.4	Banana	116	1	0.5	100	0.3
5.5	Water melon	23	0.4	0.3	30	0.1
5.6	Pineapple	57	0.4	0.5	100	0.5
6. Meat and meat products						
6.1	Beef	262	16	2.5	0	0
6.2	Goat meat	145	16	2.5	0	0
6.3	Rabbit meat	134	20	1.5	0	0
6.4	Liver	136	20	10	0	0
6.5	Mutton (Moderately fat, whole)	249	15	2.4	0	0
7. Poultry and eggs						
7.1	Chicken	139	19	1.5	0	0

Nutrients/100g of Edible Portion (EP) of food						
No	Food	Energy (Kcals)	Protein (g)	Iron (mg)	Vitamin A (IU)	Dietary fibre (mg)
7.2	Duck	139	19	1.5	0	0
7.3	Turkey	139	19	1.5	0	0
7.4	Eggs (Chicken)	158	13	2.8	0	0
8. Milk and milk products						
8.1	Cow's milk	64	3.3	0.1	150	0
8.2	Goats milk	71	3.3	0.1	120	0
8.3	Yoghurt	59	10	0	0	0
8.4	Cheese (Whole cow's milk, hard)	384	24	0.4	1400	0
8.5	Ghee	828	0	0	2000	0
9. Fish and fish products						
9.1	Whole fish Tilapia (Fresh water fish)	95	18	1.0	0	0
9.2	Whole fish Nile Perch (Fresh water)	95	18	1.0	0	0
9.3	Small pellagic fish/mukene (Dried)	335	58.6	2.5	0	0
9.4	Fish oil (Liver oil)	900	0	0	100,000	0
9.5	Dried fish (Fresh water fish)	309	63	8.5	0	0
10. Edible fats and oils						
10.1	Animal-source fat (e.g. Kimbo, ghee)	891	0	0	0	0
10.2	Hydrogenated fats (e.g. margarine)	765	0	0	300	0
10.3	Vegetable oil	900	0	0	0.85	0
10.4	Red palm oil	900	0	0	20,000	0
11. Sugars and confectionaries						
11.1	Sugar (white)	400	0	0	0	0
11.2	Sugar (Brown)	389	0.2	2	0	0
11.3	Salt	0	0	0.1	0	0
11.4	Cakes (Pan cakes)	334	24	0	0	0
11.5	Biscuits	260	4.8	2.5	0	1
11.6	Sweets, chocolate and candies	535	8	2.0	0	3.4

Source: West, Pepping and Temalilwa (1988)¹⁸ and Lukmanji *et al.*¹⁹

¹⁸West, C. E., Pepping, F., & Temalilwa, C. R. (1988). *The composition of foods commonly eaten in East Africa*. Wageningen Agricultural University.

¹⁹Lukmanji, Z., Hertzmark, E., Mlingi, N., Assey, V., Ndossi, G., & Fawzi, W. (2008). *Tanzania food composition tables*. MUHAS-TFNC, HSPH, Dar Es Salaam Tanzania.

Annex 4: RDA for major nutrients as recommended by FAO/WHO

		Recommended Dietary Allowance (RDA)																						
Weight	Height	ENERGY	PROTEIN	VITAMIN A	VITAMIN D	VITAMIN E	VITAMIN K	VITAMIN C	THIAMIN	RIBOFLAVIN	NIACIN	VITAMIN B ₆	FOLATE	VITAMIN B ₁₂	CALCIUM	PHOSPHOROUS	MAGNESIUM	IRON	ZINC	IODINE	SELENIUM			
																						(kcal)	(g)	(µg)
kg	lb	cm	Inch																					
Males																								
11-14	45	99	157	62	2500	45	1000	10	10	45	50	1.3	1.5	17	1.7	150	2.0	1200	1200	270	12	15	150	40
15-18	66	145	176	69	3000	59	1000	10	10	65	60	1.5	1.8	20	2.0	200	2.0	1200	1200	400	12	15	150	50
19-24	72	160	177	70	2900	58	1000	10	10	70	60	1.5	1.7	19	2.0	200	2.0	1200	1200	350	10	15	150	70
25-50	79	174	176	70	2900	63	1000	5	10	80	60	1.5	1.7	19	2.0	200	2.0	800	800	350	10	15	150	70
51+	77	170	173	68	2300	63	1000	5	10	80	60	1.2	1.4	15	2.0	200	2.0	800	800	350	10	15	150	70
Females																								
11-14	46	101	157	62	2200	46	800	10	8	45	50	1.1	1.3	15	1.4	150	2.0	1200	1200	280	15	12	150	45
15-18	55	120	163	64	2200	44	800	10	8	55	60	1.1	1.3	15	1.5	180	2.0	1200	1200	300	15	12	150	50
19-24	58	128	164	65	2200	46	800	10	8	60	60	1.1	1.3	15	1.6	180	2.0	1200	1200	280	15	12	150	55
25-50	63	138	163	64	2200	50	800	5	8	65	60	1.1	1.3	15	1.6	180	2.0	800	800	280	15	12	150	55
51+	65	143	160	63	1900	50	800	5	8	65	60	1.0	1.2	13	1.6	180	2.0	800	800	280	10	12	150	55
Pregnant																								
					+300	60	800	10	10	65	70	1.5	1.6	17	2.2	400	2.2	1200	1200	320	30	15	175	65
Lactating																								
1st 6 mo.					+500	65	1300	10	12	65	95	1.6	1.8	20	2.1	280	2.6	1200	1200	355	15	19	200	75
2nd 6 mo.					+500	62	1200	10	11	65	90	1.6	1.7	20	2.1	260	2.6	1200	1200	340	15	16	200	75

Source: FAO/WHO 1998.²⁰

²⁰FAO/WHO (1998). *Preparation and Use of Food-Based Dietary Guidelines*. Report of a joint FAO/WHO Consultation Technical Series 880. Geneva: World Health Organization.

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