

Nutrition-Sensitive-Agriculture

Lecture Note, Department of NRM/NREM

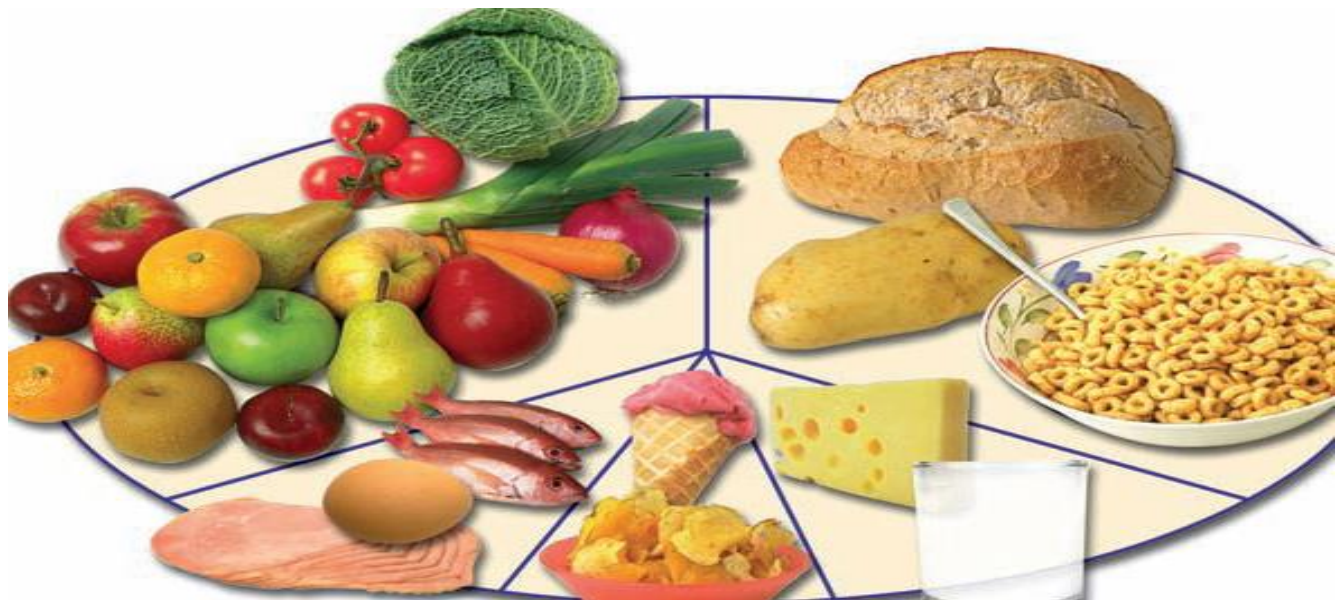


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Acronyms

CCPS= Determines critical control points

EBF: Exclusive breast feeding

EDHS: Ethiopian Demographic and Health Survey

FAO: Food and Agriculture organization

GHP= Good Hygienic Practices

HACCP= Hazard Analysis Critical Control Point

IDA: Iron deficiency

IDD: Iodine Deficiency disorder

IYCF = Infant and young children feeding practice

LDC=Less Developed Countries (s)

NBCC=Nutrition Behavioral Change Communication

NNCB =National Nutrition Coordinating Body

NNP: National Nutrition program

NNSAS: National Nutrition Sensitive Agriculture Strategy

NSA: Nutrition Sensitive Agriculture

PEM: Protein Energy Malnutrition

PSNP: Productive Safety Net Program

SBCC= Social and behavior change communication

WASH: Water Sanitation and Hygiene

WHO: World Health Organization

Preface

Agricultural development plays an essential role in improving nutrition. The relationship between agriculture and human nutrition is far more complex than the relationship between food production and food consumption or the economic relationship between food supply and food demand. Increased food production raises the availability of food, but by itself does little to ensure that poor and vulnerable people have access to the food that is produced. Recently, the term “nutrition-sensitive agriculture” has emerged as a way to define agriculture investments made with the intention of also improving nutrition. Current food systems are increasingly challenged to provide adequate, safe, diversified and nutrient-rich food that make up healthy diets due to constraints posed by resource scarcity and environmental degradation, as well as unsustainable production and consumption patterns, food losses and waste, and inequitable distribution.

Despite the agriculture sector has a lion share role to address malnutrition with nutrition sensitive agricultural practices, the agriculture cadres from the Ethiopian agricultural college/higher learning institutions did not have the competencies that address this issue as their curriculum lack the basic nutrition competencies. Therefore, the nutrition sensitive agricultural practices left untouched agenda; resulted in the current complicated malnutrition problem in Ethiopia.

This teaching/learning module is developed by MOANR and MOLF in collaboration with Jhpiego. This module will be used to teach agriculture cadres to enable them throughout the implementation of nutrition sensitive agriculture of MoANR/MOLF to contribute for the reduction of under-nutrition in the country by promoting and assisting production and consumption of diversified foods in rural Ethiopia.

Chapter 1: Basics of Human Nutrition

1.1. Introduction

The science of nutrition is the study of the nutrients and other substances in foods and the body's handling of them. Its foundation depends on several other sciences, including agriculture biology, biochemistry, and others. As sciences go, nutrition is young, but much has happened in nutrition's short life. Human nutrition is a complex, multifaceted scientific domain indicating how substances in foods provide essential nourishment for the maintenance of life. To understand, study, research, and practice nutrition, a holistic integrated approach from molecular to societal level is needed. Optimal, balanced nutrition is a major determinant of health. It can be used to promote health and well-being, to prevent ill-health and to treat disease. The study of the structure, chemical and physical characteristics and physiological and biochemical effects of the more than 50 nutrients found in foods underpins the understanding of nutrition.

The hundreds of millions of food- and nutrition-insecure people globally, the coexistence of under-nutrition and over nutrition, and inappropriate nutritional behaviors are challenges that face the nutritionist of today. Nutrition practice has a firm and well-developed research and knowledge base. Therefore, this chapter can be used as a tool to bridge theory and practice of nutrition and to stimulate discussions to link agriculture with nutrition. It summarizes the holistic understanding of human nutrition.

Chapter Objectives: At the end of this chapter students will be able to:

- Define important nutrition related terms
- Describe food groups, nutrients and functions of nutrients
- Discuss food and nutrition security
- Discuss malnutrition and its different forms
- Mention the impact of malnutrition
- Discuss nutrition intervention strategies to combat malnutrition
- Analyze the causal framework of malnutrition

1.2. Definitions of basic Terms

Nutrition: is the science of foods and the nutrients and other substances they contain, and of their actions within the body (including ingestion, digestion, absorption, transport, metabolism, and

excretion). A broader definition includes the social, economic, cultural, and psychological implications of food and eating.

Foods: Any substance, consisting essentially protein, carbohydrate, and fat used in the body of an organism to sustain growth, repair, and vital process and to furnish energy; also together with supplementary substances (as minerals, vitamins and condiments).

Diet: is the foods and beverages a person eats and drinks.

Meal: is an eating occasion that takes place at a certain time and includes specific, prepared food, or the food eaten on that occasion.

Energy: the capacity to do work. The energy in food is chemical energy. The body can convert this chemical energy to mechanical, electrical, or heat energy.

Nutritional requirement: refers to the different nutrients required by the body for energy, growth and repair, as well as protection from disease. Nutritional requirements differ according to age, gender, physical activity, height, weight, and health status of the individual. Nutritional status of an individual person results from nutrient intake, nutrient requirements, and the body's ability to digest, use and absorb the nutrients that are ingested.

Nutrition Assessment: nutrition assessment: a comprehensive analysis of a person's nutrition status that uses health, socioeconomic, drug, and diet histories; anthropometric measurements; physical examinations; and laboratory tests.

Nutrition specific interventions: are interventions or programs that address the immediate determinants of fetal and child nutrition and development. Adequate food and nutrient intake, feeding, care giving and parenting practices, and low burden of infectious diseases are parts of nutrition specific interventions.

Nutrition sensitive interventions: are interventions or programs that address the underlying determinants of fetal and child nutrition and development. Food security; adequate caregiving resources at the maternal, household and community levels; and access to health services and a safe and hygienic environment are incorporated in nutrition sensitive goals and action.

Nutrition sensitive agriculture: Nutrition-sensitive agriculture is a food-based approach to agricultural development that puts nutritionally rich foods, dietary diversity, and food fortification at the heart of overcoming malnutrition and micronutrient deficiencies

1.3. Nutrient and their functions

Nutrients: are chemical substances obtained from food and used in the body to provide energy, structural materials, and regulating agents to support growth, maintenance, and repair of the body's tissues. Nutrients may also reduce the risks of some diseases. In general, based on the amount of nutrient our body needs for metabolism, there are two types of nutrients: Macronutrients and micronutrients. **Macronutrients:** are nutrients required in a large amount and they provide the bulk energy an organism's metabolic system needs to function. Macronutrients include carbohydrates, proteins and fats. **Micronutrients:** are nutrients required in a small amount and provide the necessary co-factors for metabolism to be carried out and include vitamins and minerals. Micronutrients are very important for normal growth and maintain health of human body. Based on function and source there are six different types of nutrients:

1. **Carbohydrates** – are what our body burns most often for fuel, much like firewood. They are used in the body to provide the first source of energy. Cereal, grains, legumes, fruits and vegetables are the main source of carbohydrates.
2. **Proteins** - are the building blocks of the body tissue, and can also serve as a fuel source. They build the walls of our body (hair, skin, muscles, etc), just like bricks build our home. Meat, egg, poultry, milk, fish and legumes are main source of protein.
3. **Fats** - are also burned for energy and they give more fuel and are easy for our bodies to store for later use. Fats have twice as many calories as proteins or carbohydrates.

This is much like paraffin in our homes; it is stored in a small jug and a little fuel goes a long way. They also help the body absorb vitamins. Fish, butter, beef, egg, pork, milk, fruits such as avocado, nuts and soybeans are good source of fat.

4. **Vitamins** – are essential for normal growth and health. They are like **watchdogs** which protect us from thieves while vitamins in our body protect us from diseases. They are required in small quantities in the diet because they cannot be synthesized by the body. Most vegetables and fruits are good source of vitamins. Based on solubility, there are two types of vitamins:

i. Fat-soluble vitamins:

- They are digested and absorbed with the help of fats that are in the diet.
- They can be stored in the body for long periods.
- They are soluble in fat and this group includes vitamin A, D, E & K

Table 1.1. fat soluble vitamins

<i>S.No</i>	<i>Vitamin</i>	<i>Source</i>	<i>Function</i>
<i>1</i>	<i>Vitamin A</i>	<ul style="list-style-type: none">– Dark green and yellow fruits and vegetables.– Butter, eggs, milk, liver of beef, pork, chicken, and fishes– Orange flashed sweet potato (OFSP) and Yellow maize	<ul style="list-style-type: none">– Needed for strong bones, good vision and healthy skin.– Plays a role in immune function, promotion of growth and skin health.– Protection of surface tissue
<i>2</i>	<i>Vitamin D</i>	<ul style="list-style-type: none">– Foods are also considered as good source of vitamin D– Sunlight	<ul style="list-style-type: none">– Helps calcium and phosphorus to form straight, strong bones and teeth.
<i>3</i>	<i>Vitamin E</i>	<ul style="list-style-type: none">– Vegetable oils, cereals, meat, poultry, eggs, fruits, vegetables, and wheat germ oil.	<ul style="list-style-type: none">– antioxidant activities
<i>4</i>	<i>Vitamin K</i>	<ul style="list-style-type: none">– Green leafy vegetable	<ul style="list-style-type: none">– Reduce the risk of bleeding.

ii. Water-soluble vitamins

- They are water soluble and not stored in the body for long, therefore, good sources of vitamin B and C should be eaten every day.
- Vitamins in this groups includes vitamin B and C

Vitamin B: helps to maintain healthy skin and a well-functioning nervous system. Vitamin B also help to convert carbohydrates into energy.

Vitamin C or ascorbic acid: is needed for building the connective tissue that holds body cells together. Vitamin C is essential for healthy teeth, gums and blood vessels. It also helps the body to absorb iron. Vitamin C deficiency will result in scurvy. Citrus fruits are good sources of vitamin C.

5. Minerals – are nutrients such as iron, calcium, iodine, zinc and magnesium that are important for normal body growth and health. Animal and plant food sources provide most of the essential minerals. Iron (Fe), Iodine (I), Zinc (Zn), Calcium (Ca) and Phosphorus (P) are some examples of minerals.

Table 1.2: Public health important minerals

S.No	Mineral	Source	Function
1	Iron	<ul style="list-style-type: none"> – Hem iron (Highly bio-available) <ul style="list-style-type: none"> – Animal products like red meat and liver – Non Hem iron (Less bio-available) <ul style="list-style-type: none"> – Plant products (Pulses, Cereals) 	<ul style="list-style-type: none"> – Part of hemoglobin, a protein which carries oxygen from our lungs throughout our bodies
2	Iodine	<ul style="list-style-type: none"> – Iodized salt – Sea foods, vegetables grown near the sea 	<ul style="list-style-type: none"> – Participate in regulation metabolic rate, reproduction, growth, blood cell production, nerve and muscle function
3	Zinc	<ul style="list-style-type: none"> – Meat 	<ul style="list-style-type: none"> – Cofactor by more than 100 enzymes – stabilizes cell membranes, helping to strengthen their defense against free-radical attacks – Assists in immune function and in growth and development

6. Water - is needed for most body functions, including maintenance of health and integrity of every cell in the body.

1.4. Food groups and their sources

Most people, particularly those with a low income, consume only one or two types of mostly staple foods. Since the different food groups provide different nutritional and health benefits, consumption of diversified foods is important for health, proper growth and development of children and adolescents. There are a number of food classifications containing five, six, seven and ten food groups according to different literature. The basis for the classification is mainly on the nutritional needs of population group. Here in this chapter we will see the six food group classification which is adopted from FAO food group classification (Fig 1.1.)

- i. Staples:** This food groups are basic sources of energy. Foods in this category include cereal grains such as sorghum, millet, maize, barley, oats, wheat, teff, rice and starchy roots (inset, cassava, sweet potato and potato).
- ii. Legumes and nuts:** This group includes beans (like faba, haricot and kidney beans), lentils, peas, chickpeas, ground nuts and soya beans. Apart from soybean and groundnut, which is also rich in oils and fats, they provide mainly protein and are important for growth, repair and body building.
- iii. Animal source foods:** All foods in this group are of animal origin such as meat, poultry, eggs, milk and milk products and fish. They provide protein, fats, vitamins and minerals. They help the child to grow, have strong bones and be health.
- iv. Vegetables:** This group includes green leafy and yellow and orange vegetables such as cabbage, kale, green pepper, pumpkin, onion, tomato, carrot, spinach, cauliflower, lettuce, celery, cucumber, eggplant, broccoli, and others such as mushroom. They provide mostly vitamins, minerals and water. Vegetables also contain natural indigestible fibers that are necessary for proper digestion and healthy bowl movement.
- v. Fruits:** They include citrus fruits (oranges, lemons and mandarins), bananas, papaya, mango, avocado, pineapple, apple, guava, watermelon, grapes, peach, sweet melon and many other indigenous fruits. Fruits provide mostly carbohydrates, vitamins, minerals and water.
- vi. Fats:** This group includes fats from plant and animal origin. Fats and oils from plants are oilseeds (soybean, linseed, and groundnut). Fats provide an additional energy, essential fatty acids and fat-soluble vitamins.

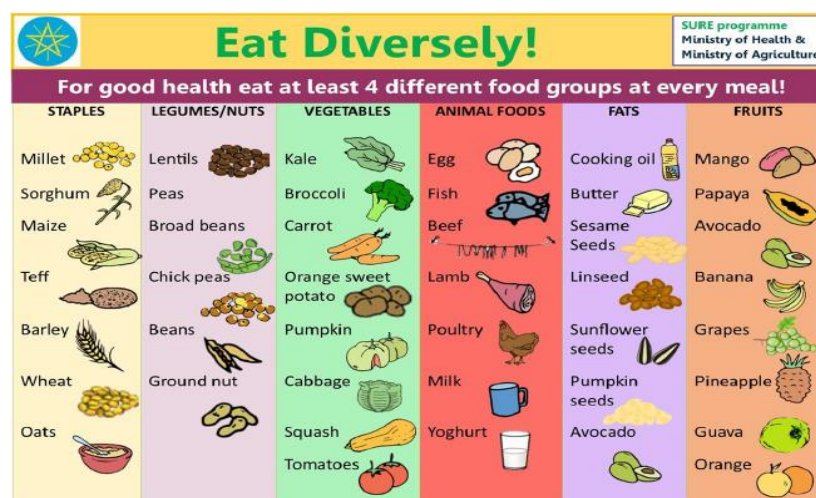


Figure 1.1. Six food classifications (adopted from FAO food classification)

There are foods unclassified in this food groups and not desired for diet diversification. These are mainly processed foods such as biscuits, various kinds of sweets and alcohol. Industrial food processing in most cases refines or modifies natural foods and makes them nutrient dense by removing natural components like fibers. They also have more undesired nutrients like salt, sugar and fats in excess to enhance their flavor and taste for market purpose.

1.5. Food and nutrition security

The conceptual framework for food and nutrition security is helpful in disaggregating the related concepts of food security and nutrition security at both household and individual levels.

- **Food security:** the condition when all people, at all times, have physical and economic access to sufficient, safe and nutritional food to meet their dietary needs and food preferences for an active and healthy life.
- **Nutrition Security:** The condition when all people have ongoing access to the basic elements of good nutrition, i.e., a balanced diet, safe environment, clean water, and adequate health care (preventive and curative), and the knowledge needed to care for and ensure a healthy and active life for all household members. The overlap between food and nutrition security is shown in Figure 1.2.

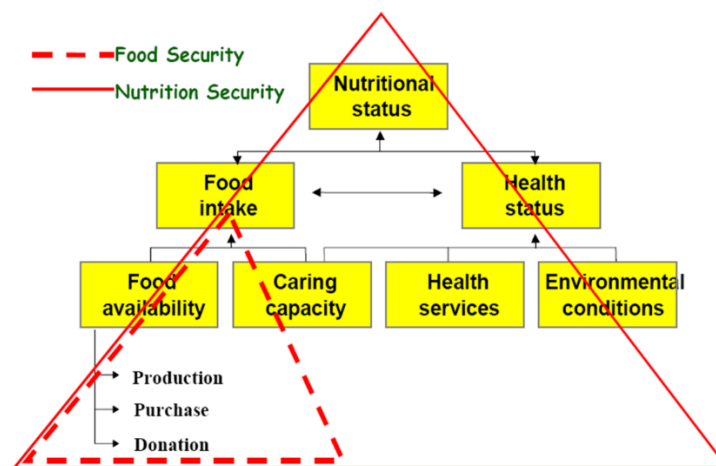


Figure 1.2. **Conceptual** frameworks for food and nutrition security

Food and Nutrition security: Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is consumed in sufficient quantity and quality

to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life.

1.6. Malnutrition

1.6.1. Definition and basic concepts of malnutrition

Malnutrition refers to abnormal nutrition condition, both under-nutrition and over nutrition. Currently it is a public health problem for both developed and developing countries. While majority of developed countries suffer from problems related over-nutrition, developing countries suffers from the double burden of under-nutrition and over-nutrition. Malnutrition is currently considered the leading cause of child mortality. The global community is urging for prevention of under-nutrition in children by focusing on the 1000 days nutrition interventions- the period from pregnancy to the first two years of life. This period is called the 'window of opportunity' because proper nutrition during this period has the greatest effect on child health, growth and development. If under-nutrition occurs during this period, the damage on child physical and cognitive development will be irreversible.

1.6.2. Causes of Malnutrition

Malnutrition is not caused by a single factor. The nutritional status of an individual, households, and the community at large is determined by many different and interconnected factors. UNICEF in 1990 identified malnutrition and death in children and women as the final outcome of a long sequence of interconnected factors. These factors are classified at three levels of causes as immediate, underlying, and basic causes of malnutrition.

Immediate Causes of Malnutrition

Inadequate dietary intake and diseases are the most significant immediate causes of malnutrition of children and women. An individual will get malnourished either due to inadequate dietary intake or infection of diseases, or both at the same time.

Underlying Causes of Malnutrition

The causes for inadequate dietary intake and disease can be numerous. The underlying causes for malnutrition are context-specific and classified in to three interrelated groups as follows.

- Insufficient food availability and access
- Inadequate care for children and mothers
- Insufficient health services and inadequate provision of a healthy environment (e.g. clean water and sanitation).

Basic Causes of Malnutrition

The major *basic* causes of malnutrition include economic, technological, political, cultural, and institutional structures and processes, the means of control of physical resources, and the level of human development.

The three categories of causes of malnutrition function synergistically with each other. It is also important to recognize that there are horizontal cause and effect relationships at all levels, although these linkages are somewhat more obvious for the underlying causes, the food-care-health triad. The following framework of causes of malnutrition depicts these vertical and horizontal relationships of causes at different levels (Fig 1.3).

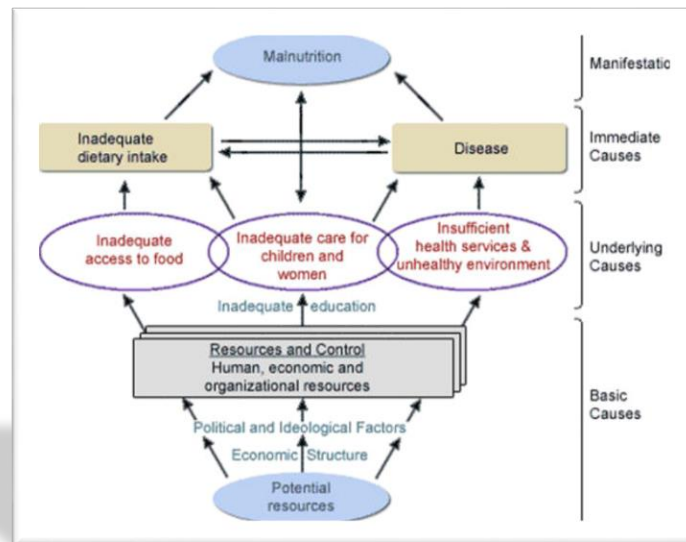


Figure 1.3. Causal framework of malnutrition

1.6.3. Forms of Malnutrition

In general malnutrition can be classified in to:

- 1. Under nutrition**

- **Protein-energy malnutrition:** arises due to inadequate intake of calories from macronutrients: Carbohydrates, fats and proteins.
 - **Micro-Malnutrition (Hidden Hunger)** refers to mineral and vitamin deficiency such as iron, iodine, and vitamin A.
2. **Over-nutrition**
 - Overweight and obesity
 - Health consequences (diabetes, cardiovascular diseases)
 3. **Co-existence of under and over-nutrition: “double burden of malnutrition”**
 - Obesity and protein energy malnutrition (PEM) in the same family
 - Obesity and micronutrient deficiencies in the same individual
 4. **Chronic and acute malnutrition**

From the perspective of developing countries, malnutrition results from inadequate intake of nutrients and/or from disease factors. Protein energy malnutrition, iron deficiency anemia, vitamin A and iodine deficiency disorders are the most common forms of malnutrition. Both protein energy malnutrition and micronutrient deficiency can have serious negative consequences for physical and mental health.

Protein-Energy Malnutrition(PEM)

Protein-Energy Malnutrition (Macronutrient Deficiency) is currently the most important nutritional problem in developing countries including our country Ethiopia. Failure to grow adequately is the first and most important manifestation of protein energy malnutrition. It often results from consuming too little food, especially energy, and is frequently aggravated by infections. It can be due to long-term or short term food shortages and infections. The term protein energy malnutrition is used to describe both the moderate and the severe forms of under-nutrition. Moderate (mild) PEM is manifested mainly as poor physical growth in children. Stunting, underweight, and wasting are manifestations of child growth failure due to mild/moderate PEM. Kwashiorkor (petting oedema) and nutritional marasmus (severe wasting) are manifestations of severe PEM, and often lead to death of many children.

Stunting: is a malnutrition condition reflected by inadequate linear growth of a child. It is referred to as chronic malnutrition. Stunted children are too short for their age (Fig 1.5). Stunting develops over a long period of time as a result of inadequate dietary intake, and repeated infections. Stunting is an irreversible condition; a stunted child will become mentally less developed adult. The irreversible physical and cognitive damage from stunting leads to lower adult productivity and

enormous long-term economic loss to societies. Stunted children will perform low at schools, sport activities, and will be less innovative and productive at adult stages.

Wasting: wasting is reflection of current nutritional status and is measured using the ratio of a child's weight to height/length. Wasted children are too light for their height/length. Wasting is caused by inadequate intake of total calories resulting in rapid weight loss or failure to gain weight. Wasting can be reversed with improved diet and the treatment of underlying illnesses. Wasted children should be identified and treated with nutritious foods at the community level or at health facilities. If not treated on time these children will start to manifest clinical sign and symptoms of marasmus, kwashiorkor or marasmic kwashiorkor (Fig 1.4) and they may die.

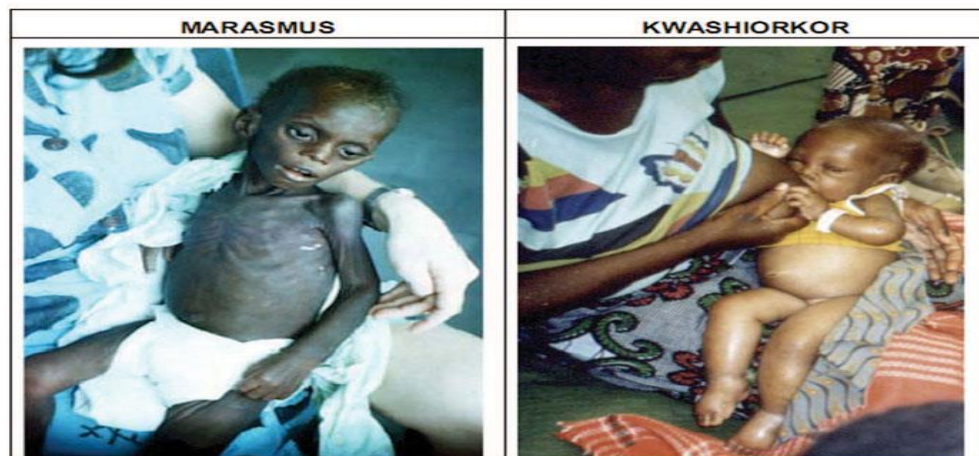


Figure 1.4. Manifestations of Marasmus and Kwashiorkor

Underweight: underweight children have low weight for their age. Children may become underweight because of wasting or stunting or both. Underweight is measured in children using weight for age.

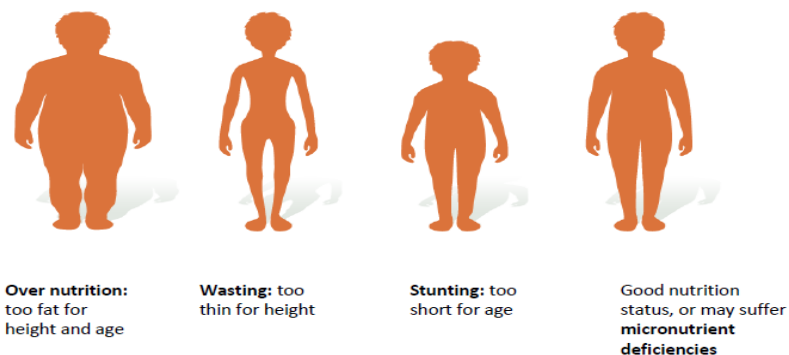


Figure 1.5. Different forms of malnutrition in children (FAO, 2015)

Micronutrient Deficiency

Micronutrient deficiency refers to deficiencies in one or more essential vitamin or mineral, often caused by disease and/or inadequate intake of micronutrient-rich foods such as fruit, vegetables, animal products, and fortified foods. Micronutrient deficiencies increase the severity and risk of dying from infectious disease. The deficiency of micronutrients is not usually visible, and termed as “**hidden hunger**”. Deficiency of Iron, Iodine, vitamin A, and zinc are most important in terms of prevalence and severity.

Iron Deficiency

Dietary iron deficiency contributes to the development of anemia. Anemia in general is a disorder condition related to red blood cells and shortage of oxygen for cellular respiration. Iron deficiency is the major cause of dietary anemia, and leads to a type of anemia called iron deficiency anemia (IDA). This results from lack of sufficient consumption of high-iron containing foods, such as animal products and legumes. The consequences of anemia for children include increased morbidity and mortality, stunting, retarded cognitive development, reduced IQ, lower academic performance. Anemic pregnant women are at greater risk of giving birth to underweight babies, preterm and still births, and increased risk of maternal mortality associated with bleeding during and after birth. In adults, anemia is associated with weakness and fatigue, lower productivity in agriculture and any other business.

Iodine deficiency

Iodine deficiency in our body leads to enlargement of the thyroid gland developing a disease condition called goiter (fig 1.6). Goiter can also appear in the form of smaller, less visible enlargements of the thyroid gland. Apart from goiter iodine deficiency causes more severe consequences related to child physical growth and intellectual development. These conditions together are termed iodine deficiency disorders (IDD). Iodine deficiency during pregnancy may lead to cretinism, mental retardation and other problems, which may be permanent in the child. Iodine deficient pregnant mothers will also be at greater risk of spontaneous abortions and stillbirth. Iodine deficiency at early age of the child causes mental retardation, and poor physiological and neurological development.



Figure 1.6. Goiter (Source: courtesy of Wikipedia common)

Zinc deficiency

Zinc deficiency is recently recognized as a public health problem. Available evidences show that it is most likely to be a serious problem with diets poor in animal foods. Zinc deficiency will contribute for child growth retardations, impaired immune function, increased child morbidity and mortality from infectious diseases like diarrhea. Zinc deficiency also causes reduced appetite and may expose to protein-energy malnutrition.

Vitamin A deficiency

Vitamin A Deficiency (VAD) is a disorder condition resulting when vitamin A intake falls below recommended levels. Dietary deficiency of vitamin A most importantly affects the eyes, and the body immunity (Fig 1.7)

Children with vitamin A deficiency are at greater risk of infection and death. Consumption of vitamin A bio-fortified foods such as orange-flashed sweet potato and maize, and vitamin A fortified oils, are some of the solution for the problem.



Figure 1.7. Vitamin A deficiency (Source: Courtesy Google)

1.6.4. Status of Malnutrition in Ethiopia

Under-nutrition is a major public health problem in Ethiopia. Thirty-eight percent of children under age 5 are stunted (short for their age); 10% are wasted (thin for their height); 24% are underweight (thin for their age), and 1% are overweight (heavy for their height) (Fig 1.8). The feeding practices of only 7% of children in Ethiopia age 6-23 months meet the minimum standards with respect to all three IYCF practices (breastfeeding status, number of food groups, and times they were fed during the day or night before the survey). Regarding the maternal nutrition, twenty-two percent of women age 15-49 are thin (with BMI less than 18.5), while 8% are overweight or obese

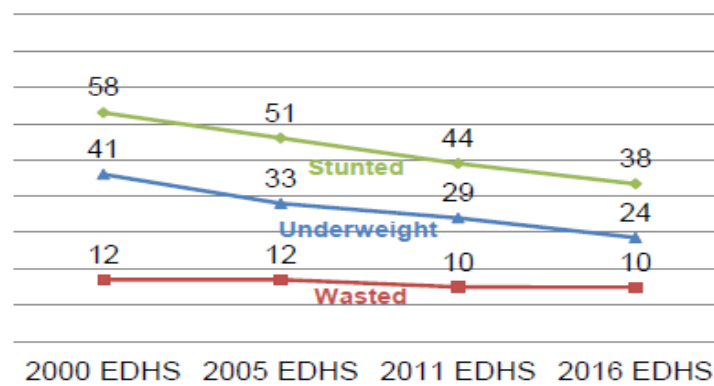


Figure 1.8. Trend of malnutrition among children in Ethiopia (EDHS, 2016)

1.6.5. Impacts of Malnutrition

Malnutrition has a series of public health consequences that diminish the individual quality of life and the prospects for socioeconomic progress. The impacts of malnutrition can be reflected at the individual, household, and community level. Children and mothers usually suffer the most because many nutrients are critical for normal growth and development. Malnutrition in pregnant mothers causes intra-uterine growth retardation of the fetus leading to low weight at birth and lower chance of survival. Long time malnourishment deprives our body from the nutrients for proper health and development and makes us vulnerable to infection and disease. Impacts of malnutrition are described below:

1. Susceptibility to mortality (death)

Stunting and other forms of under-nutrition are clearly a major contributing factor to child mortality, disease and disability. Specific nutritional deficiencies such as vitamin A, iron or zinc deficiency also increase risk of death.

2. Susceptibility to acute morbidity (disease)

Compared with people with adequate nutrition, those with poor nutritional status are more likely to contract diarrheal and respiratory infections and more likely to suffer from these illnesses for longer duration.

3. Poor cognitive development

Stunting is associated with poor school achievement and poor school performance. Specific nutrient deficiencies such as iodine and iron impaired cognitive development.

4. Decreased economic productivity

Under-nutrition early in life clearly has major consequences for future educational, income and productivity outcomes. Malnourished individuals will remain unhealthier and physically unfit than individual with optimal nutritional status. All these condition will result in less productivity and innovation which leads to poor socio-economic development of countries (fig 1.9).

5. Susceptibility to chronic diseases in later life

Children experiencing malnutrition in their early life will have increased risk of overweight and obesity. Different researches are proving that stunted children will suffer from disproportionate and rapid weight gain later in life. Poor foetal growth, small size at birth and continued poor growth

in early life followed by rapid weight gain later in childhood raises the risk of coronary heart disease, stroke, hypertension, and diabetes (type II).

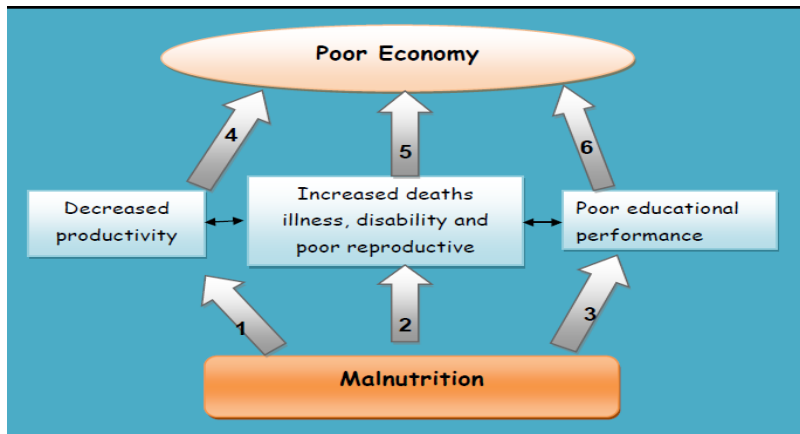


Figure 1.9. Over all impacts of malnutrition

1.7. Nutrition Intervention Strategies to Combat Malnutrition

Nutrition intervention strategies are designed to change nutrient intake, nutrition-related knowledge or behavior, environmental conditions, or access to supportive care and services. Nutrition intervention strategies and goals provide the basis for monitoring progress and measuring outcomes. There is no single bullet proof nutrition strategy that can meet the goal of achieving optimum nutrition for all. So, different strategic intervention approaches need to be applied based on context for improvement of nutritional out-come of the population.

Nutrition interventions are of two types. The first one is nutrition sensitive intervention. Nutrition sensitive interventions or programs address the underlying determinants of undernutrition which are food security; adequate caregiving resources at the maternal, household and community levels; and access to health services and a safe and hygienic environment with specific nutrition goals and actions.

Nutrition-sensitive programs can serve as delivery platforms for nutrition-specific interventions, potentially increasing their scale, coverage, and effectiveness. Nutrition Sensitive interventions/programs include:

- ✓ Agriculture and food security;
- ✓ Social safety nets;
- ✓ Early child development; maternal mental health;
- ✓ Women's empowerment; child protection; schooling;
- ✓ Water, sanitation, and hygiene; health and family planning services

Nutrition Specific interventions are interventions or programs that address the immediate determinants of fetal and child nutrition and development. Adequate food and nutrient intake, feeding, caregiving and parenting practices, and low burden of infectious diseases are among the main nutrition sensitive interventions. The major areas of action are

- ✓ Adolescent, preconception, and maternal health and nutrition
- ✓ Maternal dietary or micronutrient supplementation
- ✓ Promotion of optimum breastfeeding
- ✓ Complementary feeding and responsive feeding practices and stimulation
- ✓ Dietary supplementation
- ✓ Diversification and micronutrient supplementation or fortification for children
- ✓ Treatment of severe acute malnutrition
- ✓ Disease prevention and management
- ✓ Nutrition in emergencies

The above nutrition sensitive and specific activities are summarized in to core intervention areas and presented in detail as follows.

1. Life Cycle Approach to Nutrition

The life cycle of human beings originates from a fertilized egg, which develops into a fetus that is eventually born as a baby. A baby develops into a child, transitions through the wonderful phase of adolescence, becomes an adult, and then advances into old age and eventually death. A person's stage of life influences their health and nutritional requirements. Nutritional status is an intergenerational continuum. Maximum benefits in one age group come from investments in an earlier age group (there is a cumulative effect in the next generation). Health & nutrition programs

implemented well before women become pregnant, & within a life-cycle perspective, have long term impacts on succeeding generations. Investing in nutrition throughout the life cycle will have both short term and long-term benefits of economic and social significance, including large savings in health care costs, increased educability and intellectual capacity, and increased adult productivity

i. Pre-conception nutrition

Human reproduction is the result of a superb orchestration of complex and interrelated genetic, biological, environmental and behavioral processes. Given favorable states of health, these processes occur smoothly in females and males and set the stage for successful reproduction. However, less than optimal states of health, brought about by conditions such as acute under-nutrition or high levels of alcohol intake, can disrupt these finely tuned processes and diminish reproductive capacity. Sometimes conception occurs in the presence of poor nutritional status. Such events increase the likelihood that fetal growth and development, and the health of the mother during pregnancy, will be compromised.

Generally, every population group needs to make sure of getting diversified diet every day to ensure adequate nutrient intake for an active and healthy life. The following are important measure that a women planning to be pregnant needs to take care of.

- Achieve health body weight: among the critically important factor for improved pregnancy outcome is maternal body weight.
- Use iodine fortified salt
- Consume diversified diet from at least five different food groups
- Take folic acid supplementation every day if you are planning for pregnancy to lower your risk of folic acid deficiency.
- Stop smoking and drinking alcohol.

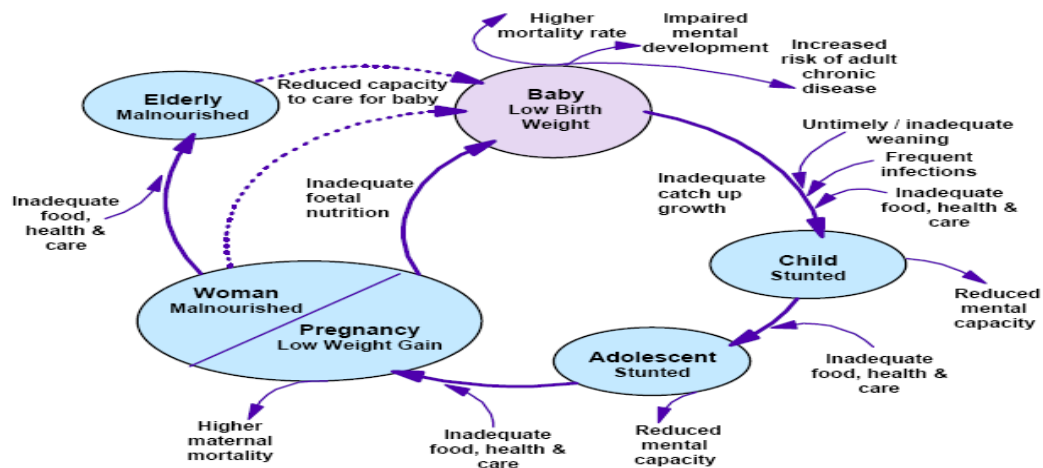


Figure 1.10. Diagram depicting nutrition throughout the lifecycle

ii. Windows of opportunity (1000 days)

The 1,000 days between pregnancy and a child's 2nd birthday are the most critical time for positive impact on a child's cognitive and physical development. The health and well-being of a pregnant and lactating woman is directly connected to the growth and health of her infant.

Optimal nutrition for the mother and for the child during this time can have a profound impact on the child's growth and development and reduce disease risk, as well as protect the mother's health. Under-nutrition during pregnancy, is among the major determinant of stunting and can lead to restricted growth which later results in neurological problems, poor school achievement, early school dropout, low-skilled employment, and reduced productivity during adulthood which cannot deliver good care of their own children, thus contributing to the intergenerational transmission of poverty and malnutrition.

Promote and support good maternal nutrition during pregnancy and lactation

Meeting women's nutrient requirements is key as nutrient needs increase during pregnancy and lactation. Engagement of fathers, grandmothers, and other community influencers to assure that pregnant and lactating women receive adequate food and support are very much important. So it is important to make sure that the following key interventions are addressed to ensure optimal maternal nutrition during pregnancy and lactation.

- ✓ During pregnancy & lactation provide
 - Iron/Folic Acid supplementation
 - Treatment & prevention of malaria
 - Increase food intake
 - one extra meal each day during pregnancy
 - Two extra meals each day during lactation
- ✓ De-worming during pregnancy
- ✓ Vitamin A Supplementation within 45 days of delivery

Promote and support optimal infant and young child feeding (IYCF)

The following important IYCF and care practices need to be applied for optimal child nutrition.

- ✓ Immediate initiation of breastfeeding after birth (within one hour of delivery)
- ✓ Exclusive breastfeeding for the first 6 months of life (no other food than breast milk)
- ✓ Starting at 6 months appropriate complementary feeding (e.g., diverse diet) together with continued breastfeeding to 2 years or beyond
 - Complementary food needs to be prepared from at least four of the six food groups to ensure adequate macro and micro nutrient intake
 - Increase number of feedings with age, Increase density & quantity with age
- ✓ Adequate care and feeding of sick children to prevent both acute malnutrition and stunting
 - Increase frequency of breast feeding and complementary food during times of child illness
 - After recovery, provide the baby with good amount of food for catch-up growth
- ✓ Ensure water, sanitation and hygiene practice

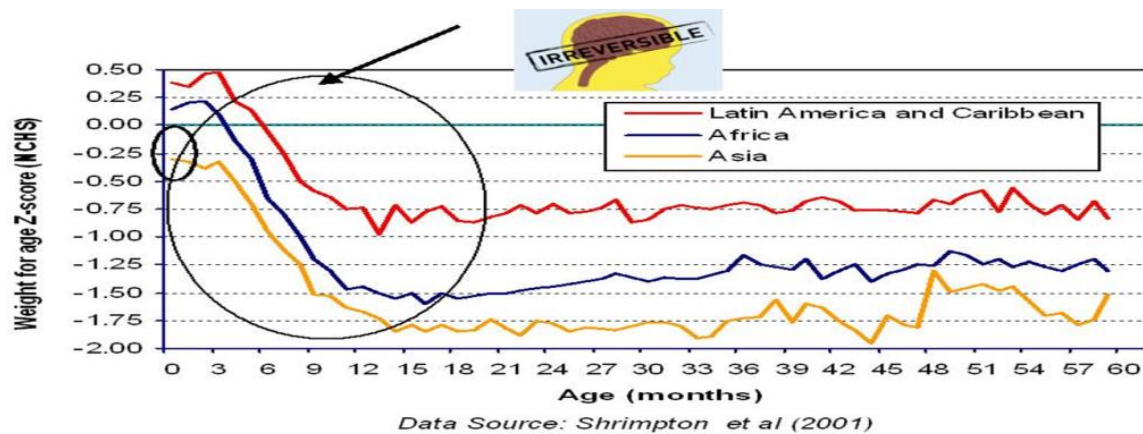


Figure 1.11. Windows of opportunity by weight for height z-score for children aged 0-24months

i. Adolescent nutrition

Poor nutrition starts before birth, and generally continues into adolescence and adult life and can span generations. Chronically malnourished girls are more likely to remain undernourished during adolescence and adulthood, and when pregnant, are more likely to deliver low birth-weight babies. Total nutrient needs are higher during adolescence than any other time in the lifecycle. Nutrition and physical growth are integrally related; optimal nutrition is a requisite for achieving full growth potential. Failure to consume an adequate diet at this time can result in delayed sexual maturation and can arrest or slow linear growth. Currently the Ethiopian National nutrition program incorporated adolescent nutrition among the areas of intervention to break the intergeneration cycle of malnutrition.

The following are key activities which are important to improve adolescent nutrition in Ethiopia

- ✓ Ensure consumption of diverse diet from different food groups
- ✓ Supporting adolescents for nutritional assessment and counselling services in health facilities
- ✓ Integrate adolescent nutrition services into youth centers and related community based programs
- ✓ Regular monitoring of the nutritional status of school-age children/students
- ✓ Improving access to school based biannual de-worming.
- ✓ Improving access to biannual de-worming for out of school adolescents
- ✓ Ensuring access to iron folic acid supplementation for adolescent girls at schools and health facilities

- ✓ Delay first pregnancy

2. Nutrition Sensitive agriculture

Nutrition-sensitive agriculture is a food-based approach to agricultural development that puts nutritionally rich foods, dietary diversity, and food fortification at the heart of overcoming malnutrition and micronutrient deficiencies. Food-based approaches include food production, dietary diversification and food fortification, as sustainable strategies for improving nutrition. This approach stresses the multiple benefits derived from enjoying a variety of foods, recognizing the nutritional value of food for good nutrition, and the importance and social significance of the food and agricultural sector for supporting rural livelihoods. The overall objective of nutrition-sensitive agriculture is to make the global food system better equipped to produce good nutritional outcomes. The Ethiopian Ministry of Agriculture and Natural Resource produced National Nutrition Sensitive agriculture strategy to direct and lead the sector's agricultural practices to be nutrition sensitive. Nutrition sensitive agriculture works in three main ways to contribute for improved nutrition:

- ✓ **Making food more available and accessible:** Increasing agricultural production makes more food available and affordable, which improves both the health and the economic status of the community. Sustained income growth in turn has a sizeable effect on reducing malnutrition.
- ✓ **Making food more diverse and production more sustainable:** Increasing diversity in food production and promoting sustainable production practices like conservation agriculture, water management and integrated pest management can improve nutrition levels without depleting natural resources. Family farming, home gardens and homestead food production projects can make a wider variety of crops available at the local level.
- ✓ **Making food itself more nutritious:** Fortification (Bio-fortification, Agronomic bio-fortification and artificial fortification) can prevent micronutrient deficiencies by enhancing micronutrient content in foods through processing, plant breeding and improved soil fertility.

In the national nutrition sensitive agriculture strategy of ministry of agriculture and natural resource three important pathways are depicted to show agriculture contribution for nutrition. These pathways depict how diversified agricultural production, increased household income from agriculture, and women empowerment impact for improved maternal and child nutrition (see the

detail in Chapter 2). All the three factors depicted in the pathways improve food availability, access and utilization there by contributing to improved food and nutrition security. It is important that you refer the National Nutrition Sensitive Agriculture Strategy for more information but here we will be presenting you the highlights of each of the strategic objectives.

Strategic Objective # 1: To leverage nutrition into agriculture and livestock sector policies, strategies, programs and work plans at all level.

The agriculture sector policies, strategies and programs did not explicitly aim to improve the nutritional status of communities and households, incorporation of nutrition objectives into the agricultural policies, strategies, programs and investments documents was taken as the first step in mainstreaming nutrition into agriculture sector and to ensure agricultural interventions are done with due consideration and with nutrition lens.

Strategic Objective # 2: To establish/strengthen institutional and organizational structure and capacity responsible for implementing nutrition sensitive agriculture.

This strategic objective of the National Nutrition Sensitive Agriculture Strategy (NNSAS) aimed at generally to build the capacity of the agriculture sector to implement NSA. The core activities include establish and/or strengthening food and nutrition structure at all level, building the capacity of NSA implementers, and revision of curricula of agriculture graduates. This course is also the result of consensus among different parties due to the anticipated potential benefit for sustainable integration of nutrition sensitivity of the agriculture sector through incorporation of NSA in preservice training curricula of agriculture graduates.

Strategic Objective # 3: Increase year-round availability, access and consumption of diverse, safe and nutritious foods

This strategic objective in the NNSAS aims at ensuring improved production and consumption of diverse nutrient dense foods by all population groups. Traditionally Ethiopian rural households use cereals as staple diets which are usually low in micronutrients and also do not contribute to dietary diversity. The consumption and also production is seasonally affected consumption of diversified diet is very much restricted. So as to curb this problem, this strategic objective states

various intervention strategies for diversified production and consumption. We advise you to refer the NNSAS of Ethiopia.

Strategic Objective # 4: Enhance resilience of vulnerable agrarian, agro-pastoral and pastoral communities and households prone to climate change and moisture stress

The rain fed agriculture and chronic and transitory food insecurity has created nutrition insecurity in moisture stress areas of the country. This strategic objective of the strategy focuses on strengthening resilience of food insecure and vulnerable households and communities by incorporating nutrition sensitive agriculture interventions and practices into the resource transfer programs/projects.

Strategic Objective # 5: Ensure women and youth empowerment and gender equality

Gender has been reported as the cause and also consequence for hunger and malnutrition and also associated with higher levels of acute and chronic under-nutrition. So addressing the issue of cultural and traditional hurdles and also making women to be at the center of nutrition related interventions both in the rural and urban settings is an important measure to improve maternal and child nutrition. In light of these, the NNSAS has emphasized empowering women and youth for improved maternal and child nutrition. You are advised to refer the NNSAS for detailed actions and focus areas of the strategy.

Strategic Objective # 6: To establish/strengthen strong multi-sectorial coordination within the agriculture sectors and with signatories of NNP and other development partners

This is the last strategic objective of the NNSA strategy. As the problem of malnutrition demands action from different sectors, the intra and inter sectoral collaboration is vital to have significant improvement in the state of nutrition of the country. In Chapter six you will be touching different aspects of multi-sector coordination.

3. Caring Practice

Care practice specifically focuses on the care given to mothers and children for improved nutritional outcome. In the UNICEF conceptual framework, inadequate care and feeding practice is depicted as an underlying cause for malnutrition. Caring practices such as breastfeeding, appropriate complementary feeding, as well as hygiene and health seeking behaviors support good nutrition.

These practices can be severely disrupted in various conditions like during high burden of work on the mother which could limit the time that she needs to spend caring for herself and her baby. This condition could result in poor dietary intake and increased infection, both of which are immediate causes of under-nutrition. In order to tackle this problem, involvement of other family members mainly the husband has to be promoted in the caring as well as participation on other daily household activities specially during times of pregnancy and lactation of the mother.

4. Water, Sanitation and Hygiene (WASH)

In 2014, an estimated 159 million children under five years of age were stunted, and 50 million were wasted around the world. Based on WHO 2015 report 2.4 billion individuals lack access to improved sanitation and 663 million lack access to a protected water source. The report showed that more often communities affected by under-nutrition also have limited access to safe water and sanitation. There are evidence based interventions which are proven to work in improving nutrition of individuals implemented along with other intervention measures. These WASH interventions include use of improved water supply, safe household water management treatment and storage, improved household toilets or latrines, and handwashing with soap. Keeping food safe through safe handling, preparation and storage and prevention of contamination is among the important measures which need to be addressed all the time. In Ethiopia WASH is one of the major areas of intervention for improved health and nutritional status.

Summary

Nutrition is the science of foods and the nutrients and other substances they contain, and of their actions within the body. Food is a product derived from plants or animals that can be taken into the body to yield energy and nutrients. Nutrients are chemical substances obtained from food and used in the body to provide energy, structural materials, and regulating agents to support growth, maintenance, and repair of the body's tissues. Based on function and source there are six different

types of nutrients (carbohydrate, fat, protein, vitamin, mineral and water). We can classify food groups into six (Staple, legume, animal source, vegetable, fruit and fats and oils).

Malnutrition refers to abnormal nutrition condition, both under-nutrition and over nutrition. Malnutrition is not caused by a single factor. Causes of malnutrition are classified at three levels as immediate, underlying, and basic causes of malnutrition. From the perspective of developing countries, malnutrition results from inadequate intake of nutrients and/or from disease factors. Protein energy malnutrition, iron deficiency anemia, vitamin A and iodine deficiency disorders are the most common forms of malnutrition.

As per the UNICEF conceptual framework for the causes for malnutrition, we can see that there needs to be customized different intervention approaches to break each of the casual pathways. In general, different intervention measures need to be used both nutrition sensitive and specific approaches to effectively address the problem of interest. We have seen the lifecycle approach for prevention of maternal and child under-nutrition which include preconception nutrition, nutrition for pregnant and lactating women and IYCF from nutrition specific intervention point of view. Regarding nutrition sensitive approaches, we have raised NSA and WASH which are critical for improved maternal and child nutrition. To impact on nutrition, the agriculture sector needs to ensure that food produced is more available and accessible, more diverse and nutritious. The sector has also responsible to promote consumption of diversified food items.

Self-Assessment Questions

- Q1. What is the difference between food security and nutrition security?
- Q2. Explain the different forms of malnutrition
- Q3. Discuss the causes of malnutrition
- Q5. Describe the impacts of malnutrition
- Q6. Discuss briefly about strategies to tackle malnutrition

Learning Activity

Class work for subtopic 1.3 and 1.4:

Objective: At the end of this exercise the students will be able to categorize food items they ate in the past 24 hours and list the nutrients in each category of the food.

Instruction:

- ✓ All students are expected to do the exercise
- ✓ Follow the following steps to answer the questions
 - List all the foods you have consumed within the previous day (over 24 hours) including drinks, within and outside of your home.
 - Categorize the listed food items in to the six food groups (Use the provided table for categorization).
 - List the nutrients available in the food groups you have consumed in the past 24 hour
 - Identify the food groups you missed in the previous day and list what kind of nutrients do they contain?

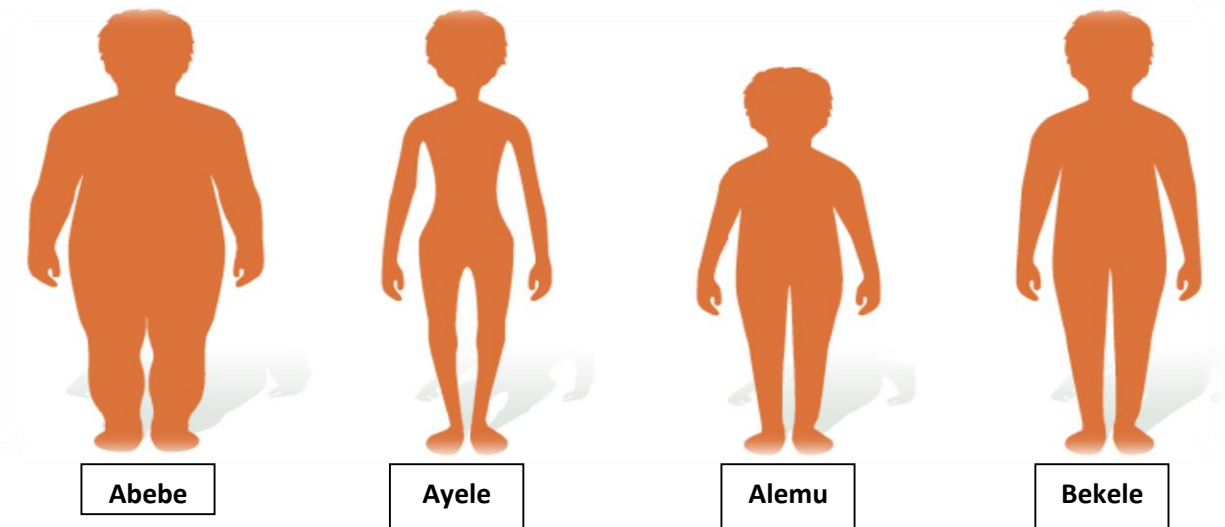
Food groups					
Staples	Legumes/Nuts	Vegetables	Fruits	Animal source foods	Fat

Class activity

Objective: At the end of this exercise the students will be able to classify different forms of malnutrition

Instruction:

- ✓ All students are expected to do the exercise
- ✓ Follow the following steps to answer the questions
 - Look the picture below very carefully
 - Assume all of the four children are found within the same age group.
 - Discuss the nutritional status of the children



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Chapter 2: NRM and Nutrition Linkage as a means for food diversification

2.1. Introduction

It is evident that natural resources are the basis for agricultural development. Therefore, proper and sustainable management and use of these resources are major determinant factors for agriculture and food production thereby achieving food and nutrition security. For example, maintaining soil fertility is important to grow healthy plants so as to produce surplus and nutritious food for consumption. This enables feeding more people with better food.

There are various effective natural resource management technologies developed and prepared in the form of packages for various agro-ecologies. The important thing that students need to consider is that natural resource management technologies can contribute for improvement of nutrition. For example, watershed management, agroforestry, and soil and water conservation practices can address the issue of nutrition by incorporation of multipurpose trees like fruits into the systems. Therefore, learning and researching about the linkage between natural resources management and nutrition is vital. It covers different topics dealing with possibilities of conserving natural resources for diversifying food production system and thereby contributing to the improved nutrition security of the community. Particularly it covers the importance of diversified food production to improve nutrition; impact of climate change on agricultural production and nutrition; climate smart agriculture for sustainable food production system; significance of natural resources conservation for nutrition; and consequences of natural resources degradation on nutrition.

At the end of this chapter, students will be able to

- Describe the link between natural resource and nutrition
- Explain the significance of natural resource in diversifying agricultural food production
- Explain the contribution of NRM in promoting climate smart agriculture
- Describe the link between climate smart agriculture, diversified food production and nutrition
- Analyze the significance of integrated NRM for promoting enhanced food production and nutrition security
- Develop the basic understanding of the consequences of natural resources degradation on nutrition

2.2. Importance of diversified food production to improve nutrition

2.2.1. Diversified Food Production

Many people in sub-Saharan Africa lack adequate amounts of foods that are rich in the nutrients needed for health and a productive life. Deficiencies of iron, vitamin A and iodine are also widespread; Malnutrition increases people's vulnerability to infections, causing numerous deaths. In the face of this bleak situation, major efforts are required by national governments and the international community to bring about reductions in malnutrition and micronutrient deficiencies.

Therefore, promoting diversified food production is required for achieving major nutritional improvement. Diversified food production is about producing foods from various sources that are rich in all the essential micronutrients, available in sufficient quantities and accessible to people all year round. This requires the collaboration of people working in different disciplines such as agriculture, fishery, forestry, small animal husbandry, industry, marketing, communications, women's participation, home economics and nutrition. The wide application of proven technologies and approaches in these fields, as well as the development of new concepts, will contribute towards solving nutritional problems. The results of research must be transmitted to farmers, and efforts must be made to build on farmers' indigenous knowledge. Consumers, too, need to be involved and educated on how to prevent nutritional deficiencies.

Access to stable and sustainable food supplies is a precondition for the establishment of food security at the household level. Greater and more sustained yields from the farming system will increase the potential access of the household to an adequate diet. Similarly, farming practices that improve the regular flow of a variety of different foods into the household throughout the seasons enhance food security for its members.

Strategies for food and dietary diversification at the community and household levels include a range of food-based activities that can maximize the availability of adequate amounts and greater variety of nutritious foods. These activities include:

- Promotion of mixed cropping and integrated farming systems;
- Introduction of appropriate new crops into the agro-ecology;

- Promotion of underexploited traditional foods and home gardens;
- Small livestock raising;
- Promotion of fishery and forestry products for household consumption;
- Promotion of improved preservation and storage of fruits and vegetables to reduce waste, post-harvest losses and effects of seasonality;
- Strengthening and re-orienting of watershed management for improving nutrition;
- Nutrition education to encourage the consumption of a healthy and nutritious diet year round.

2.2.2 Role of natural resources for diversified food production

Natural resources have got various contributions in diversifying food production and thereby contributing to the improvement of nutrition. Forests and trees, for example, provide foods that supplement and complement traditional agricultural sources. However, nutritionists and foresters have until recently paid insufficient attention to forest foods. In many parts of the world, non-wood forest products (NWFPs), defined by FAO as "goods of biological origin other than wood, as well as services, derived from forests and allied land uses", have an important biological and social role in local food systems. They can contribute substantially to nutrition, either as part of the family diet or as a means of achieving household food security. They can also improve health through their role in prevention and treatment of diseases. Poor households residing in and around forest areas, particularly landless people, women and children, depend to a varying extent on the exploitation of common-property forest resources in daily life or in periods of crisis.

Forest foods can constitute an important element of sustainable diets. They can broaden the food base and diversify the diet, thus preventing nutrient deficiencies and ensuring dietary balance. They come from locally available natural resources which are part of or compatible with the local ecosystem. NWFPs also contribute to household food security and health. Wild leaves and fruits contain many essential nutrients. Seeds, nuts, roots and tubers found in forests supply fats and carbohydrates. Mushrooms, gums and saps provide protein and minerals. Wild animals from the forest often supply most of the meat consumed by people living in or near forest areas. Other forest resources have a major role in the economy of many households, not only contributing food, but

also providing timber for building, fuel wood and inputs for agricultural production, as well as generating income, thereby contributing to household food security.

NWFPs have not received the required attention in development planning, and forest foods are overlooked in most nutrition programmes. Foresters have a major role to play in the promotion of NWFPs, and this role should not be limited to the design and promotion of sustainable exploitation techniques. It is increasingly recognized that the forest should be seen as a dynamic system and that the needs of indigenous people, and particularly their household food security and nutritional well-being, should be taken into account in discussing productivity and environment. The promotion of NWFPs should not be seen, however, as the sole responsibility of forest departments. All government and NGO development workers operating in or near forested areas, and particularly agricultural extension workers and health staff, should be made aware of the present and potential contributions of NWFPs and should be involved in a concerted effort to promote household food security and improved nutrition of the local population on the basis of existing resources. The development of technological research and quality standards and the design of communication strategies for consumer information will be particularly important for the successful marketing of forest foods that have economic potential.

2.2.3. The link between Diversified Food Production and Nutrition Security

Diversified food production which is production of various food products/items can lead to improved nutrition security. Many people in developing countries like Ethiopia are becoming self-sufficient in food production but diet remains poorly diversified. This indicated that food production sufficiency is not a grantee for nutrition security. Therefore, diversifying and increasing food production through integrating agriculture with natural resource management is the key element for promoting nutrition security. The conservation of natural resource such as forest, area closures and the ecosystem at large can affect diversified agricultural production through enhancing water availability and soil fertility. Agricultural diversification through a cropping strategy and livestock production can influence household dietary diversity in two ways: (a) through increasing production of crops and animals for own consumption and (b) through the sale of agricultural crops and animals that affect household incomes and household food purchasing decisions. The two approaches are further described below.

(a) Production for improved food security

Diversification into high nutritive food production has potential to improve nutritional outcomes for farm households. Crop and livestock production diversification have found varying effects on nutrition through increasing households access to nutritionally rich crop and animal products. For purposes of improving food diversity and nutritional outcomes, it therefore suggested that agricultural production interventions be implemented alongside social investment programs in health and education. Considering the importance of improved agricultural production to the country' food security, there should be a policy support to the link between agricultural diversification and natural resource management that enhance smallholders' nutrition security.

(b) Incomes for improved food security

Agricultural diversification and particularly crop and animal diversification are fundamental for development in agrarian based economies like Ethiopia. This has been promoted in developing countries for its ability to enhance household incomes and ensure food and nutrition security. At the household level crop diversification is a potential vital pathway for household food security and nutrition through increased incomes realized from the sale of agricultural produce. Therefore, agricultural incomes can make a positive contribution to child nutrition particularly where households have well conserved natural resource base. However, the income from the agricultural products in enhancing nutrition security is subject to different characteristics such as food markets, level of empowerment to make decisions on household food purchases, and household nutritional knowledge.

Therefore, diversification of smallholder crop production is a crucial step in food and nutrition security strategies. Diversifying production to include horticulture and high value crops allows smallholders to broaden sources of food in local diets and enter domestic markets for higher value products. It strengthens resilience to economic and climate risks. Diversified production can help improve nutrition, strengthen livelihood, create opportunities for local agro-processing, generate employment along the value chain, and stimulate local economic development.

Cognizant of the importance of diversified food production for nutrition security, FAO programs for crop diversification include among their goals improvements in the nutritional health status of low-income households, through increased production of nutrient-rich foods for direct consumption and generation of the income needed to procure the amount and variety of food families need.

Among nutritionally vulnerable households with limited land, one of the most effective diversification strategies is homestead food production. By employing household labor intensively on small vegetable gardens and fruit tree plots, homestead production improves the quality of family nutrient intake, while allowing women to fulfill domestic and child care roles. With extension support, access to land and water, credit and markets, and economies of scale achieved through the organization of women in groups, homestead programs can generate incomes that women control, leading to better child nutrition education and health, sustainable livelihoods and community development.

Growing horticultural crops increases the supply of fresh, nutritious produce and improves poor people's economic access to food. Access to nutritious food is a key dimension of food security. In Africa and Asia, urban households spend up to 80 percent of their food budgets on cheap "convenience" foods that are often deficient in vitamins and minerals. Horticultural foods, such as fruits, vegetables and nuts, are important for the daily diet and are among the richest natural sources of micronutrients, providing dietary fiber, vegetable proteins, lipids and other bioactive components. But in developing countries, daily fruit and vegetables consumption is just 20–50 percent of FAO/World Health Organization (WHO) recommendations.



Benefits of crop diversification



Figure 2.1. Benefits of Crop Diversification

2.3. Impact of Climate change on Agricultural Production and Nutrition

Climate change is mostly affecting the ecosystem, forest and mountain regions where the nutritionally rich fauna and flora species are found. In addition, water and air quality are deteriorating while continued increases in consumption and associated waste have contributed to the exponential growth in the existing environmental problems. Increases in the intensity and/or frequency of many extreme weather events such as alerted drought, erratic rainfall, pests and diseases, flood, changing in growing season, and severe dust storms can adversely affect the agricultural land where our food is produced. Impacts of such disasters range from hunger and susceptibility to disease, to loss of income and livelihoods, affecting human survival and well-being.

The population growth, use of forests for grazing land, seasonal movement of livestock and improper land use practice are also creating a pressure to the natural resource base in developing countries aggravating the impact of climate change thereby food insecurity and malnutrition. The poor, who is under stress of getting food and affected by malnutrition is the most vulnerable to the climate change. The reason why the poor is the most vulnerable is; it's heavily dependent on natural resource, net buyer of the food items, low adaptive capacity, limited social network and few assets they can sell. Therefore, making agriculture climate smart through conserving the natural resource base is suggested for improving the nutrition status of the poor and the community at large under changing climate change particularly, in low income countries. Identifying the exposure; what going to be affected particular climate hazard, what characteristics make something more susceptible to harm, creating a system to anticipate respond, cope and cover would help to adapt climate change and thereby alleviate poverty and nutrition insecurity. Understanding and addressing the causes of climate change vulnerability such as avoid natural resource use conflict, protect forest illegal logging, and avoid grazing in protect areas can minimize climate impacts and increase diversified food production for improved nutrition provision for the community.

2.3.1. Basic Concept of Climate Change

What is Climate Change?

The United Nations Framework Convention on Climate Change (UNFCCC) defines it as a change of climate that is attributed directly or indirectly to human activity, altering the composition of the global atmosphere.

Human activity includes the pollution that arises from industrial activity and other sources that produce greenhouse gases. These gases, such as carbon dioxide, have the ability to absorb the spectrum of infrared light and contribute to the warming of our atmosphere. Once produced, these gases can remain trapped in the atmosphere for tens or hundreds of years.

Some key issues about climate change include the following:

- Climate change is already happening, and its future effects will be most pronounced in the global South, especially Africa south of the Sahara and Southeast Asia.
- The rural poor are the least able to adapt; thus, climate change increases inequity.
- The global food system both drives and is impacted by climate change.

- Without action, climate change will impact nutrition through decreased food quantity and access, decreased dietary diversity, and decreased food nutritional content.
- We need a climate-smart and nutrition-sensitive food system in order to ensure that mitigation and adaptation strategies take nutrition into account.

2.3.2 Effect of Climate Change on Nutrition security

The intersection of climate change, food security, and nutrition is critical given growing adverse climate change impacts that threaten food security and nutrition outcomes, especially for the most vulnerable society groups in the developing world. Therefore, a better understanding of the pathways linking climate change and nutrition is critical for developing effective interventions to ensure that the world's population has access to sufficient, safe, and nutritious food. Under-nutrition can be exacerbated by the effects of climate change at all stages of the food value chain. In addition, disease is affected by climate and can, in turn, increase nutrient demands and reduce nutrient absorption. Dietary diversity and animal-source foods can be important tools for improving nutrition and health in nutritionally deficient populations.

In many regions of the world, particularly in Africa south of the Sahara and in South Asia (although variation within countries and regions is certain), agriculture will have greater difficulty in producing enough food that is of good quality (diverse, high in nutrient density, and safe). Food systems and ability to move food from production to markets will be affected, which will further limit consumers' access to diverse and high quality diets in their local food environments.

There are different stages where nutrition can enter and exit in the value chain at all stages, from agricultural inputs and food production to food consumption and utilization. Accordingly, the effects of climate change on nutrition can be described along the food value chain. The first step in the food value chain is the agricultural input supply, which includes seeds, fertilizer, irrigation, and extension services. At this point in the chain, the seeds impact what crops and varieties are grown, which is key for crop diversity as well as for choosing varieties that are heat and drought resistant in the face of climate change. Fertilizer and other methods of improving soil quality affect how productive and nutritious crops are. Irrigation also affects crop productivity and provides increased stability against changing precipitation patterns due to climate change.

The second step along the chain is food production. Changing temperatures and precipitation patterns affect where food can be grown. Increased carbon dioxide levels increase some crop growth to a certain extent but also decrease crops' nutritional quality. The third step is food storage. Again, increasing temperatures and changes in precipitation cause new food safety risks, especially with aflatoxins. It is critical to address these risks in storage to keep food safe. Rising temperatures will also increase demand for cold storage in order to maintain food safety and quality, and to prevent food waste. Extreme weather events also pose a risk for food storage and can lead to food waste.

The fourth step is processing, which provides an opportunity to add nutrition through fortification or to increase the quality and stability of nutritious vegetables, fruits, and animal-source foods through fermentation, drying, and other methods. However, some processing, such as milling, causes a loss of nutrition. The fifth step is distribution, which allows food to be moved from areas of surplus to areas of shortage and can be used to target vulnerable populations. However, climate change will impact methods of transportation, from roads to rail lines, through both long-term changes in climate and short-term extreme weather events. Transportation disturbances as a result of climate change can impact food availability and prices.

The sixth step is marketing and retail. At this stage, it is critical that sustainability, as well as nutrition, be incorporated into food marketing and dietary guidelines. The seventh and final step is food consumption and utilization. It is important for people to have the knowledge and skills to prepare nutritious foods and to minimize nutrient losses during preparation. Climate change also threatens to increase infectious diseases, including diarrheal diseases, which can decrease nutrient absorption and increase individuals' nutritional needs.

Net increase in nutrition along the value chain

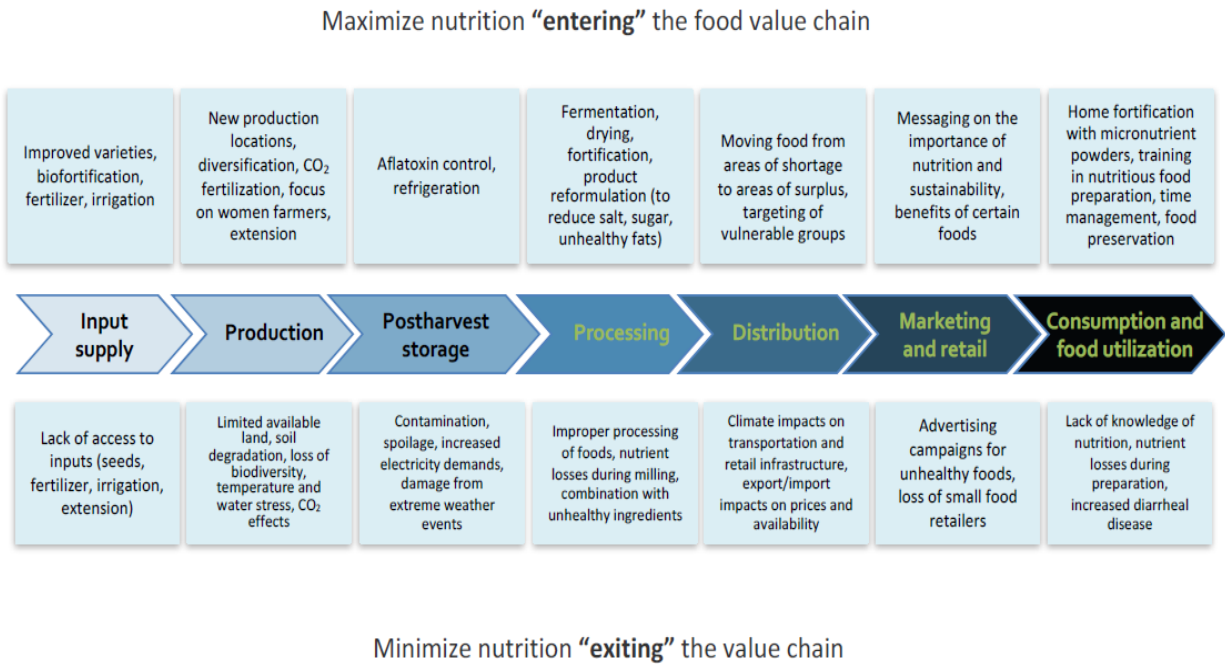


Figure 2.2. Net increase in nutrition along the food value chain

Climate change effects on nutrition can generally be described in terms of the effects of changes in rainfall and temperature.

Effects of changes in rainfall on nutritional status

Globally, more than 80 percent of agriculture, and about 95 percent of croplands in Africa and South of the Sahara are rain fed. The importance of rainfall is evident in terms of food supply and availability, which have direct implication for nutritional status. The effects of changes in rainfall vary (can be positive or negative) across regions and sub-populations.

An increase in rainfall could support food production; especially in countries in Africa south of the Sahara where advanced irrigation technologies are uncommon, and result in higher quantities of food available during pregnancy and infancy. Increased food availability could also influence food prices, which in turn affect the food access of these households. However, the opposite could also be true, with increased rainfall damaging crop output, which in turn could negatively affect child nutritional status through these same pathways.

Effects of changes in temperature on nutritional status

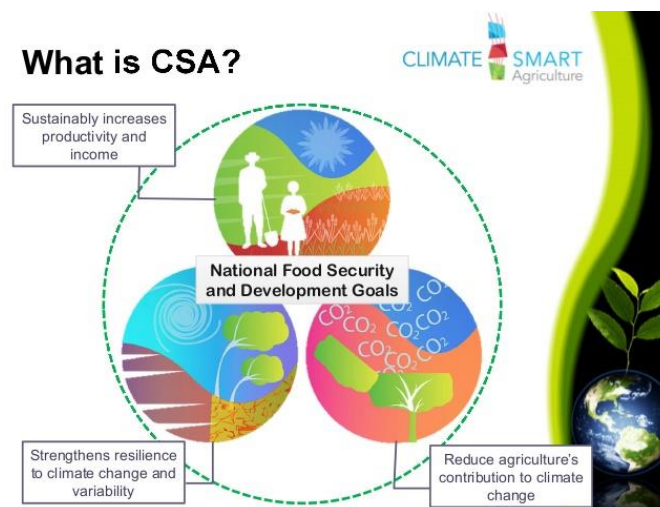
Similar to precipitation, changes in temperature have both positive and negative impacts on nutritional status with regional differences depending upon the specific context under consideration.

2.4. Climate smart agriculture (CSA) for sustainable food system

What is CSA?

Climate-smart agriculture (CSA) may be defined as an approach for transforming and reorienting agricultural development under the new realities of climate change. The most commonly used definition is provided by the Food and Agricultural Organization of the United Nations (FAO), which defines CSA as “agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals”. In this definition, the principal goal of CSA is identified as food security and development while productivity, adaptation, and mitigation are identified as the three interlinked pillars necessary for achieving this goal.

Figure 2.3. Schematic Presentation of CSA



Source: Irina Papuso and JimlyFaraby, 2013

There are three Pillars of CSA:

1. **Productivity:** CSA aims to sustainably increase agricultural productivity and incomes from crops, livestock and fish, without having a negative impact on the environment. This,

in turn, will raise food and nutritional security. A key concept related to raising productivity is sustainable intensification.

2. **Adaptation:** CSA aims to reduce the exposure of farmers to short-term risks, while also strengthening their resilience by building their capacity to adapt and prosper in the face of shocks and longer-term stresses. Particular attention is given to protecting the ecosystem services which ecosystems provide to farmers and others. These services are essential for maintaining productivity and our ability to adapt to climate changes.
3. **Mitigation:** Wherever and whenever possible, CSA should help to reduce and/or remove greenhouse gas (GHG) emissions. This implies that we reduce emissions for each calorie or kilo of food, fibre and fuel that we produce. That we avoid deforestation from agriculture. And that we manage soils and trees in ways that maximizes their potential to acts as carbon sinks and absorb CO₂ from the atmosphere.

Key characteristics and principles of CSA:

- **CSA addresses climate change:** Contrary to conventional agricultural development, CSA systematically integrates climate change into the planning and development of sustainable agricultural systems.
- **CSA integrates multiple goals and manages trade-offs:** Ideally, CSA produces triple-win outcomes: increased productivity, enhanced resilience and reduced emissions. But often it is not possible to achieve all three. Frequently, when it comes time to implement CSA, trade-offs must be made. This requires us to identify synergies and weigh the costs and benefits of different options based on stakeholder objectives identified through participatory approaches.
- **CSA maintains ecosystems services:** Ecosystems provide farmers with essential services, including clean air, water, food and materials. It is imperative that CSA interventions do not contribute to their degradation. Thus, CSA adopts a landscape approach that builds upon the principles of sustainable agriculture but goes beyond the narrow sectoral approaches that result in uncoordinated and competing land uses, to integrated planning and management.
- **CSA has multiple entry points at different levels:** CSA should not be perceived as a set of practices and technologies. It has multiple entry points, ranging from the development of technologies and practices to the elaboration of climate change models and scenarios, information technologies, insurance schemes, value chains and the

strengthening of institutional and political enabling environments. As such, it goes beyond single technologies at the farm level and includes the integration of multiple interventions at the food system, landscape, value chain or policy level.

- **CSA is context specific:** What is climate-smart in one-place may not be climate-smart in another, and no interventions are climate-smart everywhere or every time. Interventions must take into account how different elements interact at the landscape level, within or among ecosystems and as a part of different institutional arrangements and political realities. The fact that CSA often strives to reach multiple objectives at the system level makes it particularly difficult to transfer experiences from one context to another.
- **CSA engages women and marginalized groups:** To achieve food security goals and enhance resilience, CSA approaches must involve the poorest and most vulnerable groups. These groups often live on marginal lands which are most vulnerable to climate events like drought and floods. They are, thus, most likely to be affected by climate change. Gender is another central aspect of CSA. Women typically have less access and legal right to the land which they farm, or to other productive and economic resources which could help build their adaptive capacity to cope with events like droughts and floods. CSA strives to involve all local, regional and national stakeholders in decision-making. Only by doing so, is it possible to identify the most appropriate interventions and form the partnerships and alliances needed to enable sustainable development.

2.5. Significance of natural resources conservation for nutrition

2.5.1. Watershed management and nutrition

Watershed is an area of land that drains water, sediment and dissolved materials to a common receiving body or outlet. The term is not restricted to surface water runoff and includes interactions with subsurface water. Watersheds vary from the largest river basins to just acres or less in size. Sound management of watersheds provides multiple benefits in terms of food production, environmental health, and nutrition. Properly managed watersheds, rangelands, forests, and fisheries enhance ecosystem functions that boost agricultural productivity, increase access to clean water, replenish aquifers, mitigate damage from storms and floods, and reduce negative environmental impacts from agriculture. Watershed programs are designed to influence the biophysical and environmental aspects thereby bringing changes in socioeconomic conditions that

will contribute to the improvement of the nutritional status of the communities. Nutrition security is central to the sustainable development agenda of the developing nations. Therefore, developing and properly managing watershed could contribute to the improved nutritional status of smallholder farmers through enhancing agricultural production and diversification. The existence of well enriched watershed can help farmers to get an increased access of water and fertile soil for agricultural production. It can also appreciate/increase smallholder's disposable income with an increase in crop diversification and employment through wage works. Its contribution to nutritional security with an increase in access to quality foods such as milk, meat, fruits and vegetables is vital. Therefore, managing the watershed is essential for improving the nutritional status of the community through enabling farmers produce a diversified food from it.

2.5.2. Role of agroforestry practices for nutrition

Agroforestry, which is an ecologically based traditional farming practice, integrates trees into the farming systems to increase agricultural productivity and diversify income for households and communities. It is also one of the best uses of agro-biodiversity that also generates multiple benefits, including ameliorate soil fertility, control erosion and moisture retention which improves productivity and production of diversified food products. In many tropical countries certified organic products are produced successfully in agroforestry systems. The system includes a diversity of cash and subsistence crops (e.g. bananas, coffee, cocoa, pineapple, yams, and beans) as well as livestock. Domestication of nutritionally rich and diversified plants in the agroforestry system is essential for addressing the issue of malnutrition. This can also support the future food needs of the growing population through ensuring people to have access to adequate and nutritious food produced in an environmentally and socio-culturally sustainable manner. For instance, nutritionally rich and diversified vegetables can be grown in the agroforestry systems mixing with fruit trees, leguminous trees, banana, palm trees, and other species covering the soil. The agroforestry systems may reach a high degree of diversity where there are fewer risks of pest and diseases, however, these systems need continuous organic productions in order to maintain the productivity at acceptable levels. An example of agroforestry in the tropics is the combination of palm trees, papaya, bananas and vegetables.

Forests and trees can play an important role in many food systems, either through direct and indirect provisioning for human nutrition, particularly in developing countries. Especially in areas

where farming land is very minimal (mostly less than half a hectare) and challenged to produce diversified food to secure nutrition, forests and tree can contribute through providing nutritionally rich edible plants. Agroforestry practice therefore is among the many options support sustainable agricultural production for promoting improved nutrition in rural households.

The other important agroforestry practice which important for improving food security and nutrition is home garden agroforestry. Home gardens combining trees and horticultural crops are an important form of agroforestry and provide a substantial amount of total dietary energy consumed by some farming communities. Traditional compound farms can contain more than 60 species of trees that provide food products. Forest foods are extremely important because they are frequently available to tide households over hungry seasons when other food crops are in short supply.

2.5.3. Link between soil management and nutrition

The most widely recognized function of soil is its support for food production. It is the foundation for agriculture and the medium in which nearly all food-producing plants grow. In fact, it is estimated that 95% of our food is directly or indirectly produced on our soils. Healthy soils supply the essential nutrients, water, oxygen and root support that our food-producing plants need to grow and flourish. Soil health is defined as the capacity of soil to function as a living system. Healthy soils maintain a diverse community of soil organisms that help to control plant disease, insect and weed pests, form beneficial symbiotic associations with plant roots, recycle essential plant nutrients, improve soil structure with positive effects for soil water and nutrient holding capacity, and ultimately improve crop production. A healthy soil also contributes to mitigating climate change by maintaining or increasing its carbon content. Therefore, nutritious and good quality food can only be produced if our soils are healthy. A healthy living soil is therefore a crucial ally to food security and nutrition. The depletion in soil will lead to a decreased agricultural productivity and production aggravating hunger and malnutrition. Therefore, soil management using the numerous and diverse farming approaches such as agro ecology, conservation agriculture, organic farming, zero tillage farming and agroforestry that promote the sustainable management of soils will directly contribute the nutritional status of the community.

2.5.4. Irrigation and nutrition

Agricultural interventions, such as irrigation, increase food production and availability. But does more food always lead to better nutrition? Increased food availability is likely to result in better nutrition, though this might not always be the case. Other factors such as food access and utilization are also important determinants of food security and related nutrition outcomes.

Food security is usually defined according to three dimensions that need to be fulfilled simultaneously and maintained over time: food availability, food access, and food utilization. Food availability refers to the existence of adequate food supply from domestic agriculture or food imports. Food access involves a household's ability to obtain food in the market or from other sources, which is usually determined by a household's income and the existence of markets. Finally, food utilization refers to the ability to consume nutritious foods and benefit from them. Irrigation schemes are likely to provide enhanced food security and nutrition to farmers due to a greater availability and stability of food supplies and crop diversification. The use of irrigated agriculture enables crop production during the dry/lean season, which increases the number of harvests per year and leads to increased yields and crop diversification. In Ethiopia, for example, farmers using irrigation systems produced crops twice, and sometimes even three times, per year and thereby enhance their agricultural production contributing to the improvement of nutrition.

Smallholder irrigation systems are mostly used to grow vegetables in the dry season; consequently, vegetable consumption among irrigation users and their communities usually increases. Vegetables are rich in micronutrients and provide important benefits, especially for children. Irrigation systems are also likely to improve the intake of animal-source foods as a result of higher incomes and improved livestock productivity. Therefore, it can generally be concluded that irrigation interventions can improve nutritional outcomes through increased productivity and availability of food supplies and improved diet (both in quantity and quality).

2.6. Consequences of natural resources degradation on nutrition

Environment and natural resources preservation is vital to the economic growth of any country or a region in many ways but also susceptible to the extent that their utilization, management and sustainability can be affected by performance and deeds of various factions within the society. Natural resources and environmental issues matters and apprehensions are cross-sectorial but also render input in every sector in terms of reducing poverty and destitute conditions of people and therefore need to be accorded highest precedence within the overall framework of the Poverty Eradication Action Plan. The soil, for example, that covers the surface of the earth is the key to the well-being and survival of individuals. On the other hand, the degradation of various forms of biodiversity (e.g. forest and tree resources, and other aquatic organisms), which are sources of various foods can lead to problems of malnutrition. In addition, without proper environmental conditions for providing various ecosystem services for sustainable food systems, there would be absence of foods from both plant and animal sources.

Summary

Natural resources are generally the bases for enhanced, diversified and sustained agricultural production and thereby contributing to the improvement of nutrition. Among the long lists of natural resources, for example, forest and tree resources are the major sources of foods that can supplement the traditional agricultural food sources. These food sources of biological origin are among the Non-wood Forest Products (NWFPs) that can broaden the food base of the community and diversify the diet, thus preventing nutrient deficiencies and ensuring dietary balance. In addition, natural resources can contribute to improving nutrition through sound and sustainable management of other resource components such as soil management, water management (especially through use of water for irrigation), agroforestry practices, and also through various integrated watershed management interventions. The significance of conserving the underlying natural resources base for nutrition can also be explained in terms of climate change mitigation and adaptation. With this regard, promotion of climate-smart agriculture, which targets on increasing agricultural production on a sustainable basis while enhancing resilience (adaptation) and reducing greenhouse gases emission (mitigation) has got substantial contribution for improving nutrition.

Self-Assessment

- Q1. Explain about diversified food production, and how natural resources can contribute to food diversification.
- Q2. Discuss the significance of natural resources for improving nutrition.
- Q3. Describe the effects of climate change on sustainable food production and on nutrition.
- Q4. Discuss about the significance of Climate Smart Agriculture in sustainable food systems and nutrition.

Learning activities

Case study 1: watershed, irrigation and nutrition linkage

Objective: at the end of this case study, students will be able to analyze the linkage between the watershed management, irrigation and nutrition.

Instruction

1. Be in a group of five
2. Read the scenario carefully and discuss the question
3. Each group will submit written linkage between the watershed management, irrigation and nutrition
4. Time allotted is 15min.

Village X is a village living alongside of the Watershed. In this village the main livelihood is mixed farming. Farmers in this village dominantly grow wheat and barley in the rain fed agriculture system. In this village following the existence of well managed watershed, water is available all year round accessible both for irrigation and livestock. However, studies in this area indicated that the community only produces wheat and barley for household consumption. Further the main reason for keeping animals in this village was to get traction oxen.

Q1. In your opinion do you think that the availability of watershed is helping the community to improve their nutrition status? if not why

Q2. What can you suggest to the community to improve their nutritional status under the given scenario?

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Chapter 3: Safe Production and Post-Harvest Handling of Agricultural Products

3.1. Introduction

Food safety is a scientific discipline describing handling, preparation and storage of food in ways that prevent foodborne illness. This comprises a number of practices that should be followed to avoid possible health risks. The pathways within this route of thought are safety among food value chain (production, industry, the market and then between the market and the consumer). In seeing industry to market practices, food safety concerns contain the origins of food including the practices relating to food labeling, food hygiene, food additives and pesticide residues, as well as rules on biotechnology and food and guidelines for the management of governmental import and export inspection and certification systems for foods. In considering market to consumer practices, the usual thought is that food must be safe in the market and the concern is safe delivery and preparation of the food for the consumer.

Postharvest handling is the stage of production immediately following harvest, including cooling, cleaning, sorting and packing. The instant agricultural produce is removed from the ground, or separated from its parent plant, it begins to deteriorate. Post-harvest treatment largely determines final quality, whether a crop is sold for fresh consumption, or used as an ingredient in a processed food product. The most important goals of post-harvest handling are keeping the product cool, to avoid moisture loss and slow down undesirable chemical changes, and avoiding physical damage such as bruising, to delay spoilage. Sanitation is also an important factor, to reduce the possibility of pathogens that could be carried by fresh produce, for example, as residue from contaminated washing water. Therefore, this chapter of the course will cover the basic principles of good agricultural and hygienic practices and the effect of post-harvest handling, processing and preservation on nutrient content of food.

Learning Objectives: At the end of this chapter students will be able to

- Apply safe production and post-harvest handling of agricultural produce
- Describe Good Agricultural Practice (GAP) and Good Hygienic Practice (GHP)

- Identify the effect of post-harvest handling, processing and preservation on nutrient content of foods

3.2. Safety of agricultural products

3.2.1. Definition of food safety and related terms

- **Food Hygiene:** All measures necessary to guarantee the safety of food at all stages of the food chain.
- **Foodborne Illness:** Sickness or injury caused by eating food containing a microbiological, chemical or physical hazard(s).
- **Foreign Material:** Any substance or object that does not naturally or normally belong in a food product.
- **Good Agricultural Practices (GAP's):** This refers to an integrated management system and the resulting 'best-practices' designed to ensure the efficient production of safe agricultural products.
- **Good Manufacturing Practices (GMP's):** General procedures to reduce food safety hazards.
- **Good Hygienic Practices (GHP):** The basic rules for the clean and healthy handling, storage, processing, distribution and final preparation of all food along the food production chain.
- **Hazard Analysis Critical Control Point (HACCP):** It is a systematic food safety assurance method to identify, evaluate and control of food hazards.
- **Hygiene:** Conditions and practices followed to maintain health including sanitation and personal cleanliness.
- **Pesticide:** A substance used to prevent, destroy or repel any insect, nematode, rodent, predatory animal, parasite, bacteria, fungus, weed or other form of plant or animal life.

3.2.2. Food quality versus food safety

Food safety and food quality are two important terms which describe aspects of food products and the characters of the processors. The terms food quality and food safety are important in any food manufacturing environment, and often used interchangeably, but there is a distinct relationship between food quality and food safety.

Food quality

Food quality can be defined as a total of traits and criteria which characterize food as regards its nutritional value, sensory value, convenience as well as safety for a consumer's health. Good quality exists when the product complies with the requirements specified by the client. This means quality is a term defined by the consumer, buyer, grader, or any other client based on a number of subjective and objective measurements of the food product.

Food safety

Food safety is a component of quality and an assurance that food will not cause adverse harm to the consumer when it is prepared and/or consumed according to its intended use to final consumers. Food safety is not negotiable. All requirements relating to the safety characteristics of a food must be met; there must be no unacceptable health risk associated with a food. Safety differs from many other quality attributes since it is a quality attribute that is difficult to observe. A product can appear to be of high quality, i.e. well colored, appetizing, flavorful, etc. and yet be unsafe because it is contaminated with undetected pathogenic organisms, toxic chemicals, or physical hazards. On the other hand, a product that seems to lack many of the visible quality attributes can be safe.

3.2.3. Food safety hazards

The safety of a food can be related directly to certain harmful substances that are present in the food; these substances are food safety hazards. Any substance that is reasonably likely to cause harm, injury or illness, when present above an established acceptable level, is a food safety hazard. An unacceptable level of a food safety hazard in a food presents a health risk to the consumer.

There are three recognized categories of food safety hazards: biological hazards, chemical hazards, and physical hazards. The origin of these hazards in foods can be from naturally occurring

substances or agents in foods, from deterioration or decomposition of foods, or from contamination of the foods with the hazard at various stages of their production, harvesting, storing, processing, distribution, preparation, and utilization.

i. Biological hazards

Raw produce can become contaminated with pathogenic and non-pathogenic microorganisms at a number of different stages, by several means, from production through to consumption. Biological hazards occur in foods includes bacteria, fungi, virus and parasites. Pathogens can contaminate at any point along the food chain, at the farm, packing shed, processing plant, transportation vehicle, retail store or food service operation, and at home. The foods that are commonly involved in these food poisoning incidents include meat and poultry and their products, seafood and seafood products, egg and egg products, milk and dairy products, fruits and vegetables and their products, cereals, legumes, oilseeds/ low-acid canned foods, and water.

ii. Chemical hazards

Chemical hazards occur when a chemical enters the food and person ingests it. These chemicals include cleaning agents, sanitizer, pesticides, certain metals, or unapproved food containers and naturally occurred toxins like oxalate in rhubarb, alkaloids in potatoes, toxins in mushrooms and in shellfish. Agricultural and industrial inputs are source of chemical hazards. Agricultural residues are a group of residual chemical or biochemical substances found in foods and are directly attributable to certain substances that have been approved for use in the production of crops and livestock for food. They include residues of permitted pesticides, herbicides, fungicides, drugs, hormones, and antibiotics. Some of these residues are considered as added harmful substances attributable to human actions and are regulated by governments.

Several harmful chemicals that enter the environment as a result of industrial activity have been shown to be present in foods. These substances include heavy metals (lead, mercury, arsenic), organo-chlorinated compounds such as polychlorinated biphenyls (PCBs), and are considered as industrial or environmental contaminants.

iii. Physical hazards

Physical hazards include organic or inorganic substances, commonly referred to as foreign objects, foreign matter, or extraneous materials. Hard and sharp physical hazards are of particular concern. Depending on their size and dimensions, hard and sharp physical hazards can cause injury to the

mouth or teeth, or can cause serious injuries if swallowed. In addition, some physical hazards, depending on their size, shape, and texture, have the potential to cause choking if swallowed. Physical hazards in foods can be particularly harmful to infants. Certain hard and sharp foreign objects that are natural components of food (e.g., prune, date or olive pits; fish bones nutshells) are not considered physical hazards since it is expected that the consumer will be aware that these objects are natural components of the foods. However, if the food carries a label stating that the hard and sharp object has been removed (e.g., pitted prunes), the presence of the hard and sharp object in the food represents a hazard, since it is not expected by the consumer. The common hazards considered as avoidable physical hazards in foods include broken glass, pieces of hard or soft plastic materials, stones, pieces of metal, pieces of wood and personal articles. A variety of personal articles can become foreign objects in foods, resulting from unintentional adulteration by employees during preparation, handling, processing, and packaging. Personal articles that have been found in foods include jewelry, pens or pencils or their parts, Band-Aids, and ear plugs.

3.2.4. Safety and Quality Management Systems

In order to preserve the various quality features in food products, various safety and quality assurance systems have been developed. Some of the systems are obligatory by law and some voluntary to be implemented by the food chain members. The distinction between obligatory and voluntary systems is based on the safety (hazard-free products) being the quality of food required by law. Thus, obligatory systems have been established to assure food safety, and are subsequently called “safety assurance systems”. These include Good Hygiene Practices (GHP), Good Agricultural Practice and Good Manufacturing Practices (GMP) which are generally called accepted best practices and Hazard Analysis and Critical Control Point (HACCP), which is preventive methods applied, to different extents, by most enterprises that export food in order to reduce the risk of microbial, chemical and physical contamination

i. Good agricultural practice (GAP)

GAP focuses on the best practices to be used for producing agricultural products to ensure the quality and safety of the final product. GAP is guidelines, which ensure that all agricultural practices, in particular pest and disease control are in accordance with Integrated Crop

Management (ICM) and Integrated Pest Management (IPM) practices. GAP aims at ensuring sustainable agriculture by minimizing hazards for the workforce, other actors along the food chain, consumers and the environment while ensuring economically viable production. With the increasing need for food quality and safety through the chain, the trend goes towards integrating HACCP and traceability concepts into GAP systems.

ii. Good hygienic practice (GHP)

Guidelines for GHP aim at establishing processing, handling, transport and distribution procedures that are appropriate to prevent perishing due to micro-organisms, growth of pathogens on food stuff, contamination with chemical residues or contaminants (e.g. mycotoxins). Basic rules are set out in the 'Codex General Principles of Food hygiene. They include requirements for the design of facilities, control of operations (including temperature, raw materials, water supply, documentation, and recall procedures), maintenance and sanitation, personal hygiene and training of personnel. Hygienic practices form an integral part of all food safety management systems, as for example within the HACCP system.

iii. Good manufacturing practices (GMP)

There are many reactions occurring during processing and manufacturing of raw materials that cause changes in composition, nutritional value, physical structure and sensory properties. The objectives of GMP are to control these changes so as to develop the desired qualities in the product, to ensure food safety and to stop or slow down any deterioration in the food. Good Manufacturing Practices means understanding, analyzing and controlling the manufacturing process.

iv. Hazard Analysis and Critical Control Point (HACCP)

The hazard analysis critical control points (HACCP) is a common sense approach to identifying, quantifying and controlling food safety hazards. It sets up a framework allowing the detailed examination of a process to identify hazards and where the hazards can be controlled. HACCP system is a food safety management strategy which has been widely tested and established as an effective means of preventing food-borne diseases were correctly implemented. It is considered a scientific and systematic system for assuring food safety, which can be applied throughout the whole food chain. HACCP further strengthen preventive and systematic approaches to assuring food safety.

It is a management system in which food safety is addressed through the analysis and control of biological, chemical and physical hazards from raw material production, procurement and handling to manufacturing, distribution and consumption of the finished product. HACCP, which is recognized for its science-based approach, consists of a set of seven principles that have been adopted internationally through the work of Codex Alimentarius Commission. The seven principles of HACCP are:

1. Assesses the hazard, list the steps in the process where significant hazards can occur and describe the prevention measures;
2. Determines critical control points (CCPS) in the process;
3. Establishes critical limits for each CCP;
4. Establishes procedure to monitor each CCP
5. Establish corrective actions to be taken when monitoring indicates a deviation from the CCP limits;
6. Establish record keeping for the HACCP system; and
7. Establish procedures to verify that the HACCP system is working correctly.

3.2.5. Food safety and nutrition linkage

Access to safe and adequate food is a basic human need. Food safety is the assurance that food will not cause harm to the end user. Food can be unsafe at different points from farm to plate: production, distribution, retail/sale, preparation and consumption. Unsafe food is not food because contaminated food could cause disease, immune suppression and stunting. When contaminated agricultural produce is withdrawn from the supply chain the quantum of food is directly impacted and affects access to markets and rural incomes, access to food and economic well-being.

Foodborne and waterborne diarrheal illnesses murder an estimated 2.2 million people yearly, mostly children are affected. Diarrheal is the most common foodborne illness caused by pathogens. The Vicious cycle of disease and malnutrition, particularly affecting most vulnerable groups affects productivity.

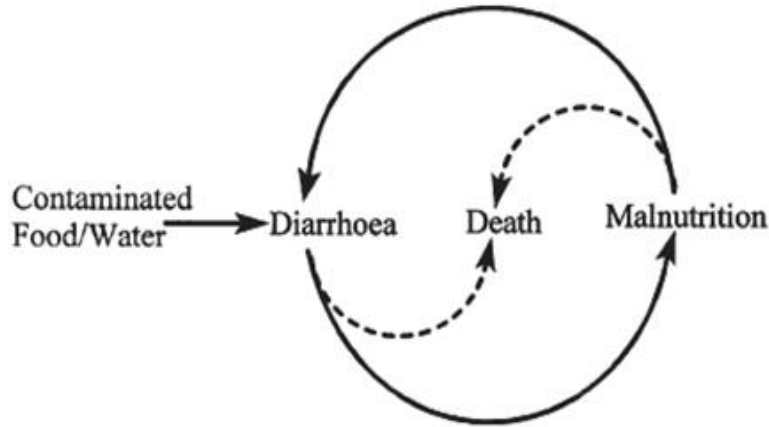


Figure 3.1. Diarrhea malnutrition cycle

Chemical or toxin contamination cause acute poisoning or chronic diseases, cancer. Foods rich in trans-fats, saturated fats, sugars and salt/sodium - increased risk of non-communicable diseases, e.g. diabetes and high blood pressure. Food safety, nutrition and food security are inseparably linked.

Food safety affects food security pillars

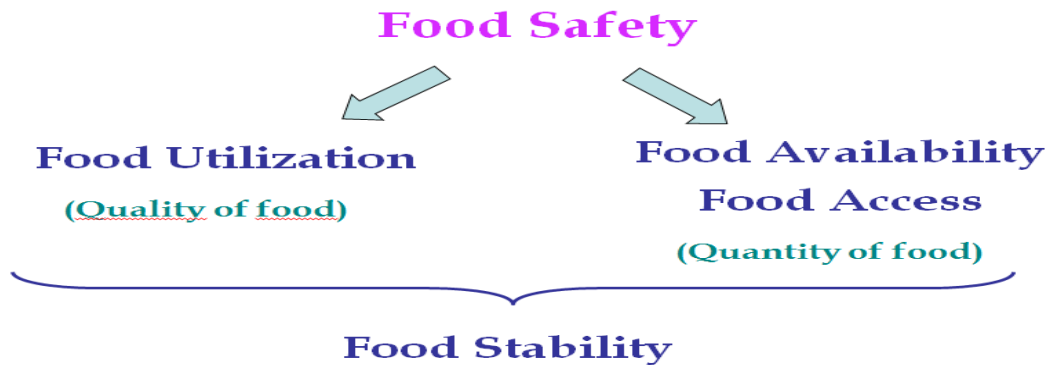


Figure 3.2. Food safety and food nutrition security linkage

Foodborne diseases have negative economic consequences for individuals, families, communities, businesses and countries by imposing substantial burden on health-care systems, trade and tourism, reduce economic productivity and threaten livelihood. Full spectrum of burden of foodborne diseases is challenging to quantify because they are underreported. Thus Policy makers at all levels need science-based, reliable estimates on burden of foodborne disease to make informed decisions and mobilize resources.

Food safety is not negotiable. All requirements relating to the safety characteristics of a food must be met; there must be no unacceptable health risk associated with a food.

3.3. Post-harvest Handling

The post-harvest or post-production operations of agricultural and horticultural products include a wide range of functions between production and consumption. These functions have to be carried out efficiently by different agencies/ individuals in the post-harvest chain in order to supply food of good quality to keep transaction costs low and to deliver high quality and safe raw material for further processing and value addition. Post-harvest operations deserve high priority since they contribute in several ways to the overall goal of sustainable development in agriculture and impact on its profitability. A substantial part of the consumer price for agricultural products, depending on the commodity, the type of post-harvest operation and the organizational structure, is attributable to processing, marketing, transport, storage and handling of the raw product. Therefore, efficient post-harvest handling, storage and marketing can tremendously contribute to social and economic aspects of rural communities.

A considerable part of post-production activities is actually or may be potentially fulfilled on-farm by members of farm households. This adds to the value of the farm product and therefore the income of the household. Women and weaker sections with little access to resources can find income opportunities in handling, processing and trading agricultural products. Especially in rural areas, post-harvest operations contribute to employment, income generation and alleviation of poverty for these groups. Minimal processing has opened new avenues for handsome returns in the production catchments.

There is a pressing need to establish efficient, time-cost-energy saving post-harvest technology systems, which reduce losses and optimize produce suitability and quality for market requirements. Among the critical areas that urgently require attention are: loss minimization, handling production

surpluses, safe transport, transit or longer time storage, market access and creating favorable conditions for higher acceptance of high quality and competitively priced processed food.

3.3.1. Basic principles of post-harvest handling

The post-harvest system should be thought of as encompassing the delivery of agricultural produce from the time and place of harvest to the time and place of consumption, with minimum loss, maximum efficiency and maximum return for all involved. The term "system" denotes a dynamic, complex aggregate of logically interconnected functions or operations within a particular sphere of activity. The term "chain" or "pipeline" highlights the functional succession of various operations but tends to ignore their complex interaction.

In considering the system or the agro-food chain as a whole, harvesting can be seen as the centre, or as a point between the pre-harvest slope, corresponding to production activity and the post-harvest slope, extending from harvesting to consumption. These ideas are illustrated in the following diagrams, which give Bourne's graphic representation of the food pipeline.

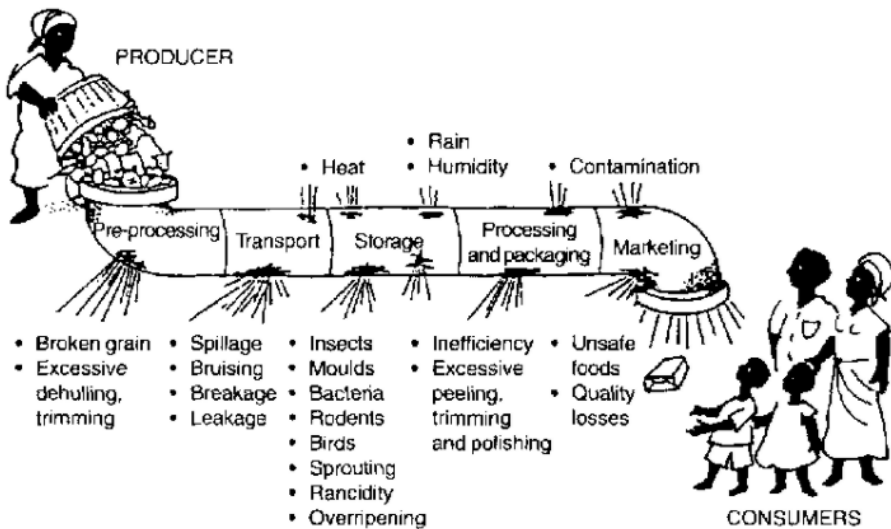


Figure 3.3. The Food Pipeline(Source: Bourne, 1977)

3.3.2. Postharvest loss

Postharvest loss can be defined as the deprivation in both quantity and quality of a food in the postharvest system. This scheme includes interrelated activities from the time of harvest through crop processing, marketing and food preparation, to the final decision by the consumer to eat or discard the food. Postharvest losses can be categorized as: **a) direct losses** :caused by waste or consumption by non-human agents, such as insects, rodents, birds, fungi, bacteria and others; **b) indirect losses:** because of worsening in quality or acceptability of the product up to the point of complete rejection by the consumer, which changes in its appearance, texture, and colour caused by climate, mishandling, transportation, or infrastructure; and **c) economic losses** are losses brought about by changes in market conditions and expressed in economic terms that is losses due to changes in demand and supply.

Food and Agriculture Organization of U.N. predicts one-third of food produced that is about 1.3 billion tons of food are internationally wasted or lost per year. Minimization of these losses would increase the quantity of food obtainable for human consumption and improve global food security the increasing worry with escalating food costs due to growing consumer demand, increasing demand for biofuel and other industrial uses, and increased weather variability. In addition, crop production contributes significant proportion of typical incomes in certain regions of the world (70 percent in Sub-Saharan Africa) and reducing food loss can directly increase the real incomes of the producers.

Currently, one of the key worldwide challenges is how to ensure food security for a world growing population at the same time as ensuring long-term sustainable development. According to the FAO, food production will need to grow by 70% to feed world population which will reach 9 billion by 2050. One important complementary factor food loss and food waste (postharvest loss) which has great importance to solve the problem of feeding the projected population is overlooked but food availability and accessibility can be increased not only by increasing production, improving distribution but also by reducing post-harvest losses. Thus, reduction of post-harvest food losses is a critical component of ensuring future global food security.

The asset needed to minimize post-harvest loss is relatively modest and the return on that investment rises rapidly as the price of the commodity increases. An important factor in developed countries is that a large amount of the food produced is not eaten but discarded, for reasons such as it was left on the plate after a meal or it passed its expiry date. In contrast, failure to consume available food in Less Developed Countries (LDCs) is not a reported concern; instead the issue in LDCs is inefficient postharvest agricultural systems that lead to a loss of food that people would otherwise eat, sell or exchange to improve their livelihoods.



Figure 3.4. Food Loss and Food waste

3.3.3. Causes of postharvest losses

Postharvest losses differ significantly amongst produces and production areas and seasons. As a product moves in the postharvest chain, post-harvest loss can happen from a number of reasons that can be categorized as follows: **physical or mechanical** are losses that can be occurred because of improper harvest methods, poor packaging, and transportation resulting in cuts, abrasions, bruises, breakage or leakage and biological factors and non-biological factors which affect the quality of agricultural produce.

Table 3.1. Generic food supply chain and examples of food waste (Parfitt et al., 2010)

Stage	Example of waste
1. Harvesting, handling at harvesting	Edible crops left in field, ploughed into soil, eaten by pests; timing of harvest not optimal; crop damaged during harvesting
2. Threshing	Loss due to poor technique

3. Drying, transportation and distribution	Quality and quantity loss during drying, poor transport infrastructure; loss owing to spoiling/bruising
4. Storage	Pests and disease attacks, spillage, contamination
5. Primary processing, cleaning, classification, hulling, pounding, grinding, packaging, soaking, winnowing, drying, sieving, milling	Process losses; contamination in process causing loss of quality.
6. Secondary processing, mixing, cooking, frying, molding, cutting, extrusion	Process losses; contamination in process causing loss of quality
7. Product evaluation and quality control	Product disregarded /out-grades in supply chain
8. Packaging	Inappropriate packaging damages produces; grain spillage from sacks; attack by pests
9. Marketing, selling, distribution	Damage during transport; spoilage; poor handling; losses caused by poor storage
10. Post-consumer	Poor storage/stock management; discarded before serving; poor food preparation; expiration
11. End of life disposal of food waste/loss at different stages in supply chain.	Food waste discarded may be separately treated, fed to animals, mixed with other wastes/landfilled

Smallholder farmers manage approximately 500 million small farms and provide over 80 % of the total food consumed in sub-Saharan Africa. The peak area of food losses reported are pre-farm gate where poor harvesting, drying, processing and storage of crops occur. There is confirmation from other developing regions where enhanced farm management practices and storage technologies have resulted in intense food loss reductions which helped farmers to stop the repeated cycle of poverty, created by pressure to sell crops quickly when prices are low to avoid losses, only to buy grain later in the season at higher prices to meet their family's consumption requirements.

Food is lost because of many reasons, which range from natural shrinkage (e.g. moisture loss), mold, pests, inadequate climate control and food waste. Food loss can be qualitative or quantitative. Qualitative losses are reduction of nutrient value and undesirable changes to taste, texture, or color while quantitative loss is measured by decreased weight or volume.

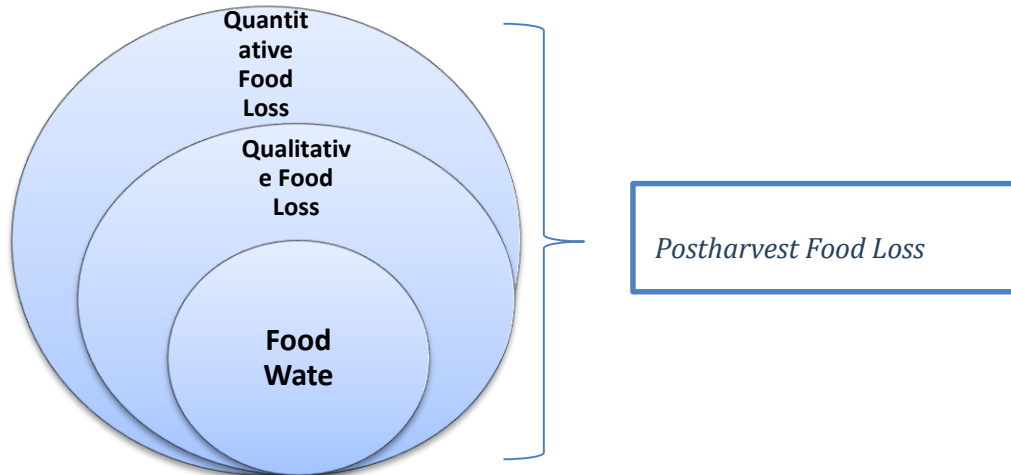


Figure 3.5. Postharvest Loss food components

Postharvest loss of Animal Source Foods (ASF)

Post-harvest losses of ASF occur during animal and product handling, food processing, distribution and consumption; and it varies with the type of animal. Handling losses for bovine, pork and poultry meat refer to death during transport to slaughter and condemnation at slaughterhouse. For fish, it refers to spillage and degradation during icing, packaging, storage and transportation after landing. For milk, handling losses is related to spillage and degradation during transportation between farm and distribution.

Processing losses for bovine, pork and poultry meat, refer to trimming spillage during slaughtering and additional industrial processing, e.g. sausage production. For fish, it refers to industrial processing such as canning or smoking. For milk, losses are related to spillage during industrial milk treatment (e.g. pasteurization) and milk processing to, e.g., cheese and yoghurt.

Distribution losses includes losses and waste in the market system, at e.g. wholesale markets, supermarkets, retailers and wet markets. Consumption losses includes losses and waste at the household level. Hence, different ASF require different postharvest handling and storage practices corresponding the type of losses associated with the type of product.

Table 3.2. Weight percentage of food losses and waste (in percentage of what enters each steps)

Estimated/assumed waste percentages for each commodity group in each step of the FSC for **sub-Saharan Africa**.

	Agricultural Production	Postharvest handling and storage	Processing and packaging	Distribution	Consumption
Cereals	6%	8%	3.5%	2%	1%
Roots & Tubers	14%	18%	15%	5%	2%
Oilseeds & Pulses	12%	8%	8%	2%	1%
Fruits & Vegetables	10%	9%	25%	17%	5%
Meat	15%	0.7%	5%	7%	2%
Fish & Seafood	5.7%	6%	9%	15%	2%
Milk	6%	11%	0.1%	10%	0.1%

3.3.4. Impacts of postharvest loss on food and nutrition security

World Food Program special operation SO 200671 summary report notes that post-harvest food loss (PHFL) is one of the major underlying factors to food insecurity in Africa, directly influencing the lives of millions of smallholder farming families every year.

Worldwide food production, supply and consumption schemes are not working to optimal productivity, with food losses in sub-Saharan Africa alone exceeding 30 % of total crop production and representing more than US\$4 billion in value every year. These annual food losses far exceed the total amount of international food aid provided to sub-Saharan African countries each year. In addition, such losses are projected to be equivalent to the annual caloric requirement of 48 million people.

3.3.5. Pre and post-harvest food safety problems and associated health risks

Controlling the food safety hazards during production, harvesting, slaughtering and postharvest handling (trimming, grading, packing, transport, processing, marketing etc.) of fresh produce is

important to protect consumers' health and to gain access to markets. From the perspective of growers many agricultural inputs require careful thought about their use, and careful management and control of their use, because they are potentially hazardous when applied purposely to agriculturally produced food products. A case in point is found in the use of pesticides, herbicides, insecticides and fungicides, animal drugs, hormones and antibiotics. Pesticides are toxic compounds used in the growing of fruits and vegetables (as well as cereals and flowers) to reduce or eliminate target organisms, thereby increasing crop yield and quality. Public health authorities express concern about the ability of some pesticides to act as endocrine disruptors, causing, for instance, the impairment of brain and other bodily functions, disruption in the development of the brain and reproductive system, weakening of the immune system and the development of behaviour disorders. Also of concern is the degree to which pesticides are absorbed by the body and deposited in fatty tissues and the liver, as was demonstrated by the organochlorine compound, DDT, amongst others. Apart from concerns about the toxicity of some active agents in pesticides and their effects on human health, there may also be reason to be concerned about other compounds present in pesticides for technical purposes. Some pesticides contain polyacrylamide to aid the adhesion of the active agents to plant leaves. Polyacrylamide is converted to acrylamide at high temperatures such as those used in food processing and cooking. Recently the presence of acrylamide in fried and baked foods has caused concern because of its carcinogenic potential.

Plenty of food is lost in our system during postharvest handling of agricultural products because the quality deteriorates beyond what is acceptable for human consumption. But sometimes spoilage or contamination is not perceptible to the human senses and goes undetected, leading to adverse health effects when food is consumed. Several well-publicized outbreaks of acute aflatoxicosis in Sub-Saharan Africa, including the death of 125 Kenyans in 2004, suggest undetected food spoilage with very severe human health implications. Mycotoxins, in the forms of fumonisin and aflatoxins, can lead to slow-developing esophageal and liver cancers (respectively) and are growth-retarding and immune suppressive even in doses well-short of the more sensational, and often deadly, acute aflatoxicosis. These food safety concerns, arising from fungal or pest infestations, have major disease and global health implications. The mycotoxin in the food is occurred during the storage, in which the fungi produce an aflatoxin, and also in other livestock products if their feeds are contaminated with aflatoxin.

i. Handling and Safety of animal food items

Food items if unsafe can be source of various food borne illnesses. For the safety of animal food items, it is imperative that good animal husbandry (GAH) or good veterinary practices (GVP) be practiced to assure consumers that foods derived from animals meet acceptable levels of quality and safety. Along with this safe animal feed, that is, free from any threats should be provided to all animals. Improved nutritional content of livestock feed may lead to direct health benefit for animals, improving their welfare, and also indirectly benefit consumers. Animal welfare and health also plays a vital role in the overall quality of food.

Well-fed and rested animal or poultry is essential requirement for getting safe and good-quality foods of animal origin. Up to six middlemen are involved in procurement and transportation of meat animals for slaughter, which exerts stress and adversely affects safety and quality of meat. Veterinary inspection of meat animals and meat from farm to plate is essential to prevent most foodborne illness and diseases, which is not being done adequately in India. Consumers should follow WHO's five keys to keep food safer at domestic level.

Safety issues of foods of animal origin, similar to other foods, begin at the primary production stage and continue till consumption. The application of Good Agricultural Practices can reduce microbial and chemical hazards, which requires written operating and monitoring procedures to ensure production of wholesome foods of animal origin. All processes and operations should be carried out as per operating procedures to maintain safety and quality of such foods. Cooking temperature affects both taste and safety of food. Hotter temperatures at the core of the meat make it safer. Safe cooking temperatures at the core of meats must be attained. Hot foods should be kept above 60°C and cold foods, below 4°C, always. The understanding and adoption of safe handling, storage, and cooking practices for foods of animal origin in home kitchens are essential for achieving adequate safety of food before consumption.

Gaps between production, consumption, and inability of regulatory authorities to check adulteration are big temptation for fraudsters to make easy money through food adulteration, at the cost of nutrition and health of consumers. Milk adulterants include water, skim milk powder, cane sugar (sucrose), starch, fat, ammonium sulfate, etc.

In Ethiopia, there are information published on the presence of mycotoxin specially aflatoxin in different agricultural food commodities including grains, and milk and products. This aflatoxin was occurred in store grain, fresh milk and milk products collected from the sources.



Rickshaws transporting milk in Bangladesh

Rickshaws transporting milk from the countryside to processing plants in Baghabarighat, Bangladesh. Transporting milk in the warm and humid climate of Bangladesh without a proper cold chain may cause milk losses. The rickshaw transportation on narrow and winding roads prolongs the time milk is handled in warm temperatures.

Source. FAO 2011 (G.DIANA)

Summary

- Food safety is a scientific discipline describing handling, preparation and storage of food in ways that prevent foodborne illness.
- Unsafe food is not food because contaminated food could cause disease, immune suppression and stunting.
- Food quality and food safety requirements are addressed through the use of systems and programs that include quality management, quality assurance, quality control, the hazard analysis HACCP system, GAP, GHP and GMPs.
- Postharvest losses can be categorized as: **Direct losses, indirect losses and Economic losses.**
- Post- harvest loss highly affects food and nutrition security: the food loss in sub-Saharan African countries far exceeds the total amount of international food aid provided to each year.

- Losses are projected to be equivalent to the annual caloric requirement of 48 million people.

Self-Assessment Questions

1. What is food safety?
2. How do you explain the linkage between food safety and nutrition?
3. How food safety impacts nutrition?
4. Explain the good agricultural practices that help to produce safe agricultural product
5. Describe the postharvest handling of agricultural produces.
6. Explain the postharvest losses and its impact on food and nutrition security

Learning activities: Mini Project Postharvest Management

Students will go to the community and assess the postharvest handling (losses) and safety status

Students will go to the local areas and assess the problems associated with:

- Safety problems of agriculture and livestock products in the nearby *Kebele*
- Postharvest losses status, the associated factors and mitigation strategies in the nearby Peasant Association/ rural Kebele and present to your classmates. Support your presentation with actual pictures taken from the kebeles.
- Identify best indigenous postharvest handling technologies in the nearby villages and discuss how to promote and disseminate those technologies to other villages.
- Clearly discuss the linkage between postharvest losses and nutrition, and food safety and nutrition

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Chapter 4. Gender and Nutrition

4.1. Introduction

A gender lens encourages a holistic understanding of the different roles of women and men and their ability to negotiate on production, distribution and consumption of food. In Ethiopia, the role of women in food production and consumption is under estimated and it required empowerment mechanisms. This chapter therefore introduces the concepts of gender in relation with production and consumption for family nutritional security. The basic concepts of gender, gender role for production and consumption of foods, gender equality and equity for nutrition, empowering women for household nutrition, labor, time and energy saving technologies for women and involvement of the male in feeding and caring practices are addressed.

Objectives: At the end of the chapter students will able to

- Differentiate basic gender related terminologies
- Discuss gender role in food production and consumption
- Assist women empowerment for household food production and consumption

4.2. Basic Gender related terminologies

Gender refers to the socially constructed roles and responsibilities assigned to men and women in a given culture or location. These roles are learned, they vary between cultures and they change over time. Gender is learned through a process of socialization and through the culture of the particular society. In most instances, gender is equated with women. However, paying attention to gender does not mean focusing on women as beneficiaries, but focusing on incorporating the needs of girls, boys, men and women at all levels of interventions

Sex refers to biological attributes that identify a person as a male or female. These attributes are generally permanent, universal and cannot be changed over time

Table 4.1. Basic difference between gender and sex

SEX	GENDER
<ol style="list-style-type: none">1. Is a natural attribute that we use to identify men and women?2. Universal in nature3. Difficult to change	<ol style="list-style-type: none">1. Social attribute that prescribes different roles, responsibilities, expectations, norms and modes of behavior to male and female2. Depends on the culture, level of development, education etc.

	3. Dynamic in nature
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Gender roles: Gender roles are the roles both women and men are expected to fulfill in the society as defined by the virtue of being female or male. Men and women get messages about their role and division of labor from family, schools, media and society at large. Gender roles show society's rule for how men and women are supposed to behave. These rules are sometimes called gender norms. They dictate what is "normal" for men and women to think, feel and act. Many of these differences are created by society and are not part of our nature or biological make-up and many of these expectations help us enjoy our identities as either men or women.

Both men and women play multiple roles in the society. These roles can be broadly categorized into:

- **Productive role:** Tasks which contribute to the economic welfare of the household through production of goods. Women's role as producers is usually undermined and undervalued.
- **Reproductive role:** Activities performed for reproduction and caring for the household, water and fuel/wood collection, child care, health care, washing, cleaning, etc.
- **Community management or socio-cultural activities:** Activities primarily carried out by men and women to ensure the co-existence of themselves as well as their family in their social environment. Examples of such activities include *Idir*, mutual help among neighbours/relatives, community groups, etc. which boosts their social capital.

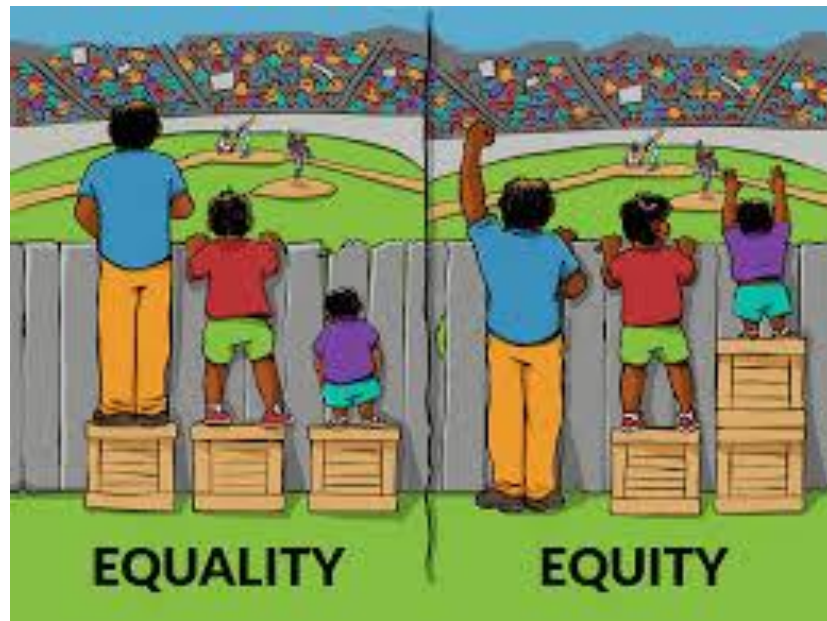
Gender equality:

- Gender equality means that women, men, boys and girls have equal opportunities, resources, rights and access to goods and services.
- Gender equality also means equal opportunities and equal responsibilities in sharing workloads and energy expended within individual capability in caring for families and communities.

Gender equity:

- Gender equity refers to fairness of treatment by gender, which may be equal treatment or treatment which is different but which is considered equivalent in terms of rights, benefits, obligations and opportunities

Figure 4.1. gender equality vs gender equity.



Source: www.quora.com

Access to resources means having the opportunity to use resources without having the authority to decide on the output and the exploitation methods.

Control over resources or benefits means having full rights to use and authority to decide what the outputs should be and how they should be used.

Gender disparity or gap: a specific difference or inequality between girls and boys, or men and women in relation to their conditions, or how they access or benefits from resource. In other words, it is a measure of gender inequality on any socio-economic indicator (e.g. men's and women's access to health service, school drop-out rate girls and boys).

Gender Sensitive: properly aware of the different needs, roles and responsibilities of men and women. Understand that these differences can result in difference for women and men in: access to control over resources; and level of participation in and benefit from resources and development.

4.3. Gender role in food production and consumption

A gender lens encourages a holistic understanding of the different roles of women and men and their ability to negotiate on production, distribution and consumption of food. The gender analysis concepts in food production and consumption can be seen in terms of division of labour; access and control over resources; decision-making; and norms and values. For example, it is not possible to only look at the division of roles between men and women without looking at how that influences access and decision-making, and vice versa. Also, gender is considered in a relational way, which means that each of the concepts, are looked at from both men and women's perspective.

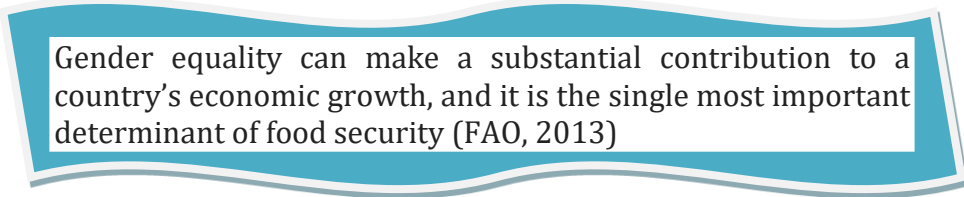
Gender relations influence what women and men do what they have access to and what decisions they can make concerning food production and consumption. This influences their food and nutrition security situation. These gender relations are dynamic and change all the time due to planned interventions, policy changes, changing behaviours or other influences. As a result, a food and nutrition security situation may be affected by changing gender relations, but food and nutrition security interventions likely affect and change gender relations as well.

Gender relations are produced and reproduced through norms and values in different institutional spaces at different levels (household, community, national, global and everything in between). Spaces where norms and values are being reproduced are for example, community meetings, religious communities, health clinics, schools, but also government and policies. A gender lens helps us to consider at community and household levels:

1. The roles men and women play in agricultural production and consumption
2. Access and control over resources men and women have (in relation to commercial and subsistence production), access to health services, clean water and hygienic toilets);
3. Intra-household decision-making around production and consumption (including care practices for children);
4. Norms and values and how these shape what people are supposed to do (role performance), their access to resources and how decisions are made in relation to food production and consumption.

4.4. Gender equality and equity for nutrition

Promoting gender equality and equity in nutrition sensitive agriculture requires taking into consideration the social, economic and biological roles, needs and differences between men and women and addressing the inequalities which are barriers to good nutrition. Inequities in access to and control of assets have severe consequences for women's ability to provide food, care, and health and sanitation services to themselves, their family members. Women with less influence or power within the household and community will be unable to guarantee fair food distribution within the household.



Gender equality can make a substantial contribution to a country's economic growth, and it is the single most important determinant of food security (FAO, 2013)

Any reduction in gender inequality benefits the entire family. Substantial evidence demonstrates that more equal access to and control over assets raises agricultural output, increases investment in child education, improves visits to health facilities for infants, raises household food security, and accelerates child growth and development. It also offers important economic payoffs for the entire society. Women's contribution to food production, food preparation, and child care are critical underpinnings for the social and economic development of communities, yet efforts in this direction are hampered by malnutrition.

4.5. Empowering women in food production and consumption

Women's empowerment refers to improving the social, economic, political and legal strength of women so that they gain power and control over their own lives. The pathway from women's empowerment to improved nutrition consists of three interrelated components: women's use of income for food and non-food expenditures; women's ability to care for themselves and their families; and women's energy expenditure.

Empowering women farmers can improve food security and nutrition both through increased food production as well through better use of food and income. Larger disparities in food production

often exist between men and women farmers in access to land, security of tenure, education, credit, extension and other services. This makes it harder for women farmers to achieve the same yields and levels of production as men can, since they cannot get the inputs or technical knowledge needed to match their labour. A particular concern is that women often have less control over household resources, such as labour and manure, than men do.

Women empowerment also includes enhancing women's socio-economic status such as education, nutrition awareness and knowledge, health-related practices, decision-making power, income, and access to and use of productive assets. Empowering women in food production and consumption requires increasing women's access to and control over assets (agricultural income) would change the allocation of household expenditures to improve household nutritional outcomes.

Focusing on food crops grown by women and improving women's access to extension, rural advisory and financial services as well as to information and markets are some examples of how women can be supported to access and gain control over productive resources and increased income. Targeting women for income-generating opportunities and ensuring equitable access to decent employment and control over earned income are equally important.

2016 National Nutrition Sensitive Agriculture Strategy of Ethiopia recommends two mechanisms of women empowerment: women's access and control over assets and promotion of labour, time and energy saving technologies for women, discussed below.

4.5.1. Women's access and control over assets

Ensuring asset transfers or asset building interventions which properly target women can empower women for better nutritional outcomes. Empirical evidence shows that increasing women's control over land, physical assets, and financial assets serves to raise agricultural productivity, improve child health and nutrition, and increase expenditures on education and hence contributing to overall poverty reduction. It includes women's access to land and other productive assets, women's control over cash from agricultural activities (e.g. intra-household allocation of income between men and women, or the extent of women's ability to make decisions about purchases)

The main policy recommendation by FAO includes:

- Focus on food crops grown by women
- Securing land rights for women
- Policies to increase access to water
- Legal and policy support for the poor to access employment opportunities
- Policies to increase extension services, financing, access to inputs and appropriate technologies for smallholders adapted to reach women and ethnic minorities
- Investment in agricultural research that reflects the interests of smallholders, particularly women
- Credit and financial services, including insurance
- Increasing smallholders' (and women's in particular) access to markets
- Increasing access to productive assets such as livestock, seeds and storage facilities
- Social protection measures such as cash, food transfers and child care services

4.5.2. Labor, time and energy saving technologies for women

Women perform productive as well as reproductive roles. Therefore, the trade-offs between child care and agricultural production should be carefully assessed. Time and labour demands should be evaluated to avoid negative impacts on care, health and nutritional status that might result from women's increased workloads.

- Moreover, promoting the adoption of labour-saving technologies and practices can reduce women's workloads and free up valuable time for child care, food preparation and women's health and leisure. For example: Higher-yielding and pest-resistant crops, use of draft animals, conservation agriculture and no-tillage methods, and transport facilities to and from fields can all decrease labour needs for agriculture production.
- Women are usually in charge of primary processing; therefore, women's work can be facilitated by the introduction of appropriate post-harvest technology, such as small pounding and dehusking machines.
- Women in rural communities also spend significant time on tasks such as collecting water and firewood; water-source construction and rehabilitation is thus a labour-saving investment, as are programmes to widen the use of fuel-saving technologies and fuel-efficient stoves for food preparation.

4.5.3. Involvement of male in feeding and caring practices

Childcare and feeding has been regarded as female's domestic role on health and nutritional outcome of children. The role of the father, though acknowledged, is the most neglected part in child health care. A child health care is 'mother centric', and less effective in participating father.

Men's greatest motivator for improved infant and child nutrition is their strong sense of responsibility as the heads of their households. While the economics of their households may dictate the quality and variety of food they can provide, fathers generally hold themselves accountable for providing food for their families. As part of the provision of nutritious food, some husbands monitor their wives' and children's diets to make sure they are eating right.

Summary

Gender refers to the socially constructed roles and responsibilities assigned to men and women in a given culture or location and it has great implication for food production and consumption. It is highly important to ensure gender equality and equity in food production and consumptions. Women have great contribution in food production and consumption as they mainly involve in production and preparation. To ensure nutritional security, empowering women by enhancing women's socio-economic status such as education, nutrition awareness and knowledge, decision-making power, income, and access to and use of productive assets is very important. To achieve better nutritional outcomes, economic empowerment of women such as access and control over assets, promoting time, energy and labour saving technologies to women need to be in place.

Self-assessment questions

1. Define and differentiate the following terms:
 - Sex and Gender
 - Gender equality and gender equity
 - Gender role
2. Discuss how gender roles in food production and consumption affect nutrition?
3. Explain women empowerment interventions for improving nutrition?

Learning Activity

Gender equality and equity for nutrition

Field visit

One of the most important thing to work on gender equality and equity is to acquire the ability to look the actual scenario through a gender lens.

Activities:

- ✓ Make small working groups (group member4-5)
- ✓ Walk to the nearby community.
- ✓ Visit/ ask the production and food consumption practices at the household level
- ✓ Observe gender differences:
 - Observe what men are doing - Interpret it
 - Observe what women are doing - Interpret it
 - Ask the food consumption practices by female and male at the household level
- ✓ Write a report on the pattern of Gender Equality and equity in relation to nutrition in the community
- ✓ Present your findings in max 10 minutes

Learning Activity

Empowering women in food production and consumption

Role Play**Scenario:**

Women in Dembia District of North Gondar Zone are in charge of several productive, reproductive tasks and community roles. They are highly engaged in agricultural production and food preparation for the households. Despite their role in different productive and reproduction activities, their access to and control over important assets is limited and the decisions at the household level are dominated by male. Recognizing the multiple role of women in food production and consumption, it is the high time to empower women both in different economic and decision making roles. Cognisant to this, play role on the women empowerment by bringing both male and female together.

Roles Player:

1. One student as agricultural extension workers
2. One student as district level women affairs expert
2. One student (female) as wife
4. One student as husband

Note: The role should focus on the problems, challenges, focusing on household food production and consumption. Time given for the role play is 10 minutes

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Chapter 5: Social Behavioral Change Communication (SBCC) for Nutrition

5.1. Introduction

Improved agricultural productivity is an important intervention to achieve food security but it does not necessarily translate into improved nutrition security either for producers or consumers. In Ethiopia where most of the society is bounded by culturally oriented food consumption, the culture and behavior of diversified production and consumption has to be challenged through communicative interventions. This chapter is therefore about social behavior change communication for nutrition. Specifically, the culture of food consumption in Ethiopia and its impacts on nutritional status is presented. Then the need for behavior change related to food production and consumption through different behavior change communication tools is presented.

Objectives: At the end of the chapter, students will be able to:

- Explain the food consumption culture in Ethiopia
- Discuss the need for nutrition behaviour change communication
- Discuss the need for nutrition education and nutrition extension through SBCC
- Differentiate nutrition behaviour change communication tools
- Demonstrate appropriate behaviour change communication for nutrition

5.2. The culture of food consumption in Ethiopia

Ethiopians, particularly rural households, use cereals as staple diets which are usually low in micronutrients and also do not contribute to dietary diversity. Though animal foods are dense in nutrient content, they are not widely used by the society because of accessibility and affordability and associated culture of the community.

Culture, religion and traditional knowledge affect food and nutrition security by shaping a community's diet, food preferences, intra-household food distribution patterns, child feeding practices, food processing and preparation techniques, health and sanitation practices, traditional medicine and the accessibility and use of biomedical public health services. The food and nutrition security impact of culture, religion and traditional knowledge is inherently localized. Certain beliefs and practices may be harmful for one community and beneficial for another, depending on

the specific diet and the social, economic and ecological environment (e.g. labour division, local food availability). Nevertheless, some general trends can be distinguished. Significant life events such as pregnancy and childbirth are generally characterized by numerous cultural or religious beliefs and practices regarding food and health. These beliefs and practices substantially affect health seeking behaviour and traditional medicine.

Diets and eating behaviours are influenced by many factors at individual, family, community and national levels. The following table shows cultural and socio-economic factors affecting the distribution and consumption of foods.

Table 5.1. Factors that affect eating behaviour.

Individual	family /group	community / institutional	National
<ul style="list-style-type: none"> • Food preferences & enjoyment • Beliefs, attitudes, values, perceptions • Knowledge, skills 	<ul style="list-style-type: none"> • Cultural & social practices • Social support • Networks • Peer influence 	<ul style="list-style-type: none"> • Rules, informal structures, • Child care organizations • Workplaces, schools • Neighbourhoods, shops, restaurants • Community organizations • Information available • Recreational facilities, parks 	<ul style="list-style-type: none"> • Health care system • Food assistance programs • Food industry • Food & agricultural systems • Policy • Political & social structures • Media • Social & cultural norms

Source: FAO (nd) Infographic on the role of food and nutrition education, <http://www.fao.org/nutrition/education/en/>

5.2.1. Food preferences and nutrition

Individual, family and community have different food preferences. Food preference could be the result of many factors including socio-economy, culture, growth stage, physiological need and exposure experience for different food types. Food preference in most case is individual attribute on which people do have their own choices of available foods, which will have direct impact on nutritional status. Food preference is common in pregnant women and children, which in most cases is driven by their physiological needs. The peer influence, availability, familiarity and palatability could also be the factor for food preference of children.

Group Activity:

- Be in groups have 5-7 members
- Identify preferred food types in your locality and discuss the reasons behind
- Report to the larger group
- You have 15 minute (10 minutes for preparation or discussion and 5 minutes for presentation)

5.2.2. Food taboos and nutrition

Food taboos refer to the restriction of specific foods as a result of social or religious customs. In many traditional societies, cultural norms and customs govern behaviors including during different life stages like pregnancy. Pregnancy is a particular period when physiological nutrient demands are substantially increased. To meet this increased nutrient requirement for both the woman and the fetus, a pregnant woman is supposed to increase the amount and quality of foods she consumes. Nevertheless, when misconceptions or food taboos exist, the pregnant women and children ability to meet such increased demands can even be more compromised, hence putting them at a greater risk of adverse pregnancy outcomes.

Various forms of taboos, misconceptions, and cultural beliefs towards certain foods exist in various countries. For example, foods consumed cold like fruits and vegetables were reported to be taboo among nursing mothers in Mexico. Similarly, snails and grass cutter meat are taboo among pregnant women and eggs among children in South Eastern Nigeria. The study conducted in Hadiya Zone, Ethiopia revealed that milk and cheese were regarded as taboo foods by nearly half of the women (44.4%) followed by linseed and fatty meat (16% 11.1% respectively). The reasons for avoiding foods include fear of difficult delivery (51%), discoloration of the fetus (20%) and fear of abortion (9.7%).

5.2.3. Food sharing among family members

Many other animals actively share food; however, the patterning and complexity of food sharing among humans is truly unique. Food sharing is a human universal trait that forms the centerpiece of economic and social life. Human livelihoods require sharing at all life stages to support pregnancy, infancy, childhood, and adolescence, and to help reduce risk of daily food shortfalls in adulthood. Food sharing could also be between intra-household and inter-households based on the objectives.

Food sharing varies from one community to the other depending on specific culture. In many part of rural Ethiopia, food sharing is prevalent during holiday ceremonies and other social events. Food sharing at the household level is very important to achieve nutritional outcome among the members. Depending on culture, specific event, availability and types of food prepared at the household, there is disparity of food sharing among family and family members.

In the case of some specific food types like “Dero Wot” and other foods with high nutritional values, the sharing among the family members not equal. The father or male along with guest if any are the first to be served whereas the female and children come to be served at the last. The nutrition extension intervention by the rural extension workers should give due attention to change the practice of food sharing among the family member on the basis of equity. Priority should be given for member like pregnant women, lactating mothers, children and disabled persons.

5.3. Nutrition education, counseling and communication

Nutrition education: is any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behaviors conducive to health and well-being. Nutrition education is delivered through multiple venues and involves activities at the individual, community, and policy levels.

Effective education is a key factor in improving nutrition and health, yet nutrition education continues to be overlooked in health and food security interventions, and is often weak or absent in professional training. It also enhances the impact of nutrition and food security interventions and is often critical to their success. Long-term nutrition education develops popular capacity to make good dietary choices and builds self-reliance. Nutrition education’s main goal is to make people aware of what constitutes a healthy diet and ways to improve their diets and their lifestyles. It helps individuals, families, and communities make informed choices about food and lifestyles that support their physiological health, economic, and social well-being.

Nutrition counseling: is a two-way interaction through which a client and a trained counselor interpret the results of nutrition assessment, identify individual nutrition needs and goals, discuss ways to meet those goals, and agree on next steps. Nutrition counseling aims to help clients

understand important information about their health and focuses on practical actions to address nutrition needs, as well as the benefits of behavior change. Nutrition counselors may be nurses or other facility-based providers or community health workers or volunteers.

Nutrition communication: Nutrition communication is recognized as a primary form of intervention in national food and nutrition programs. The ultimate goal of nutrition communication is to produce nutritionally literate decision makers who are motivated, knowledgeable, skilled and willing to choose proper nutrition alternatives. Nutrition communication is a two-way process, where participants can freely exchange knowledge, values and practices on nutrition, food, and related areas. It ensures the active involvement of those who could and should take part in decision-making, and in motivating and providing users with easy access to nutrition related information, resources, and services. Rural Extension workers and agriculture cadres are responsible for coordinating and supporting all nutrition communication activities at individual, household and community levels.

5.4. Nutrition social behavioral change communication (NSBCC)

NSBCC is a set of interventions that systematically combines elements of interpersonal communication, social change and community mobilization activities, mass media, and advocacy to support individuals, families, communities, institutions, and countries in adopting and maintaining high impact nutrition-specific and nutrition sensitive behaviors or practices. Effective nutrition SBCC leverages enablers of behaviors and reduces barriers to adopting and maintaining behaviors over time.

Human behavior is complex and profoundly influenced by social norms, access to resources, self-efficacy, structural constraints and opportunities, and habits. Systematically addressing the range of behaviors that have a direct or indirect impact on nutrition as well as the social and environmental factors that influence the adoption and maintenance of these behaviors is critical to the implementation of the Multi-Sectoral Nutrition Strategy

Why do behaviors matter for nutrition?

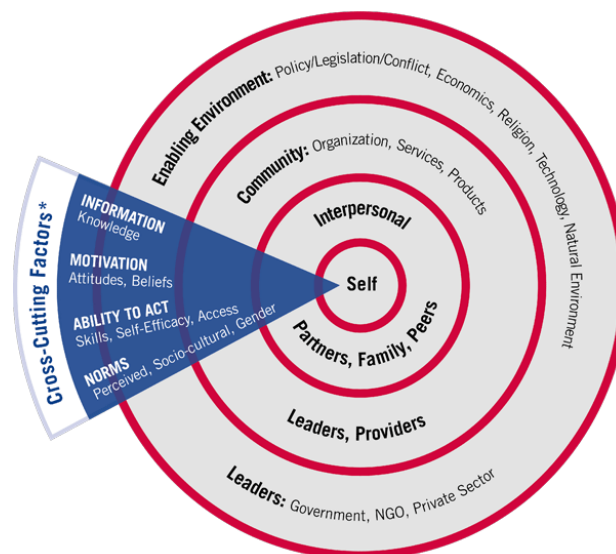
Virtually all the immediate and underlying causes of malnutrition are behavioral – influenced by the behaviors of individuals and their household members. Nutrition is also influenced, however, by the behaviors of many other actors. These actors range from healthcare providers and school teachers to farmers and other agricultural agents, from religious and community leaders to private sector companies and policymakers, who collectively directly or indirectly influence care and feeding practices, household food security, the household environment, and healthcare services

How do behaviour change?

The Socio-Ecological Model

Over the years, there has been a shift in thinking about human behaviour. For example, 20 years ago, health communication practitioners largely believed that behavior change would result directly from giving correct information about prevention. While providing correct information is an important part of behavior change, information alone has proved to be insufficient. Four key facts about human behavior are now widely acknowledged:

1. People make meaning of information based on the context in which they live.
2. Culture and networks influence people's behavior.
3. People cannot always control the issues that determine their behavior.
4. People are not always rational in deciding what is best for their health and well-being. While several models exist, the Socio-Ecological Model, illustrated in Figure 5.1 demonstrates the evolution of thinking from approaches focused on the individual alone to those considering social condition. The Socio-Ecological Model views individual behavior as a product of multiple overlapping individual, social, and environmental influences, and combines individual change with the aim to influence the social context in which the individual operates.



*These concepts apply to all levels (people, organizations, and institutions). They were originally developed for the individual level.

SOURCE: Adapted from McKee, Manoncourt, Chin and Carnegie (2000)

Figure 5.1 The Socio-Ecological Model for Change

In this model, levels of analysis are represented by the rings, which show domains of influence as well as the people representing them at each level. The “self” ring represents those most affected by the issue. The next two rings represent those that have direct contact with those most affected and influence their attitudes, beliefs, and actions. They may shape community and gender norms and/or access to and demand for community resources and existing services. The outermost ring includes those that indirectly influence those most affected by the issue and represent the enabling environment. Components of this ring may facilitate or hinder change and include government policies and regulations, political forces, prevailing economic conditions, the private sector, religion, technology, and the natural environment.

Each level is influenced by four main cross-cutting factors that SBCC interventions may be able to modify to generate change. These factors may act in isolation or in combination and are discussed below. **Information:** People need information that is timely, accessible, and relevant. With such information, some individuals, groups, or communities may be empowered to act. For most people, however, information is not enough to ignite change.

Motivation: Motivation, represented by attitudes and beliefs about the issues, is needed. Motivation can be affected by SBCC through effective counseling, peer education, or radio programs, for example. If done well, such communication can foster individual attitudinal and behavioral change, as well as social norm change. However, even motivation may not be enough.

Ability to Act: In particular circumstances, especially those that may pose a threat or that involve strong gender or social norms against the behavior, people need the ability to act. Skills needed for the ability to act include problem solving, decision making, negotiation, critical and creative thinking, and interpersonal communication (IPC), for example. Efficacy, the confidence of individuals and groups in their own skills to affect change, access to services and transportation, and the ability to buy a diversity of foods, for example, are important elements in the ability to act.

Norms: Finally, norms, as expressed in perceived, socio-cultural, and gender norms, have considerable influence. Norms reflect the values of the group and specify those actions that are expected of the individual by its surrounding society. Perceived norms are those that an individual believes others are holding and therefore are expected of him or herself. Socio-cultural norms are

those that the community as a whole is following because of social status or cultural conventions. Gender norms shape the society's view on what is expected of males and females.

In order to change their behavior, people go through stages in adopting a new behavior. The chart below shows the stages of behavior.

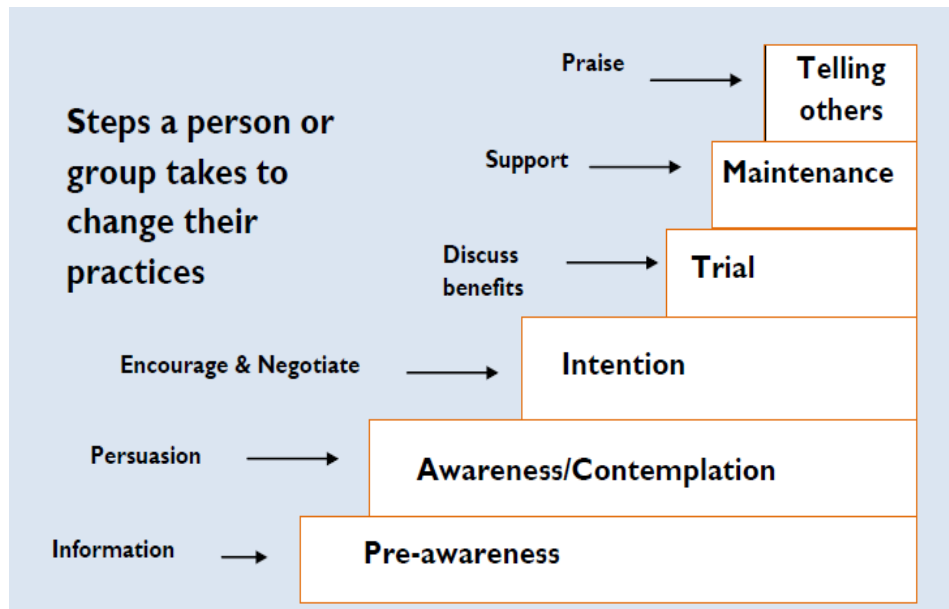


Figure 5.2. Stages of behavior change

The arrows indicate communication supports that Agricultural/rural extension workers should give according to the stage of the individual/family whose behavior they are trying to change.

Stages of behavior change and communicative interventions to encourage the target audience to try a new behaviour/practice are given in the table below.

Table 5.2. Stages of behaviour change

	Steps	Appropriate interventions	Specific Tools
1	<i>Pre-contemplation</i> Never heard about the behaviour	Build awareness/provide information	<ul style="list-style-type: none"> ✓ Drama, fairs ✓ Community groups ✓ Radio ✓ Individual counselling ✓ Mother-to-mother support groups
2	<i>Contemplation</i> Heard about the new behaviour or knowing what it is	Encourage/discuss benefits	<ul style="list-style-type: none"> ✓ Group discussions or talks ✓ Oral and printed word ✓ Counselling cards ✓ Breastfeeding and Young Child Feeding Support Groups

3	Intention (Preparation phase) Thinking about new behaviour to take action	Negotiate and help to overcome obstacles	<ul style="list-style-type: none"> ✓ Home visits, use of visuals ✓ Group of activities for family and the community ✓ Negotiate with the husband and mother-in-law (or other influential family members) to support the mother
4	Action Trying new behaviour	Praise/reinforce the benefits	<ul style="list-style-type: none"> ✓ Congratulate mother and other family members as appropriate ✓ Suggest support groups to visit or join to provide encouragement ✓ Encourage community members to provide support (radio programmes)
5	Maintenance Continuing to do new behaviour or maintaining it	Provide support at all levels	<ul style="list-style-type: none"> ✓ Reinforce the benefits ✓ Praise ✓ Tell others

To facilitate the progress of a person through each stage of behavior change use the different actions and communication strategies provided as examples in the table. These are just possible examples and are by no means an exhaustive list of all the possible strategies.

5.5. Tools for nutritional behavioral change communication

Behavior change communication (BCC): is any communication (e.g., interpersonal, group talks, mass media, support groups, visuals and print materials, videos) that helps foster a change in behaviour in individuals, families, or communities. It is a multi-level tool for promoting and sustaining risk-reducing behaviour change in individuals and communities by distributing tailored nutrition messages in a variety of communication channels. It includes careful and focused listening, understanding, and then negotiating with individuals and communities for long-term positive nutrition behaviours.

BCC can be used as strategic use of communication to promote positive nutrition outcomes, based on proven theories and models of behaviour change. In using BCC for nutrition, it can be started by a systematic process with formative research and behavior analysis, followed by communication planning, implementation, and monitoring and evaluation. Audiences are carefully segmented, messages and materials are pre-tested, and both mass media and interpersonal channels are used to achieve defined behavioral objectives.

The BCC process includes identifying, understanding, and segmenting audiences and providing them with relevant communication through well-defined strategies using appropriate mix of interpersonal, group, and media channels including interactive methods.

Social and behavior change communication (SBCC): Social and behaviour change includes not only communication, but also actions to create an enabling environment for sustained behaviour change. The actions may be formulation of policy, provision of needed systems, services, or infrastructure, social support, or measures to sway social norms. Social change is understood as a process of transformation in the way society is organized within institutions, and in the distribution of power within various social and political institutions. For behaviours to change on a large scale, certain harmful cultural practices, societal norms and structural inequalities have to be taken into consideration. Social change approaches, thus, tend to focus on the community as the unit of change.

Nutrition Behavior Change Communication (NBCC): is used to change nutrition related behaviours in a community. It involves not only health related messages but also educating the community about a wide range of Nutrition sensitive activities and multi-sectoral collaborations.

5.6. Nutrition extension through SBCC/NBCC

Nutrition extension through behavior change communication (BCC) improves household nutrition. It influences caregivers' preferences towards more nutrient-rich foods, intra-household allocation of food to benefit pregnant and lactating women and children, and other practices related to child feeding, care giving, sanitation and hygiene, and use of health services.

Agriculture & Nutrition SBCC is a strategic package of behaviour centred interventions (activities, programs and policies) aimed at supporting individuals, households, groups, and communities to adopt and sustain high impact ag & nutrition practices by:

- promoting specific individual and group behaviours – among mothers, fathers, caregivers, nutrition and health service providers, farmers, peer networks, and others
- shifting social attitudes, structures, and norms
- creating enabling environments that promote and provide support for social change & positive change in agriculture & nutrition behaviours
- and that above all ... aim to DO NO HARM

Summary

Culture, religion and traditional knowledge affect food and nutrition security by shaping a community's diet, food preferences, intra-household food distribution patterns, child feeding practices, food processing and preparation techniques and the accessibility and use of foods. Different communities, households and individuals have different food preference, taboos and sharing practices which depend on culture, specific event, availability and types of food. To ensure nutritional security of individuals, households, community and national at large, nutrition extension education using behavioral change communication tools for food production and consumption is apparently important.

Self-assessment questions

1. Identify the major factors of food taboo in your locality?
2. Discuss on food sharing culture of your community?
3. Explain BCC and SBCC tools for nutrition education?

Activity: Role play (Section 5.4)

Today a mother from Buture Kebele has visited the agriculture extension worker in the agriculture office for their second meeting. This meeting is a continuation of the first meeting done last month in which the extension worker discussed with a mother about diversification of food production though practicing home gardening. Before the first meeting, the mother has no prior information that home gardening can diversify food consumption for her family. The mother has nine family members of which four are children under five ages. Last month, the extension worker then explained for her the role of home gardening in diversifying family diet. The mother then accepted the advice of the extension worker and already started preparation of the land in her garden. Today the mother has come for the second appointment with question about what types of foods to produce in the garden.

Questions

- What stage in the behavior change process do you think the mother has reached?
- What should the extension worker advice the mother for her next question?
- What could the extension worker can do to help other women with this case?

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USAID Multi-Sectoral Nutrition Strategy 2014–2025 Technical Guidance Brief

Chapter 6: Biodiversity and Nutrition

6.1. Introduction

Agricultural biodiversity is important for food and nutritional security, as safeguard against hunger, a source of nutrients for improved dietary diversity and quality, and strengthening local food systems and environmental sustainability.

This chapter, therefore, explores the contribution of biodiversity in general, and that of agricultural biodiversity in particular for improving nutrition and food security. Using experiences and case studies from around the globe, and from the national context, the chapter reveals the interconnections between agriculture, biodiversity and ecosystem conservation and nutrition (which is the basic idea of eco-nutrition).

At the end of this chapter, students will be able to:

- Describe the role of agricultural biodiversity for nutrition;
- Identify nutritionally rich biodiversity species in both aquatic and terrestrial ecosystems;
- Explain about the significance of ecosystem functions and services for sustainable food production;
- Analyze the role of ecosystem and biodiversity conservation for nutrition security through the application of eco-nutrition.

6.2. Harmonizing agricultural production with biodiversity conservation for nutrition

Achieving food and nutritional security requires every member of society to have access to nutritious food and the information and freedom to make appropriate choices concerning good nutrition. Progress has been made in reducing under nourishment, underweight, child stunting, child mortality, and micronutrient deficiencies. But progress has varied among countries and setbacks are common due to volatile food prices, conflicts and natural disasters. Currently, about 870 million people (12.5%) are chronically under nourished in terms of energy intake and about 2 billion people suffer from vitamin and mineral deficiencies, malnutrition. Environmental pollution, loss of forests and biodiversity, and degradation of land and other natural resources

would accelerate the problem even further. Better conservation of biodiversity or less emissions of carbon above ground vegetable biomass or soil of natural ecosystem will have positive consequences on reducing poverty and malnutrition. Therefore, mainstreaming the biodiversity conservation to the agricultural production can sustainably address the issue of malnutrition. See the diagram below to have a better understanding on how biodiversity conservation can be harmonized with agriculture for sustainable nutrition security.

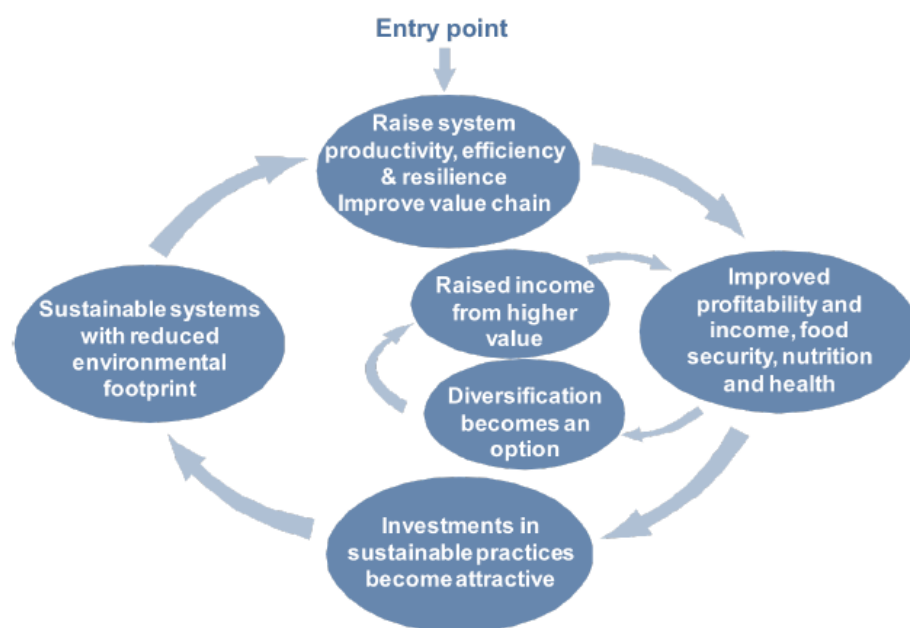


Figure 6.1. Sustainable Agricultural Production System and Livelihood

6.2.1. Link between agricultural production and biodiversity conservation

In developing countries particularly Ethiopia agriculture is the dominant land use supporting the livelihood of more than 80% of the rural households. Current trends suggest that, during the twenty-first century, a continuing and growing demand for agricultural and wild products and ecosystem services will require farmers, agricultural planners and conservationists to reconsider the relationship between production agriculture and conservation of biodiversity. There should be optimization of farm diversification and land management practice in the agriculture to contribute to biodiversity whilst at the same time utilizing it as a sustainable resource for increasing economic viability in the medium to long term. Maintaining biodiversity in turn is considered to be essential in order to sustain the ecological functions and processes which ensure the fertility and

productivity of agricultural ecosystems. The diversity among living organisms which provide these functions has been termed “functional biodiversity”, and represents an important contribution to biodiversity by agriculture.

Agriculture is the utilization of natural resource systems to produce commodities which maintain life, including food, fibre, forest products, horticultural crops, and their related services. Whilst biodiversity may once have been seen as a by-product of providing agricultural products and services, it is now clear that society also demands that farming delivers high quality and safe products whilst in the meantime providing a range of environmental services. Thus, whilst sustainable food production remains the major concern of Ethiopian agriculture, it is also a key sector for the provision of wider societal benefits in relation to, for example, biodiversity conservation and enhancement. With close links to the food supply industry through common long-term objectives such as food security and preservation of the environment, actions carried out by both sectors can be seen to have wider outreach and potential influence.

6.2.2 Role of agricultural biodiversity for improving nutrition

Though there is a strong and positive relationship between biodiversity, dietary diversity and health, the link between biodiversity and agricultural production for improved nutrition is ignored. One important component missing from many complementary strategies aimed at scaling up nutrition interventions is agricultural biodiversity, also called agro biodiversity, which applies a food systems approach to intervention strategies. Agro biodiversity within food systems not only provides a wide and varied range of nutrient-rich foods and dietary components with important health properties, it is also a resource that is locally available; it is the basis of dietary diversity, the preferred choice for nutrition and health. There are a lot of untapped nutritionally rich flora and fauna species. Furthermore, because agro biodiversity links to communities’ food culture, traditions and practices, it can reinforce the cultural and social determinants of wise food choices by individuals that are fundamental to the good health of the population.

Productive terrestrial and marine ecosystems, both wild and managed, which are the components of the biodiversity, are the source of our food – a prerequisite for health and life. It is well understood that the sustainability of the global ecosystem in general and of the agriculture in

particular, is dependent on the conservation, enhancement and utilization of biological diversity, or biodiversity which includes the variety of plants, terrestrial animals and marine and other aquatic resources (species diversity), along with the variety of genes contained in all individual organisms (genetic diversity), and the variety of habitats and biological communities (ecosystem diversity). It is essential for humanity, providing food, fibre, fodder, fuel, and medicine in addition to other ecosystem services. So it is the lifeblood of what we eat. Biodiversity – both wild and cultivated – underpins the sustainability of agricultural production by providing the genetic diversity and material needed to drive innovation and adaptation, as well as essential ecosystem services and processes. The human nutritional and health ecosystem services that biodiversity provides is also a vital. When linked, biodiversity, agriculture and nutrition form a common path leading to food and nutrition security achievements. Therefore, linking biodiversity, nutrition, and health in to the agricultural food production will lead us to eradicated/minimize poverty and hunger and thereby ensure nutrition security.

6.3. Potential species of biodiversity for nutrition

Biodiversity is essential for food security and nutrition. Thousands of interconnected species make up a vital web of biodiversity within the ecosystems upon which global food production depends. With the erosion of biodiversity, humankind loses the potential to adapt ecosystems to new challenges such as population growth and climate change. Achieving food security for all is intrinsically linked to the maintenance of biodiversity. There are a lot of untapped animal and plant species which are nutritionally rich and could contribute in addressing the problem of malnutrition. For instance, wild indigenous fruit trees could lead to better health and nutrition across the globe, but their potential remains largely untapped as little attention has been given to their nutritional or economic value.

Food production depends largely on biodiversity and on the services provided by eco-systems. We would not have the thousands and thousands of different crop varieties and animal breeds without the rich genetic pool of the species they originated from. We could not keep livestock, fish or grow trees and other plants without the services delivered by the terrestrial and marine ecosystems and by biodiversity, including the often invisible contribution from microorganisms and invertebrates.

The genetic diversity of crops and livestock, including their wild relatives, are a fundamental resource for the continued improvement of crop varieties and livestock breeds, needed to cope with ongoing changes. Many of these genetic resources are particularly held in situ within farming.

6.3.1. Aquatic biodiversity and nutrition

Aquatic organisms are usually derived from inland capture of fisheries from wetlands, streams, rivers, or irrigation canals, and from aquaculture which means the farming of aquatic organisms including fish, mollusks, crustaceans and aquatic plants mostly in ponds, cages, tanks or rice fields. Fish and other aquatic organisms are among the important aquatic biodiversity species serving as food for rural households. Integrating the value of the aquatic resources in to the local process of agricultural planning and policy information in collaboration with local government offices and community will contribute to food security and nutrition. However, ignoring these resources left many rural households to suffer from under nutrition which is persistent problem, especially in many developing countries, with the bulk of undernourished people living in rural areas. The aquatic organisms are a substantial part of the food supply of many communities in rural people and provide animal protein and micronutrient resources for consumption. Evidences also indicated that the role and nutritional value of aquatic resources in the diet and livelihoods of rural people is so vital.

Video show about Aquatic Biodiversity and Nutrition

Instruction for the Learners:

Learners will be organized into smaller groups and will see this brief video show;

Then, they will discuss about the lessons they learned from the video show regarding the significance of aquatic biodiversity for improving nutrition in the particular case demonstrated.

Here is the video Link: <https://www.youtube.com/watch?v=NVs8aQqoQ4Y> showing the contribution of aquatic biodiversity for improving nutrition. The video show is developed by Ministry of Agriculture and Forestry, Lao PDR in rice based ecosystems.

6.3.2. Terrestrial biodiversity and nutrition

Terrestrial biodiversity is the primary source of food for hundreds of millions of people throughout the developing world. Despite widespread human reliance on terrestrial plants and animals for food, the impact of terrestrial biodiversity resource depletion on human nutrition and health remains poorly understood. Particularly in Ethiopia there are number of terrestrial biodiversity species which are nutritionally rich but not yet exploited. Many plant species and other forms of biodiversity from the terrestrial ecosystems provide wild edible fruits and other parts, among other many benefits including wildlife habitats, sources of medicinal plants, watershed protection, construction materials, fuel wood and spiritual values.

Particularly, in developing countries, millions of people are highly dependent on wild resources for wild edible and medicinal plants. Despite society's primary reliance on crop plants as major food sources, the tradition of eating wild plants and animals has not been completely disappeared. With this regard, Ethiopia as a country with varied topography and a wide spectrum of terrestrial habitats with a large number of endemic plants and animals has got a huge untapped potential for improving nutrition from biological sources in the wild.

6.4. Biodiversity conservation, ecosystem services and nutrition

Concept of Eco-nutrition

The modern and holistic approaches of improving nutrition require application of integrated approach that encourage disciplinary scientists to consider how their specific skill set or knowledge base could be applied to tackle an issue or problem outside of their disciplines. This practice has become increasingly common with ecologists, amongst other fields, leading to novel interdisciplinary domains such as ecosystem services through various concepts such as eco-nutrition, eco-health and eco-agriculture.

Eco-nutrition integrates various core disciplines, which include nutrition, agronomy, ecology and economics to jointly reduce malnutrition, increase agricultural productivity, protect the

environment, and promote economic development. The major components of eco-nutrition are described below in brief.

Nutrition

Unfortunately, the first similarity between the fields of nutrition, agriculture and environment is the current gloomy outlook. It is often cited that approximately more than one billion of the world's population lack access to adequate food and are as a result malnourished. On the other side, some reports indicate that there are more than 2.3 billion overweight adults and more than 700 million obese. Therefore, this 'double burden' of malnutrition and overweight suggests that nearly half of the global population is suffering from some form of nutritional disorder.

Agriculture

Agriculture is faced with similar challenges. Recent reviews and analyses highlight the current twin challenges of feeding the 9 billion global inhabitants projected for 2050 while decreasing the growing environmental footprint of agriculture. While agriculture has met the challenge of producing for growing populations in the past, notably through the Green Revolution, this increase has come at tremendous environmental cost. Agricultural expansion is the primary driver of biodiversity loss through conversion of certain proportions of global grasslands, savannahs, temperate deciduous forests, and tropical forests to agriculture.

Global fertilizer use has increased more than 500 per cent leading to significant impacts on global water and nitrogen cycles in particular. In terms of climate change, agriculture has also contributed to the global greenhouse gases, and is likely to be one of the industries most impacted by the global climate change.

The focus on agricultural intensification has also led to a singular focus on a handful of crop species, primarily in the grass family. Three crops, wheat, maize and rice, occupy approximately 40 per cent of the global agricultural landscape. Not only is tremendous crop diversity lost through agricultural intensification, the intra-specific, or genetic diversity of both major and minor crop species is lost, eroding the capacity of agricultural systems to weather shocks. Agricultural systems are increasingly vulnerable to climate change, globalization, the increasing price of inputs such as

water and fertilizer, and the degradation of the natural resource base. These problems are likely to be significant obstacles, particularly for small-scale farmers. Therefore, agricultural landscapes must become net producers of ecosystem services rather than consumer services. This necessitates a movement towards multifunctional landscapes.

Environment

As with human nutrition and agriculture, global environmental concerns are rising. In many cases, the negative declines on the state of the environment are tied to agriculture and include the direct impact of agricultural expansion on the loss of habitat for biodiversity. Although species extinctions are natural, never in the history of the earth has one species, our own, been the cause of the mass extinction of so many others.

Therefore, integrated approaches considering the aforementioned domains are required as long lasting solutions. Issues of hunger are the domain of nutrition, crop production (domain of agronomy), and environmental conservation (domain of ecology). There are deeper relationships between agricultural production, which provides us with our nutrition, and biodiversity. The nutritional value and the flavors of our foods are ultimately the result of complex interactions between crops and their environment. For example, the protein content of beans is the result of a symbiotic relationship with bacteria inhabiting the roots of legumes; the conversion of leaf litter to soil organic matter is the result of a host of invisible and underappreciated communities of soil microflora and fauna. Therefore, whether the nutritional value of the foods we eat, or simply the production of many of these crops within farmers' fields, it can be realized that food production and nutrition are tied to ecosystem services resulting from conserved environment.

Summary

Linking/harmonizing agriculture with biodiversity is a pre-condition for ensuring sustainable agriculture contributing to improved nutrition. Everything that we eat, the air we breathe, the fresh water we use, etc is dependent on the biodiversity and ecosystem services. The biodiversity and ecosystem provide us different services such as regulatory services (maintaining the quality of air and soil, providing flood and disease control, or pollinating crops), supporting services (habitat for

nutritionally important species, maintenance of genetic diversity), provision services (food, raw materials, medicinal plants, fresh water) and cultural services (aesthetic inspiration, cultural identity, sense of home, and spiritual experience related to the natural environment) which are directly or indirectly related to the nutrition status of the community. It is also home for various nutritionally rich fauna and flora species. The health of soil where our food production depends is affected by any change in the biodiversity and ecosystem. For ensuring sustainable food production and nutrition, promotion of eco-nutrition, which integrates different disciplines such as nutrition, agriculture, and environment, is the basic requirement as contemporary and holistic approach.

Self-Assessment

- Q1.** Discuss what is agro biodiversity and how do agro biodiversity contribute to nutrition?
- Q2.** Explain how biodiversity conservation can improve nutritional status in the context of both terrestrial and aquatic ecosystems?
- Q3.** List at least 10 nutritionally important local plant and animal species found in your local area?
- Q4.** What do you understand by eco-nutrition, and how do you link it with sustainable food production and nutrition?

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Chapter 7: Multi-Sectoral Coordination for Nutrition

7.1. Introduction

Coordination is one strategic objective focusing on multi-sectoral coordination and linkages for nutrition. The purpose is to enhance the nutritional impact at a grass root level by concerted action of various sectors. Evidence indicates that the factors that hinder progress in improving nutrition are multi-faceted and multi-sectoral. Therefore, these need to be counteracted by equally powerful, multi-sectoral, multi-stakeholder forces that combine nutrition-specific, nutrition-sensitive and environment enabling actions at all levels across sectors. To ensure viable linkages and harmonization among relevant sectors, the Federal Ministry of Health is mandated to house and manage the organizational and management structure of the NNP II. Seqota declaration is another big nutrition movement in Ethiopia with aim of ending child under nutrition by 2030. It also brings a number of parties (no less than 11 ministries and additional development partners) for joint action against malnutrition. Therefore, this chapter will cover the multi-sectoral nature of nutrition and the roles of different sectors for nutrition.

Objectives: At the end of this chapter students will be able to:

- Explain the multi-sectoral nature of nutrition
- Mention the roles and responsibilities of various sectors for nutrition
- Discuss strategies to strengthening multi-sectoral collaboration

7.2. Multi-sectoral nature of nutrition

Nutrition has a multi-dimension and multi-sectoral nature in terms of both effect and outcome. The multi-sectoral nature of nutrition requires individual, institutional and system-level capacities to operationalize effective interventions through collaborative engagement across sectors and stakeholders. Effective implementation further requires coherence both vertically (within sectors and stakeholder institutions) and horizontally (across sectors and stakeholders). In order to ensure

effective multi-sectoral coordination among different stakeholders, a common structure was already established by the government in the National Nutrition Programme II (NNP II).

7.3. The Ethiopian National Nutrition Program

The National Nutrition Program (NNP) is a national multi-sectorial program with strategic objectives to improve the nutrition condition of the country. The NNP I has been implemented during the first Growth and Transformation Plan (GTP I) and a follow on NNP II is launched in December 2016 to be implemented during GTP 2 and will be in place up to 2020. The health sector is assumed the coordination while agriculture and livestock, education, women and child, water, irrigation and electricity sectors are main sectors working to achieve the program through both mainstreaming and direct implementation of the program in their respective areas.

Strategic objectives of the NNP II are:

1. Improve the nutritional status of women (15–49years) and adolescents (10–19 years),
2. Improve the nutritional status of infants, young children and children under 5 years,
3. Improve nutrition service delivery for communicable, lifestyle related or non-communicable diseases affecting all age groups,
4. Strengthen implementation of nutrition sensitive interventions in various sectors,
5. Improve multi-sectoral coordination and capacity to ensure implementation of the NNP.

7.4. Roles and responsibilities of various sectors

The National Nutrition Coordination body remains the main mechanism for leadership, policy decisions and coordination of the NNP. Similar multi-sectoral nutrition coordination framework and program implementation arrangements are provided at regional, Woreda and Kebele levels. The terms of reference, membership, frequency of meetings and the roles and responsibilities of NNP implementing sectors have been detailed in the Guideline for Multi-sectoral Nutrition Coordination.

Ensuring good nutrition requires the contributions of many different sectors. The ranges of

sectors that are involved in efforts to reduce under-nutrition are in total 13 and presented below in the figure (Fig 7.1.)



Figure 7.1. Different sectors involved in implementation of nutrition program (Adopted from NNP II).

Each sector has a role to play in NNP II and its implementation according to their mandates (table 6.1). In order to have effective coordination, each sector needs to properly understand the importance of nutrition and what is expected of them. Assigning a responsible body is a second step towards implementation of the strategy. The agriculture sector serves as co-chair of the NNP

II and primarily takes the lead in the provision of food for the household and community. It also plays a pivotal role in reaching the rural population through strong extension system. The development committee of Kebeles' through the technical support of DAs and HEWs, plan and execute Kebele level nutrition intervention through mobilizing the development army.

Table 7.1. Major roles and responsibilities of nutrition signatory sectors

Sectors	Major Roles and Responsibilities
Health	<ul style="list-style-type: none"> • Strengthen the community level linkage and capacity of women based structures & associations at all levels to promote optimal adolescent, maternal, infant and young child nutrition (AMIYCN) and caring practices
Agriculture & Natural resource	<ul style="list-style-type: none"> • Increase year-round availability, and access to and consumption of fruits and vegetables, nutrient-dense cereals and pulses. • Promote technologies for post-harvest food processing, handling, preservation and preparation to help ensure that food is both nutritious and diverse. • Improve nutrition-sensitive agriculture (NSA) knowledge and practice among farmers. • Promote production and consumption of bio-fortified crops.
Livestock & fishery	<ul style="list-style-type: none"> • Increase year-round availability, access to and consumption of animal-sourced foods. • Promote technologies for post-harvest food processing, handling, preservation and preparation to help ensure that food is both nutritious and diverse • Improve nutrition-sensitive livestock and fishery development knowledge and practice among farmers through behavior change communication.
Industry	<ul style="list-style-type: none"> • Conduct awareness creation events for the private sector on nutrition related requirements and standards for local manufactured food items.
Trade	<ul style="list-style-type: none"> • Ensure the quality and safety of imported food items as per the national standard.

	<ul style="list-style-type: none"> • Conduct awareness creation events for the public/consumers on the benefits of fortified food.
Water, Irrigation & Energy	<ul style="list-style-type: none"> • Increase access to safe and clean water. • Increase access to small- and large-scale irrigation schemes. • Increase access to and availability of renewable energy
Government Communication	<ul style="list-style-type: none"> • Create public awareness on healthy dietary practices, healthy lifestyles, and lifestyle related non-communicable diseases. • Utilize available media outlets to promote optimal nutrition behavior
Youth & Sport	<ul style="list-style-type: none"> • Promote the provision of credits, grants, microfinance services and other income generating initiatives to support increased access to nutritious foods among vulnerable groups
Disaster risk management	<ul style="list-style-type: none"> • Strengthen and scale up early warning systems for food and nutrition information from the community level up to the national level. • Improve knowledge and practice of nutrition- sensitive disaster risk management among farmers, using behavior change communication.
Labor & social affairs	<ul style="list-style-type: none"> • Promote the implementation of gender- sensitive social safety net program and other social protection instrument in urban settings to protect vulnerable groups from food insecurity and under nutrition.
Women & Children	<ul style="list-style-type: none"> • Incorporate a gender analysis as part of the regular nutrition situation analysis, analyzing the needs, priorities and roles of men and women. • Mainstream gender equality within all nutrition training programs. • Engage and mobilize women's groups in nutrition advocacy and skills transfer. • Promote meaningful male involvement in nutrition interventions.
Education	<ul style="list-style-type: none"> • Promote and scale up school feeding programs. • Promote school health and nutrition (SHN) interventions through collaboration with other sectors.
Finance & economy	<ul style="list-style-type: none"> • Mobilize resources for nutrition and making sure public resources allocated for nutrition are properly utilized.

7.5. Role of agriculture and livestock sector in the NNP II

Agriculture in general and more specifically agriculture and natural resource and livestock and fishery sectors are responsible to provide food for the society and generate income for the rural population engaged in agriculture. Therefore, the core responsibility of the sector in terms of nutrition security is making nutritious food available and accessible. Due to agro-ecological diversity and difference in suitability, each area can only produce selected type of commodities. This naturally limits availability of various foods among localities leading to commodity specialization. On the other hand, some communities rely on narrow range of foods while others can have diverse. Culture and religion also influence preferences which type of food can and cannot be consumed.

There are two ways to diversify availability of food. The first is through developing the marketing systems in the local market where the farmers can sell their produce and buy what they do not have from others. This will eventually expand the local market and encourage farmers to specialize in certain commodities that they found to be more productive and fetch good prices. As the market expands it attracts traders to bring different products not grown in the area creating more opportunities. This will enhance farmers' specialization and thereby create further opportunities in expanding non-agricultural jobs and eventually some level of value addition. The second way is through production of diverse types of food by the household through homestead gardening and engaging in various types of agricultural and livestock production depending on the suitability of the agro-ecology and resource endowment of the family.

Various programs and projects are formulated and being implemented in the agriculture sector. Most of these projects have nutrition either as an objective or a component to address. The most important ones are Agriculture Growth Program (AGP) and Productive Safety Net Program (PSNP) being implemented in agricultural potential and food insecure areas, respectively. Generally, nutrition security is captured as an important strategic focus area in the GTP 2 enabling all programs to mainstream and ensure program implementation addresses nutrition security.

7.6. Strengthening multi sectoral coordination

Advancing nutrition in countries requires capable human resources, effective institutions, and functional systems to plan, manage, and evaluate programs. Strong country commitment and government leadership along with the active engagement of communities, the private sector, and civil society are essential for achieving and sustaining nutrition outcomes. The commitment of country leadership to nutrition at all levels, including larger and sustained resource allocations for nutrition, is essential to creating and sustaining momentum and for conversion of that momentum into results on the ground.

Building national, multi-stakeholder commitment to nutrition will foster coordination across government ministries, promote public-private partnerships, build country capacity, set strong policy foundations, and increase the ease and likelihood of being able to expand availability and utilization of nutrition services. Effective multi-sectoral coordination along with collaborative planning and programming across sectors at national, regional, and local levels are necessary to accelerate and sustain nutrition improvements. Programming nutrition-specific and nutrition-sensitive interventions in the same geographic areas can also be effective to improve nutrition outcomes. Given that the nutrition, their risk factors and social determinants have roots and implications for sectors beyond health, a multi-sectoral response is critical to tackle them in a comprehensive manner. The experiences of similar public health concerns suggest that multi-sectoral coordination mechanisms can go a long way in providing a synergistic response to nutrition in countries.

In order to realize food and nutrition security at national and household levels and to accelerate the reduction of malnutrition, the Government of Ethiopia opted for an approach that would see nutrition integrated into various sectors through a well strengthened and integrated multi-sectoral approach. Several reviews have shown that in order for a multi-sectoral coordination mechanism to succeed, it should have a strong institutional arrangement within the NNP implementing sectors. To execute its mandate of coordinating the sectors and fulfilling the aims of NNP II and the Seqota Declaration, the National Nutrition Coordinating Body (NNCB) needs to be well strengthened and functional up to the kebele levels, along with the necessary resources and accountability. Sectoral

members would therefore be held accountable, both institutionally and collectively, for the achievement of the nutrition goals and targets set by the National Nutrition Program.

The following are proved measures to strengthen multi sectoral coordination at different levels:

- Increased political will and resources for nutrition programs
- Support joint assessments, gap analyses, and program reviews between inter-office teams
- Improved systems to plan, manage, monitor, and evaluate nutrition programs
- Increased professional and institutional capacity
- Strengthen planning and coordination for effective convergence of interventions in geographical areas, as appropriate, for increasing nutrition outcomes
- Increased stakeholder engagement around national nutrition goals
- Establish joint planning mechanisms between development and humanitarian assistance agencies at the country and/or regional levels
- Intensify coordination and strategic planning of both humanitarian and development assistance programs to target high risk communities, reduce vulnerabilities, and increase development opportunities
- Document best practices in transitioning emergency response to development opportunities
- Reinforce advocacy efforts for government and donor support of multi-sectoral nutrition planning, programming, and dissemination of results
- Strengthen and expand project and program learning associated with multi-sectoral activities
- Strengthened engagement with the private sector to improve nutrition
- Work with the private sector to develop stronger communications and marketing approaches in support of improved nutrition for mothers and children and increase demand for safe and nutritious foods

Summary

- Addressing nutrition requires highly integrated and inter-sectorial intervention and thus a national coordination platform is established that goes from federal to Kebele level.

- The agriculture and livestock sector has the prime responsibility of providing diverse and nutritious food for the family and market.
- Increasing political will and resources for nutrition programs is one of the proved methods to improve multi sectoral coordination among stakeholders.

Self-Assessment Questions

Q1. Discuss the multi-sector nature of nutrition

Q2. Mention the five strategic objectives of the NNP II

Q3. Describe at least two roles and responsibilities of the agriculture sector in improving nutrition

Activity 6.3: Field visit

Activity objective: At the end of this field visit, students will be able to evaluate the multi sectoral collaboration for nutrition in different sector offices.

Instructions

- Field visit will be done in group
- The visit focuses on assessing the multi-sector collaboration of different sectors for joint and synchronized action to improve nutrition based on the NNP of Ethiopia.
- Each group will visit one of the governmental sectors (e.g. Bureau of Agriculture, Bureau of Health, Bureau of water, irrigation and electricity, Bureau of industry, bureau of livestock and fishery or any other from the signatories of NNP II) to interview and observe what the sectors are doing in relation to multi-sectoral collaboration.
- Students are expected to report back and present what they have seen in the field
- Before field visit students are expected to prepare checklist in relation to:
 - Political commitment and resources (e.g. human resource) for nutrition programs
 - Joint assessments, gap analyses, and program reviews between office teams
 - Stakeholder engagement nutrition activity
 - Documentation of best practices
 - Measures to be taken to improve the level of coordination

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Chapter 8: Planning, Monitoring and Evaluation of Nutrition Sensitive Agriculture Interventions

8.1. Introduction

Though the agriculture sector has the larger potential in feeding people well by increasing availability, affordability, and consumption of diverse, safe, nutritious foods and diets, aligned with dietary recommendations and environmental sustainability, the Ethiopian agricultural system is at its infant stage to be explicitly nutrition sensitive and this affected the agriculture sector ability to impact fully on the nutritional situation of the country.

The idea of nutrition-sensitive agriculture has not yet been internalized by agriculture project planners and managers. With respect to monitoring and evaluation, agriculture project planners and managers are facing considerable difficulty even with their existing orientation. This chapter addresses the basic planning principles, monitoring, evaluation and indicators of nutrition sensitive agriculture intervention.

Objectives: At the end of this chapter the student will be able to

- Identify basic principles of planning for nutrition sensitive agriculture interventions
- Plan nutrition interventions jointly with other nutrition stakeholders in feasible agricultural activities by respecting their boundaries
- Monitor and evaluate implementation of nutrition sensitive agriculture interventions and its impacts on the community

8.2. Basic principles of planning for NSA interventions

The basic principle of planning to make agriculture system nutrition sensitive can be classified as program principles and policy principles. The components of each principle are presented as follows:

8.2.1. Program principles

At program level, agricultural programs and investments can strengthen impact on nutrition if they are designed considering the following:

1. Incorporate explicit nutrition objectives and indicators into their design, and track and mitigate potential harms

Nutrition-sensitive agricultural investment programs should not only seek to improve nutritional outcomes, they should, at least, ensure that they *do no harm* to the nutritional status of the project stakeholders, including producers and consumers.

Types of harm that may arise from agricultural interventions:

- Employment levels have remained static or deteriorated;
- Small producers have been excluded;
- Women are not able to participate;
- Household food insecurity has deteriorated (overall or seasonally);
- Intra-household equity of income has declined;
- The labor burden of women has increased;
- The debt burden of vulnerable households has increased
- In irrigation/water use projects, changes in water-borne diseases;
- In livestock projects, changes in zoonotic disease;
- When agrochemical inputs are used, possible risks to health (e.g. using empty containers for drinking water).

During planning, we have to consider the following questions:

- What is/are the program's main objective(s)?
- Is nutrition considered as part of the objective(s)? How?
- What nutrition indicators can be used to measure the achievement of these objectives?
- What is/are the impact pathway(s) through which the program is likely to impact nutrition?

2. Assess the context at the local level to design appropriate activities to address the types and causes of malnutrition

During designing a nutrition-sensitive intervention, a thorough analysis of the context, in particular of the nutritional problems that affect different parts of the population, their multiple causes, and the social and institutional contexts that shape the food and nutrition security situation is paramount important.

3. Target the vulnerable and improve equity

During planning of our agricultural intervention, target the vulnerable (women of reproductive age group, children, youth, the landless, and others) and improve equity is paramount important. Agricultural planner, should address the following question.

- Who will benefit from the program?
- How is the project or investment expected to reach women of childbearing age and young children?
- Is it possible that the intervention may benefit one group while harming another?

4. Collaborate and coordinate with other sectors

Impact on nutritional status cannot necessarily be achieved by food and agriculture programs alone. Access to health, water and sanitation, education and social protection programs are usually required. It is therefore important to seek synergies with operations from other sectors like health, environment, social protection, water and sanitation, education, and other development partners through joint strategies with common goals, to address the multiple underlying causes of malnutrition. As an agricultural planner, we should consider the following questions during planning to collaborate with other sectors.

- Are existing or proposed mechanisms for facilitating coordination and communication among stakeholders available? At what level do they operate? Who is involved in this process?
- Could agricultural investment take place in the same geographic area as other health, water and sanitation, and social protection programs which are also important for reducing malnutrition?
- Could the project include alternative income-generating activities or link with social safety nets for hungry seasons?

5. Maintain or improve the natural resource base

During planning, our activities should consider to use the natural resources in a sustainable way, contribute to climate change adaptation, and take measures to ensure that wild biodiversity is maintained and neither crops nor agricultural practices degrade the natural resource base. Water,

soil, air, climate and biodiversity are critical to the livelihoods and resilience of vulnerable farmers and to sustainable food and nutrition security for all. We should also take into consideration the following question during planning

- Does our agricultural intervention include measures to protect or improve soil quality and biodiversity?
- Is our agriculture intervention likely to affect the quantity and quality of water available to households with malnourished individuals?
- How will the agriculture activities affect women's workloads related to water procurement and use?

6. Empower women

Women's income and decision-making power is linked to improved nutrition for household members because of the role women play across cultures as providers and gatekeepers of household nutrition, child care, and health. Furthermore, gender equity takes into account women's central role in translating agricultural inputs and outputs into nutrition impacts. Our planning should answer following questions:

- How will women be involved and benefit from the agriculture program interventions?
 - Are they likely to control income generated by the program?
 - How is the project expected to influence gender-specific time demands?
 - Are time demands for women likely to reduce the quality of child care?
 - Are time demands for women likely to result in their increased income and decision-making power?
 - Are there labor-saving technologies for women's tasks that could be included in the project to reduce the time women spend on agricultural or household tasks?
- How are men included in discussions to ultimately allow for changes to take place?

7. Facilitate production diversification, and increase production of nutrient-dense crops and small-scale livestock

Diversified production systems is important for small holder farmers to ensure resilience to climate and price shocks, more diverse food consumption, reduction of seasonal food and income fluctuations, and greater and more gender-equitable income-generations. Therefore, during planning, we have to consider the following questions:

- Do farmers reside close enough to their fields that diversifying production is likely to influence own-consumption?
- Do farmers have access to markets where they would be able to sell perishable foods?
- Are there specific micronutrient-rich foods that are unavailable or too expensive?
- What local resources or underutilized foods could be grown to improve diets and nutrient intake?
- How can market access to nutritious food be increased for both local rural and urban populations?

8. Improve processing, storage and preservation

Appropriate processing, storage and preservation are essential to reduce post-harvest losses and improve or prolong access to and consumption of micronutrient-rich foods. Processing and storage techniques can preserve the nutrient content of food, and certain processing techniques can even increase it, e.g. roasting, germination and fermentation. Therefore, we have to answer the following questions during planning for agriculture interventions:

- Does the program change the quality, food safety or nutrient content of the food(s) targeted by the project?
- What crops might be appropriate for enhanced preservation?
- Are there entry points in the value chain for aflatoxin control?

9. Expand markets and market access for vulnerable groups, particularly for marketing nutritious foods.

Market opportunities may be an incentive for farmers to produce and potentially consume nutritious foods they otherwise would not. An important contribution that investments in agricultural value chains can make to nutrition is by improving market access:

- For producers, processors and retailers, to help them sell their products and generate income which can be invested in better health, care and food consumption; and
- For consumers, to improve availability and affordability of nutrient-dense foods.

10. Incorporate nutrition promotion and education

It is important to include measures in program design to build on existing local knowledge, attitudes and practices of the community on nutrition. Nutrition knowledge can enhance the impact of production and income in rural households, especially important for women and young children, and can increase demand for nutritious foods in the general population.

8.2.2. Policy principles

Agriculture programs and investments need to be supported by an enabling policy environment if they are to contribute to improving nutrition. Food and agriculture policies can have a better impact on nutrition if they:

1. Increase incentives (and decrease disincentives) for availability, access, and consumption of diverse, nutritious and safe foods through environmentally sustainable production, trade, and distribution:

The focus needs to be on horticulture, legumes, and small-scale livestock and fish – foods which are relatively unavailable and expensive, but nutrient-rich – and vastly underutilized as sources of both food and income (refer MoANR NSA strategy document)

2. Monitor dietary consumption and access to safe, diverse, and nutritious foods. The data could include food prices of diverse foods, and dietary consumption indicators for vulnerable groups.

3. Include measures that protect and empower the poor and women: Safety nets that allow people to access nutritious food during shocks or seasonal times when income is low; land tenure rights; equitable access to productive resources; market access for vulnerable

producers (including information and infrastructure). Recognizing that a majority of the poor are women, ensure equitable access to all of the above for women. (refer to Ethiopian PSNP 4 document)

4. **Develop capacity:** Capacitate human resources and institutions to improve nutrition through the food and agriculture sector, supported with adequate financing.
5. **Support multi-sectoral strategies to improve nutrition:** within national, regional, and local government (Refer NNP2 document)

8.3. Monitoring and evaluation indicators for NSA activities

The idea of nutrition-sensitive agriculture has not yet been internalized by agriculture project planners and managers. So, proper monitoring and evaluation of agricultural projects for their impact on household food security and nutrition is important. The monitoring data that should be collected for NSA interventions are;

- Basic socio-demographic information
- Information indicating participation and the extent to which households have been reached/affected by the agriculture project
- Data on household food insecurity levels and on the dietary quality
- Data on child and maternal nutritional status
- Income level of the household
- Information on women's empowerment (qualitative and quantitative)
- Information on any harmful effects of the project on food security or nutrition.
- On-farm availability, diversity, and safety of foods
- Data on natural resource management practices

Table 8.1: Key nutrition sensitive agriculture indicators

Type of measure	Indicators	What the indicator measure	Mode of collection
Diet – Individual level	<p>Minimum Dietary Diversity for Women of reproductive age (MDD-W)</p> <p>Minimum Dietary Diversity for young children (MDD age 6-23 months)</p>	A measure of dietary quality, which reflects overall nutrient adequacy and dietary diversity. It does not reflect adequacy of specific target nutrients	Household survey (individual interview within household)
Food access – Household level	Food Insecurity Experience Scale (FIES)	Severity of food insecurity experience with in a household. Can also be measured for individuals.	Household or individual survey
On-farm availability, diversity, and safety of foods	Production of target nutrient-rich foods	A measure of availability of diverse nutritious foods	Household survey or farm survey
	Diversity of crops and livestock produced	Nutrition and food safety related knowledge and attitudes (KAP) at the community level	
	Months of Adequate Household Food Provisioning (MAHFP)		
Food environment in markets	Availability and prices of targeted nutrient-rich foods in local markets	Useful to track whether Nutrient-rich foods are available in the market	Market / Price information systems when they exist; or rapid market survey

Income	Income, disaggregated by gender, to reflect intra-household income control	Resource equity	Household survey and/or enterprise records kept by project
Women's empowerment	Women's access and control over resources (e.g. land/property ownership)	Women's empowerment	Household survey and/or qualitative process
	Women's participation in economic activities (e.g. gender gap in crop/livestock sales)	Women's empowerment	
	Women's access to and control over benefits(e.g. agricultural income earned and controlled by women)	Women's empowerment	
Natural resource management Practices	Access to improved drinking water source	Natural management practices	Farm survey

Source: FAO(2016) Compendium of nutrition sensitive agriculture

Summary

- The basic principle of planning to make agriculture system nutrition sensitive can be classified as program principles and policy principles
- Agricultural programs and investments can strengthen impact on nutrition if they are designed with nutrition lenses
- Agriculture programs and investments need to be supported by an enabling policy environment if they are to contribute to improving nutrition
- The monitoring and evaluation of agricultural projects for their impact on household food insecurity and nutrition is important

Self-assessment questions

1. What are the main gaps identified in Ethiopian agriculture sector to improve nutritional status of the community?
2. Mention at least five program principles that should be considered during designing of agriculture investment which has positive impact on nutrition?
3. Write at least 3 key indicators for nutrition sensitive agriculture intervention

Learning Activities

1. Group assignment/Homework (sub topic 7.1.)

Case Study

Objective: The student will be able to analyze the case and propose possible solution to make the agriculture system nutrition sensitive.

Instruction: After analyzing the case scenario students are expected to submit the report to the instructor to the next class

Case Scenario

During the Growth and Transformation Plan (GTP I) implementation period; the agriculture sector of Ethiopia has registered an average real agricultural GDP growth rate of 6.6% per annum. The average productivity of major crops by smallholder farmers for the main season has increased from 15.7 quintal per hectare to 21.5. Regarding the livestock sector, between 2009/10 and 2014/15 the proportion of hybrid/improved cattle increased from 10.37% to 14.53%, The accomplishments with regards to natural resources conservation and development activities are identified as one of the success stories in agriculture and environment sector of the country. Despite all the tremendous achievements in the sector, the problem of food and nutrition security of the country remains the main health and development issue. Assuming that you are assigned at Ministry of Agriculture

and Natural Resource, extension directorate as nutrition sensitive agriculture senior expert. The extension directorate is planning to make the agriculture interventions nutrition sensitive so as to improve food and nutrition security of the community. You are the only responsible person to design and make the agriculture intervention nutrition sensitive.

1. What do you think the reason that the problem of food and nutrition security remain health and development issue?
2. What will be your measure to alleviate the problem?
3. Set appropriate monitoring and Evaluation mechanisms to alleviate the problem

Project Work: Design planning, monitoring and evaluation principles for the current agricultural production system and dietary consumption pattern

Objectives of the Project work: The student will be able to:

- Identify the current agricultural production system and dietary consumption pattern
- Design appropriate agricultural planning techniques and
- Set monitoring and evaluation mechanisms for proposed NSA interventions.

Instruction: Students will be formed in a small groups; each group will choose one nearby kebele and identify the current agricultural production system and dietary consumption pattern. After that, the group will design appropriate agricultural planning techniques and set monitoring and evaluation mechanisms for NSA interventions. Students should submit the project report to the instructor within a week.

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