



La-Net

# COM 405

## PUBLIC HEALTH NUTRITION AND REHABILITATION



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**Course code: COM 405**

**Course title: Public Health Nutrition and Rehabilitation**

**Course credit load: 1 Unit**

# **Series 1: Public Health Nutrition: Definition, Diet, and Nutritional Values of Nigerian Foodstuff**

- **Part 1.1: Defining Public Health Nutrition**
  - Sub Part 1.1.1: What is public health nutrition?
  - Sub Part 1.1.2: Scope and importance of public health nutrition
  - Sub Part 1.1.3: Nutrition and community health in Nigeria
- **Part 1.2: Relationship Between Diet and Nutrition**
  - Sub Part 1.2.1: Defining diet and nutrition
  - Sub Part 1.2.2: Nutrients and their functions
  - Sub Part 1.2.3: Diet quality and nutritional adequacy
- **Part 1.3: Nutritional Values of Common Nigerian Foodstuffs**
  - Sub Part 1.3.1: Staple carbohydrate foods
  - Sub Part 1.3.2: Protein-rich foods in the Nigerian diet
  - Sub Part 1.3.3: Fruits, vegetables, fats, and oils



## Introduction

Nutrition is one of the most powerful determinants of health at both the individual and population level. What people eat influences their physical growth, cognitive development, immune function, and risk of both communicable and non-communicable diseases. Public health nutrition applies the science of nutrition to the health of populations, seeking to understand and improve dietary practices at a scale that affects entire communities rather than only individual patients.

This Series introduces public health nutrition as a discipline, examining its definition, scope, and importance for community health in Nigeria. It then explores the fundamental relationship between diet and nutrition, including the six classes of nutrients and their functions in the body, before examining the nutritional values of the most common Nigerian foodstuffs across the food groups. This foundational knowledge underpins all subsequent topics in the course.

By the end of this Series, learners will have a clear understanding of what public health nutrition is, how diet and nutrition relate, and what the major Nigerian foods contribute to meeting nutritional requirements.

## Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 1.1** define public health nutrition and describe its scope and importance for community health in Nigeria (Linked to Part 1.1),
- **SLO 1.2** distinguish between diet and nutrition, enumerate the classes of nutrients and their functions, and explain what constitutes a nutritionally adequate diet (Linked to Part 1.2), and
- **SLO 1.3** describe the nutritional values of common Nigerian foodstuffs across the carbohydrate, protein, and fruit and vegetable groups (Linked to Part 1.3).

### 1.1 Defining Public Health Nutrition



### 1.1.1 What is public health nutrition?

**Public health nutrition** is the application of nutrition science to the promotion and maintenance of population health, with the aim of preventing nutrition-related diseases and promoting optimal nutritional status across all segments of the community. It is distinguished from clinical nutrition, which focuses on the assessment and treatment of nutrition problems in individual patients, by its population-level perspective and its emphasis on **prevention, policy, and community action** rather than individual clinical management.

Public health nutrition draws on multiple disciplines, including nutritional science, epidemiology, social science, education, and public policy, to understand why populations eat the way they do and to design effective interventions that support healthier dietary practices. As a field, it addresses not only what individuals eat but the **food systems, economic conditions, cultural practices, and policies** that shape food availability, affordability, and dietary choices at the community and national level.

Fill in the blank: Public health nutrition applies nutrition science at the \_\_\_\_\_ level, focusing on prevention, policy, and community action to promote optimal nutritional status across all segments of the community.

### 1.1.2 Scope and importance of public health nutrition

The scope of public health nutrition is broad, encompassing **nutrition surveillance and assessment** to monitor the nutritional status of populations, **nutrition education and counselling** to improve dietary knowledge and practices, **food and nutrition policy development** to create enabling environments for healthy diets, **programme planning and evaluation** for nutrition interventions, and coordination with other sectors including agriculture, education, trade, and social protection.

Public health nutrition is critically important in Nigeria because the country carries a **double burden of malnutrition**, simultaneously facing widespread undernutrition, particularly among children under five and women of reproductive age, and a rapidly growing burden of



overnutrition and diet-related non-communicable diseases such as obesity, diabetes, and cardiovascular disease among urban populations. Addressing this complex nutritional landscape requires a comprehensive public health nutrition approach that goes well beyond simply advising individuals to eat more healthily.

Fill in the blank: Nigeria faces a double burden of malnutrition, combining widespread \_\_\_\_\_ particularly in children and women, with a growing burden of overnutrition and diet-related non-communicable diseases in urban populations.

### 1.1.3 Nutrition and community health in Nigeria

Nutritional status in Nigeria is shaped by a complex interplay of **biological, social, economic, and environmental factors**. Poverty and food insecurity limit access to a diverse and nutritious diet for a large proportion of the Nigerian population. Traditional food practices, while often nutritionally sound, are sometimes displaced by **processed and fast foods** in urban areas, contributing to rising rates of overweight and diet-related chronic disease.

At the community level, nutrition problems manifest in high rates of **stunting** (low height-for-age indicating chronic undernutrition), **wasting** (low weight-for-height indicating acute undernutrition), and **micronutrient deficiencies** such as iron-deficiency anaemia, vitamin A deficiency, and iodine deficiency disorders. These conditions have profound consequences for child survival, cognitive development, educational attainment, and economic productivity, making public health nutrition interventions among the highest-value investments available in the Nigerian health system.

Fill in the blank: Nutrition problems at the Nigerian community level include stunting, wasting, and micronutrient deficiencies such as iron-deficiency anaemia, vitamin A deficiency, and \_\_\_\_\_ deficiency disorders.





## Public Health Nutrition: Scope and Community Context

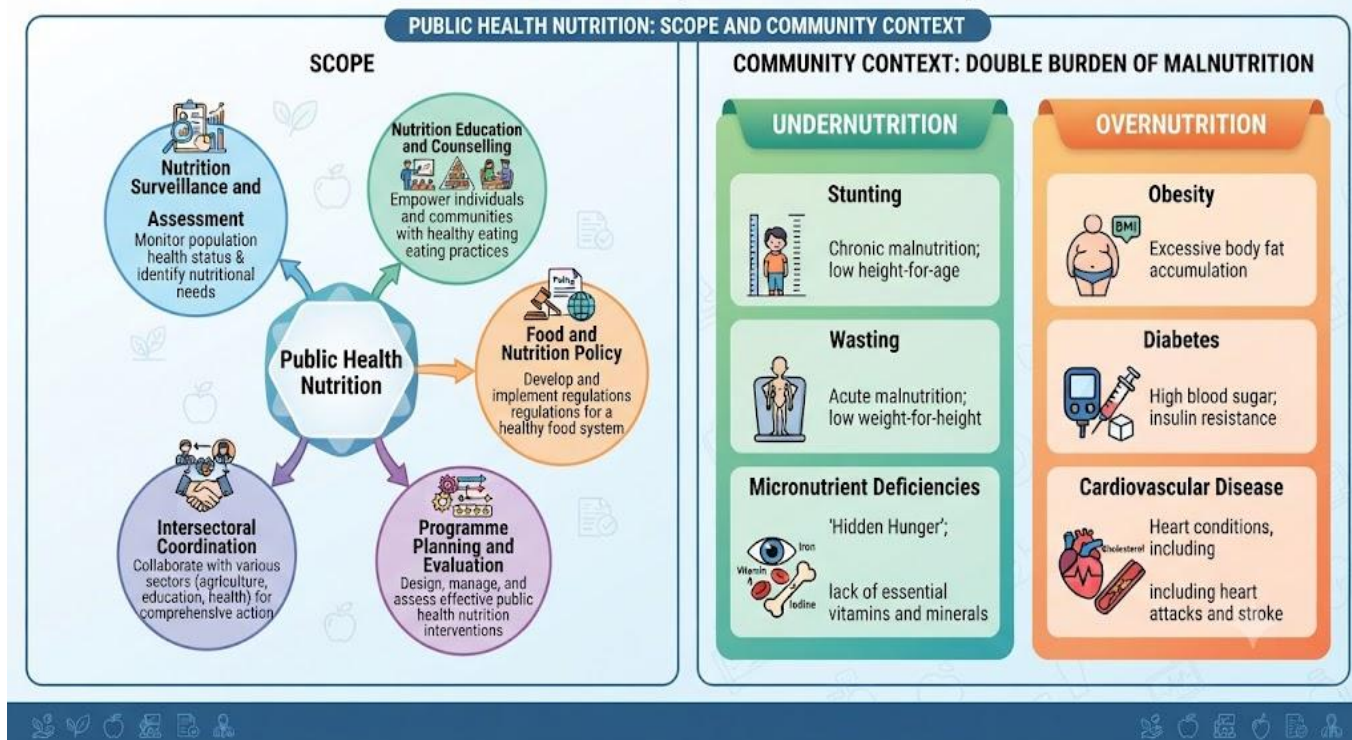


Figure 1.1: The scope of public health nutrition and the double burden of malnutrition in Nigeria

### Pilot questions 1.1

1. Define public health nutrition and distinguish it from clinical nutrition. (Linked to SLO 1.1)
2. Describe the scope of public health nutrition. (Linked to SLO 1.1)
3. Explain what is meant by the double burden of malnutrition in Nigeria. (Linked to SLO 1.1)
4. Identify three factors that shape nutritional status at the community level in Nigeria. (Linked to SLO 1.1)
5. Name three common forms of undernutrition seen at the community level in Nigeria. (Linked to SLO 1.1)



## 1.2 Relationship Between Diet and Nutrition

### 1.2.1 Defining diet and nutrition

**Diet** refers to the total sum of food and drink habitually consumed by an individual or group over a defined period, encompassing the types, amounts, and patterns of food intake that characterise a person's eating behaviour. **Nutrition** refers to the processes by which organisms take in and utilise food substances to support growth, maintenance, and repair of body tissues, the regulation of metabolic processes, and the provision of energy for bodily functions.

The relationship between diet and nutrition is therefore one of input and process: diet is the **external input** of food substances into the body, while nutrition is the **biological process** through which those substances are digested, absorbed, transported, metabolised, and utilised. A diet can be described in terms of its nutritional adequacy, that is, the extent to which the foods consumed together provide the nutrients needed by the body in appropriate quantities to support health.

Fill in the blank: Diet refers to the habitual food and drink consumed, while nutrition refers to the biological \_\_\_\_\_ by which food substances are digested, absorbed, and utilised to support growth, maintenance, and energy.

### 1.2.2 Nutrients and their functions

Nutrients are chemical substances obtained from food that the body requires to function properly. They are conventionally classified into six broad groups: **carbohydrates**, which serve as the body's primary energy source; **proteins**, which provide amino acids for growth, repair, and synthesis of enzymes, hormones, and immune proteins; **fats and oils**, which provide a concentrated energy source, support fat-soluble vitamin absorption, and contribute to cell membrane structure.

**Vitamins** are organic compounds required in small amounts to regulate metabolic processes, support immune function, and prevent deficiency diseases; they are classified as **fat-soluble (A, D, E, K)** or **water-soluble (B group and C)**. **Minerals** are inorganic elements required for



structural functions (such as calcium and phosphorus in bones) and regulatory functions (such as iron in haemoglobin and iodine in thyroid hormones). **Water** is the sixth class of nutrient, essential for all metabolic reactions, thermoregulation, transport, and excretion.

Fill in the blank: The six classes of nutrients are carbohydrates, proteins, fats and oils, vitamins, minerals, and \_\_\_\_\_; each plays distinct and essential roles in supporting bodily growth, maintenance, regulation, and energy supply.

### 1.2.3 Diet quality and nutritional adequacy

**Diet quality** refers to the degree to which the overall dietary pattern provides all required nutrients in amounts appropriate for health. A **nutritionally adequate diet** is one that meets the body's requirements for energy and all essential nutrients, is neither excessive in any nutrient to the extent of causing harm, and is sufficiently diverse to reduce the risk of both deficiency and toxicity.

The concept of **dietary diversity** is a practical proxy for diet quality, based on the principle that a diet drawn from many different food groups is more likely to meet the full range of nutrient requirements than one drawn from a narrow range of foods. The **recommended dietary allowance (RDA)** is the average daily intake level sufficient to meet the nutrient requirements of nearly all healthy individuals in a given age and sex group, and provides the reference standard against which dietary adequacy is assessed in nutrition surveys.

Fill in the blank: Diet quality is assessed by dietary \_\_\_\_\_ across food groups and adequacy of intake against the recommended dietary allowance (RDA) for each nutrient.

| <u>Nutrient Class</u> | <u>Primary Function and Nigerian Food Example</u>                      |
|-----------------------|------------------------------------------------------------------------|
| <b>Carbohydrates</b>  | Primary energy source; cassava, yam, rice                              |
| <b>Proteins</b>       | Growth, repair, enzymes and hormones; cowpeas, fish, eggs              |
| <b>Fats and Oils</b>  | Concentrated energy, fat-soluble vitamins; palm oil, groundnut oil     |
| <b>Vitamins</b>       | Metabolic regulation, immune function; vegetables, fruits              |
| <b>Minerals</b>       | Structural and regulatory functions; beans for iron, dairy for calcium |
| <b>Water</b>          | All metabolic reactions, transport; water                              |





Table 1.1: The six classes of nutrients, their primary functions, and examples from common Nigerian foods

### Pilot questions 1.2

1. Distinguish between diet and nutrition. (Linked to SLO 1.2)
2. List the six classes of nutrients and state the primary function of each. (Linked to SLO 1.2)
3. Distinguish between fat-soluble and water-soluble vitamins and give examples of each. (Linked to SLO 1.2)
4. Define a nutritionally adequate diet. (Linked to SLO 1.2)
5. Explain why dietary diversity is used as a proxy for diet quality. (Linked to SLO 1.2)

## 1.3 Nutritional Values of Common Nigerian Foodstuffs

### 1.3.1 Staple carbohydrate foods

Carbohydrate-rich staple foods form the foundation of most Nigerian diets and provide the bulk of daily energy intake. **Cassava** (*Manihot esculenta*) is the most widely consumed staple in Nigeria, processed into garri, fufu, and cassava flour; it is primarily a source of energy from starch but is low in protein, vitamins, and minerals, making dietary diversity essential when cassava forms the dietary base. **Yam** provides carbohydrate energy and is a better source of potassium and some B vitamins than cassava.

**Rice** and **maize (corn)** are also major staple carbohydrate sources; milled white rice has had much of its B vitamin and mineral content removed in processing, while whole grain maize retains more nutrients including niacin, though niacin in maize is in a poorly bioavailable form (niacytin) that can contribute to pellagra in populations dependent on maize. **Sorghum and millet** are important staples in northern Nigeria, providing energy, protein, and significant iron content relative to other cereals.



Fill in the blank: Common Nigerian carbohydrate staples include cassava (mainly energy), yam, rice, maize, and \_\_\_\_\_ and millet, important in northern Nigeria for energy, protein, and iron.

### 1.3.2 Protein-rich foods in the Nigerian diet

Protein foods are essential for growth, tissue repair, and immune function, and are obtained from both animal and plant sources in the Nigerian diet. **Legumes**, including cowpeas (beans), groundnuts, and soybeans, are the most important plant protein sources in Nigeria and are widely consumed across all regions; cowpeas provide substantial protein (approximately 23 to 25 grams per 100 grams dry weight) and significant dietary fibre and iron.

Animal protein sources include **fish**, the most widely consumed animal protein in Nigeria, available fresh, smoked, and dried, and providing high-quality complete protein, omega-3 fatty acids, and important micronutrients including iodine, selenium, and zinc. **Meat and poultry** provide complete protein and are important sources of haem iron and zinc, while **eggs** are nutritionally dense, providing protein, fat, and a range of vitamins and minerals including vitamin A, choline, and selenium. **Dairy products** such as milk and fermented milk are important sources of calcium and protein, though dairy consumption is lower in southern Nigeria than in northern pastoral communities.

Fill in the blank: Protein-rich foods in the Nigerian diet include legumes (cowpeas, groundnuts, soybeans), fish (the most widely consumed animal protein), meat and poultry, eggs, and \_\_\_\_\_ products important for calcium.

### 1.3.3 Fruits, vegetables, fats, and oils

Fruits and vegetables are critical sources of **micronutrients** including vitamins A, C, and folate, and dietary fibre, and are protective against several non-communicable diseases. **Dark green leafy vegetables** such as ugu (fluted pumpkin leaf), bitter leaf, waterleaf, and moringa leaves are particularly rich in iron, calcium, folate, and pro-vitamin A carotenoids and are widely consumed in Nigerian soups and stews. Orange-fleshed fruits and vegetables such as **mango, pawpaw (papaya), orange, and carrot** are important sources of vitamin C and beta-carotene.



**Palm oil** is the dominant cooking fat in southern Nigeria and is uniquely rich in **beta-carotene** (conferring its orange-red colour) and vitamin E, making it an important dietary source of these micronutrients; however, its high saturated fat content is a concern when consumed in large quantities. **Groundnut oil** is widely used in northern Nigeria and provides predominantly unsaturated fats. **Coconut and shea butter** are also used in some regions, each with distinct fatty acid profiles and nutritional implications.

Fill in the blank: Dark green leafy vegetables such as ugu and moringa are rich in iron, calcium, and pro-vitamin A; palm oil provides beta-carotene and vitamin E but contains high \_\_\_\_\_ fat, while groundnut oil provides predominantly unsaturated fats.

| <u>Food Group &amp; Item</u>                           | <u>Nutritional Value</u>                |
|--------------------------------------------------------|-----------------------------------------|
| <b>Carbohydrate Staples – Cassava</b>                  | Energy, low protein                     |
| <b>Carbohydrate Staples – Yam</b>                      | Energy, potassium, B vitamins           |
| <b>Carbohydrate Staples – Rice</b>                     | Energy, low micronutrients              |
| <b>Carbohydrate Staples – Maize</b>                    | Energy, niacin                          |
| <b>Carbohydrate Staples – Sorghum &amp; Millet</b>     | Energy, protein, iron                   |
| <b>Protein Foods – Cowpeas</b>                         | Protein, fibre, iron                    |
| <b>Protein Foods – Groundnuts</b>                      | Protein, fat, niacin                    |
| <b>Protein Foods – Fish</b>                            | Complete protein, omega-3, iodine       |
| <b>Protein Foods – Eggs</b>                            | Protein, vitamin A, choline             |
| <b>Protein Foods – Dairy</b>                           | Protein, calcium                        |
| <b>Fruits/Vegetables/Fats/Oils – Dark Green Leaves</b> | Iron, calcium, folate, pro-vitamin A    |
| <b>Fruits/Vegetables/Fats/Oils – Orange Fruits</b>     | Vitamin C, beta-carotene                |
| <b>Fruits/Vegetables/Fats/Oils – Palm Oil</b>          | Beta-carotene, vitamin E, saturated fat |
| <b>Fruits/Vegetables/Fats/Oils – Groundnut Oil</b>     | Unsaturated fat                         |

Table 1.2: Nutritional values of common Nigerian foodstuffs across the main food groups

### Pilot questions 1.3



1. Name three Nigerian staple carbohydrate foods and describe the nutritional strength or limitation of each. (Linked to SLO 1.3)
2. Explain why dietary diversity is particularly important when cassava is the primary dietary staple. (Linked to SLO 1.3)
3. List the most important plant and animal protein sources in the Nigerian diet and state the nutritional value of each. (Linked to SLO 1.3)
4. Describe the micronutrient value of dark green leafy vegetables commonly consumed in Nigeria. (Linked to SLO 1.3)
5. Compare the nutritional properties of palm oil and groundnut oil. (Linked to SLO 1.3)



## Series Summary

This Series introduced public health nutrition as the population-level application of nutrition science, distinguished from clinical nutrition by its focus on prevention, policy, and community action. The scope of public health nutrition encompasses surveillance, education, policy, programme planning, and intersectoral coordination, and its importance in Nigeria is underscored by the double burden of malnutrition, which combines widespread undernutrition including stunting, wasting, and micronutrient deficiencies in children and women with a rapidly growing burden of overnutrition and diet-related non-communicable diseases in urban populations. The Series then examined the relationship between diet, the habitual food and drink consumed, and nutrition, the biological processes of digestion, absorption, and utilisation; the six classes of nutrients were described along with their functions: carbohydrates (energy), proteins (growth and repair), fats and oils (concentrated energy and fat-soluble vitamin absorption), vitamins (metabolic regulation), minerals (structural and regulatory functions), and water (universal metabolic medium).

Diet quality is determined by dietary diversity across food groups and adequacy of intake relative to recommended dietary allowances, with greater diversity reducing the risk of both deficiency and excess. The Series concluded with the nutritional values of common Nigerian foodstuffs: staple carbohydrates including cassava, yam, rice, maize, and sorghum provide energy but vary widely in micronutrient content; legumes, particularly cowpeas and groundnuts, and fish as the dominant animal protein source, alongside meat, eggs, and dairy, provide essential protein and micronutrients; and dark green leafy vegetables such as ugu and moringa supply iron, calcium, and pro-vitamin A, while palm oil contributes beta-carotene and vitamin E despite its high saturated fat content.

## Glossary of Terms

- **Public health nutrition:** the application of nutrition science to the promotion and maintenance of population health through prevention, policy, and community action.



- **Diet:** the total sum of food and drink habitually consumed by an individual or group, characterised by types, amounts, and patterns of food intake.
- **Nutrition:** the biological processes by which food substances are digested, absorbed, transported, metabolised, and utilised to support growth, maintenance, and bodily function.
- **Double burden of malnutrition:** the coexistence of undernutrition (stunting, wasting, micronutrient deficiency) and overnutrition (obesity, diet-related non-communicable diseases) within the same population.
- **Stunting:** low height-for-age indicating chronic undernutrition during childhood.
- **Wasting:** low weight-for-height indicating acute undernutrition.
- **Nutrient:** a chemical substance obtained from food that the body requires to function properly, classified into carbohydrates, proteins, fats, vitamins, minerals, and water.
- **Recommended dietary allowance (RDA):** the average daily intake level sufficient to meet the nutrient requirements of nearly all healthy individuals in a given age and sex group.
- **Dietary diversity:** the consumption of foods from a variety of food groups, used as a practical proxy for diet quality and nutritional adequacy.
- **Micronutrient:** a vitamin or mineral required in small amounts in the diet, whose deficiency causes specific diseases such as iron-deficiency anaemia or vitamin A deficiency.
- **Beta-carotene:** a pro-vitamin A carotenoid found in orange-fleshed fruits and vegetables and in palm oil, converted in the body to vitamin A.





## Concept Check Questions [Series 1]

### Objective Questions

1. Public health nutrition applies nutrition science at the \_\_\_\_\_ level, focusing on prevention, policy, and community action. (Linked to SLO 1.1)
2. Nigeria faces a double burden of malnutrition, combining undernutrition with a growing burden of \_\_\_\_\_ and diet-related non-communicable diseases. (Linked to SLO 1.1)
3. Diet refers to habitual food and drink consumed, while nutrition refers to the biological \_\_\_\_\_ by which food substances are digested and utilised. (Linked to SLO 1.2)
4. The six classes of nutrients are carbohydrates, proteins, fats and oils, vitamins, minerals, and \_\_\_\_\_. (Linked to SLO 1.2)
5. \_\_\_\_\_ is the most widely consumed staple in Nigeria, processed into garri and fufu, providing mainly carbohydrate energy. (Linked to SLO 1.3)
6. Dark green leafy vegetables such as ugu and moringa are rich in iron, calcium, and pro-vitamin A; palm oil provides beta-carotene and vitamin E but has high \_\_\_\_\_ fat content. (Linked to SLO 1.3)

### Short-Answer Questions

7. Explain the double burden of malnutrition in Nigeria. (Linked to SLO 1.1)
8. List the six classes of nutrients and state the primary function of each. (Linked to SLO 1.2)
9. Compare the nutritional values of cassava and cowpeas in the Nigerian diet. (Linked to SLO 1.3)

### Long-Answer Questions

10. Define public health nutrition and describe its scope and importance in the Nigerian context. (Linked to SLO 1.1)
11. Discuss the relationship between diet and nutrition, including the classes of nutrients and the concept of dietary adequacy. (Linked to SLO 1.2)

## Answers to Concept Check Questions [Series 1]

### Objective Questions

1. Population.



2. Overnutrition.
3. Process.
4. Water.
5. Cassava.
6. Saturated.

### Short-Answer Questions

7. Nigeria's double burden of malnutrition means the country simultaneously faces widespread undernutrition, particularly stunting, wasting, and micronutrient deficiencies among children and women, and a rapidly growing burden of overnutrition and diet-related non-communicable diseases such as obesity and diabetes, particularly in urban populations.
8. Carbohydrates: primary energy source. Proteins: growth, repair, enzymes, hormones, immune proteins. Fats and oils: concentrated energy, fat-soluble vitamin absorption, cell membrane structure. Vitamins: regulation of metabolic processes, immune function. Minerals: structural and regulatory functions. Water: universal medium for all metabolic reactions.
9. Cassava is primarily a source of carbohydrate energy but is low in protein, vitamins, and minerals, making dietary diversity essential when it is the dietary base. Cowpeas are a rich plant protein source providing approximately 23 to 25 grams protein per 100 grams dry weight, plus dietary fibre and iron, making them nutritionally complementary to cassava in the Nigerian diet.

### Long-Answer Questions

10. **Basic response:** Definition: application of nutrition science to population health promotion and disease prevention through policy and community action; distinct from clinical nutrition by population-level focus. Scope: surveillance and assessment; nutrition education and counselling; food and nutrition policy; programme planning and evaluation; intersectoral coordination with agriculture, education, social protection. Importance in Nigeria: double burden of malnutrition (undernutrition: stunting, wasting, micronutrient deficiencies in children and women; overnutrition: obesity, diabetes, cardiovascular disease in urban populations); nutrition problems shaped by poverty, food insecurity, cultural practices, and displacement of traditional foods by processed foods.

**Value-added response:** The double burden of malnutrition makes public health nutrition in Nigeria particularly complex and resource-demanding, as interventions must simultaneously address the complementary needs of reducing undernutrition through food access and education while preventing the rapid expansion of diet-related chronic disease through policies limiting



unhealthy food environments; a narrow focus on either problem alone will fail to address the full nutritional reality facing the Nigerian population.

11. **Basic response:** Diet: habitual food and drink consumed; characterised by type, amount, and pattern. Nutrition: biological processes of digestion, absorption, transport, metabolism, and utilisation. Relationship: diet is the external input; nutrition is the internal biological process. Six nutrient classes: carbohydrates (energy), proteins (growth, repair, immune function), fats and oils (concentrated energy, fat-soluble vitamins), vitamins (metabolic regulation, fat-soluble A/D/E/K and water-soluble B/C), minerals (structural: calcium in bones; regulatory: iron in haemoglobin, iodine in thyroid), water (all metabolic reactions). Dietary adequacy: meeting all nutrient requirements without excess; measured against RDA; promoted through dietary diversity across food groups.

**Value-added response:** The distinction between diet and nutrition matters practically because a diet can appear adequate in quantity while being deficient in quality; energy intake may be sufficient while protein, vitamin, or mineral intake falls below requirements, resulting in the hidden hunger of micronutrient deficiency that affects millions of Nigerians whose diets are calorie-sufficient but nutritionally poor, illustrating why both quantity and quality of dietary intake must be assessed together in public health nutrition surveys.

## Answers to Pilot Questions [Series 1]

### Part 1.1

1. Public health nutrition is the application of nutrition science to the promotion and maintenance of population health through prevention, policy, and community action. It differs from clinical nutrition in its population-level perspective rather than individual patient focus.
2. The scope includes nutrition surveillance and assessment, nutrition education and counselling, food and nutrition policy development, programme planning and evaluation, and intersectoral coordination with agriculture, education, and social protection.
3. The double burden of malnutrition means Nigeria simultaneously faces widespread undernutrition including stunting, wasting, and micronutrient deficiencies in children and women, alongside a growing burden of overnutrition and diet-related non-communicable diseases such as obesity and diabetes in urban populations.



4. Three factors are poverty limiting access to diverse nutritious food, traditional food practices being displaced by processed and fast foods in urban areas, and food insecurity due to agricultural and distribution challenges.
5. Three common forms are stunting (low height-for-age indicating chronic undernutrition), wasting (low weight-for-height indicating acute undernutrition), and micronutrient deficiencies such as iron-deficiency anaemia, vitamin A deficiency, and iodine deficiency disorders.

### Part 1.2

1. Diet refers to the total sum of food and drink habitually consumed, while nutrition refers to the biological processes by which food substances are digested, absorbed, metabolised, and utilised to support growth, maintenance, and energy.
2. Carbohydrates: primary energy. Proteins: growth, repair, enzymes, hormones, immune proteins. Fats and oils: concentrated energy, fat-soluble vitamin absorption, cell membranes. Vitamins: metabolic regulation, immune function. Minerals: structural (calcium in bones) and regulatory (iron in haemoglobin). Water: essential for all metabolic reactions.
3. Fat-soluble vitamins (A, D, E, K) are stored in body fat and liver and absorbed with dietary fat; deficiency develops slowly. Water-soluble vitamins (B group and C) are not stored in significant quantities and must be consumed regularly; excess is excreted in urine.
4. A nutritionally adequate diet meets the body's requirements for energy and all essential nutrients, is not excessive in any nutrient to the extent of causing harm, and is sufficiently diverse to reduce the risk of both deficiency and toxicity.
5. Dietary diversity is used as a proxy because a diet drawn from many different food groups is more likely to provide the full range of required nutrients than one relying on a narrow range of foods; no single food provides all nutrients in required amounts.

### Part 1.3

1. Cassava: mainly carbohydrate energy, low in protein and micronutrients. Yam: carbohydrate energy, better source of potassium and B vitamins than cassava. Sorghum and millet: energy, protein, and significant iron content relative to other cereals.
2. Dietary diversity is particularly important when cassava is the staple because cassava is low in protein, vitamins, and minerals; without diverse complementary foods, the diet will be deficient in the nutrients cassava cannot provide.
3. Plant proteins: cowpeas (approximately 23 to 25 grams protein per 100 grams, fibre, iron), groundnuts (protein, fat, niacin), soybeans (high protein and fat). Animal proteins: fish (complete



protein, omega-3 fatty acids, iodine, selenium), meat and poultry (complete protein, haem iron, zinc), eggs (protein, vitamins A and choline), dairy (protein, calcium).

4. Dark green leafy vegetables such as ugu, bitter leaf, waterleaf, and moringa are rich in iron, calcium, folate, and pro-vitamin A carotenoids, making them important for preventing anaemia, supporting bone health, preventing neural tube defects, and combating vitamin A deficiency.
5. Palm oil is rich in beta-carotene and vitamin E, making it an important micronutrient source, but has high saturated fat content that is a concern in large quantities. Groundnut oil provides predominantly unsaturated fats, making it a healthier fat choice for cardiovascular health but lacking the micronutrient richness of palm oil.

## References and Attributions [Series 1]

### Textual References

- World Health Organization. (2020). Healthy Diet: Key Facts. Geneva: WHO.
- Federal Ministry of Health Nigeria. (2018). National Strategic Plan of Action for Nutrition 2018 to 2022. Abuja: FMOH.
- Ene-Obong, H. N. (2001). Eating Right: A Nutrition Handbook for the People of Nigeria. Enugu: Chuka Educational Publishers.
- Park, K. (2017). Park's Textbook of Preventive and Social Medicine (24th ed.). Jabalpur: Banarsidas Bhanot.

### Figures, Plates, Tables, and Boxes

- Figure 1.1: Scope of public health nutrition and the double burden of malnutrition in Nigeria. AI generation prompt: "Create a clean two-section diagram titled Public Health Nutrition: Scope and Community Context. Left section: a radial diagram with Public Health Nutrition at the centre connected to five bubbles: Nutrition Surveillance and Assessment, Nutrition Education and Counselling, Food and Nutrition Policy, Programme Planning and Evaluation, Intersectoral Coordination. Right section: a double burden infographic showing two columns labelled Undernutrition (stunting, wasting, micronutrient deficiencies icons) and Overnutrition (obesity, diabetes, cardiovascular disease icons); clean professional infographic style." Suggested OER search string: "public health nutrition scope double burden malnutrition Nigeria diagram".



- Table 1.1: The six classes of nutrients, their functions, and Nigerian food examples. AI generation prompt: "Create a clean two-column table titled The Six Classes of Nutrients: Functions and Nigerian Food Examples; six rows: Carbohydrates, Proteins, Fats and Oils, Vitamins, Minerals, Water; each with primary function and Nigerian food example; clean professional table design with alternating row shading." Suggested OER search string: "six classes nutrients functions table carbohydrates proteins vitamins minerals".
- Table 1.2: Nutritional values of common Nigerian foodstuffs across food groups. AI generation prompt: "Create a clean table titled Nutritional Values of Common Nigerian Foodstuffs, organised into three food group sections: Carbohydrate Staples, Protein Foods, and Fruits, Vegetables, Fats and Oils; each row lists a food with key nutritional values; clean professional table design." Suggested OER search string: "Nigerian foods nutritional values table food groups nutrients".



Course code: COM 405

Course title: Public Health Nutrition and Rehabilitation

Course credit load: 1 Unit

## **Series 2: Food Supply, Food Security, Nutritional Education, and Unbalanced Diet**

- **Part 2.1: Food Supply, Distribution, and the Food Chain**
  - Sub Part 2.1.1: Food supply and distribution systems
  - Sub Part 2.1.2: The food chain from production to consumption
  - Sub Part 2.1.3: Factors affecting food supply in Nigeria
- **Part 2.2: Food Security and Nutritional Education**
  - Sub Part 2.2.1: Defining and measuring food security
  - Sub Part 2.2.2: Food insecurity in Nigeria
  - Sub Part 2.2.3: Nutritional education: concept, principles, and methods
- **Part 2.3: Problems Associated with an Unbalanced Diet**
  - Sub Part 2.3.1: Protein-energy malnutrition
  - Sub Part 2.3.2: Micronutrient deficiency disorders
  - Sub Part 2.3.3: Overnutrition and diet-related non-communicable diseases





## Introduction

Food is not simply a biological requirement; its availability, distribution, and affordability are shaped by complex agricultural, economic, and political systems that determine whether individuals and communities can actually access sufficient, safe, and nutritious food.

Understanding these systems, from food production and supply through distribution chains to the households where food is consumed, is essential for any public health nutrition practitioner seeking to address malnutrition at the population level.

This Series examines food supply and distribution, the food chain, and the concept of food security, before turning to nutritional education as the primary tool for translating nutrition knowledge into improved dietary practices at the community level. It concludes with the major nutritional problems arising from dietary imbalance, including protein-energy malnutrition, micronutrient deficiency disorders, and the growing burden of overnutrition and diet-related non-communicable diseases.

Together these topics move from the systems level of food supply down to the community and individual level of dietary outcomes, connecting structural determinants of nutrition with the specific disease conditions they produce.

## Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 2.1** describe food supply and distribution systems, explain the food chain, and identify factors affecting food supply in Nigeria (Linked to Part 2.1),
- **SLO 2.2** define and measure food security, describe food insecurity in Nigeria, and explain the principles and methods of nutritional education (Linked to Part 2.2), and
- **SLO 2.3** enumerate and describe the major problems associated with an unbalanced diet, including protein-energy malnutrition, micronutrient deficiency disorders, and overnutrition (Linked to Part 2.3).



## 2.1 Food Supply, Distribution, and the Food Chain

### 2.1.1 Food supply and distribution systems

**Food supply** refers to the total quantity of food available for consumption within a defined population or area at a given time, determined by domestic production, imports, food stocks, and post-harvest losses. **Food distribution** refers to the processes through which food moves from points of production or import through storage, processing, and wholesale and retail trade to reach the final consumer.

In Nigeria, food distribution is characterised by a predominantly **informal market system** in which the majority of food is sold through open markets, roadside stalls, and itinerant traders rather than through formal retail chains. This informal system provides important flexibility and accessibility for low-income households but presents challenges for **food safety regulation**, quality control, and cold chain maintenance for perishable foods. Infrastructure deficits, particularly in rural road networks, power supply for refrigeration, and storage facilities, contribute significantly to post-harvest losses estimated at 30 to 40 percent of some perishable crops.

Fill in the blank: Food supply is determined by domestic production, imports, and stocks, minus post-harvest losses; food \_\_\_\_\_ moves food through storage, processing, and trade from production to the final consumer.

### 2.1.2 The food chain from production to consumption

The **food chain** describes the sequence of steps through which food passes from its origin in production to its ultimate consumption. It begins with **agricultural production**, encompassing crop cultivation, livestock rearing, and fisheries. This is followed by **post-harvest handling** including harvesting, threshing, drying, sorting, and initial storage at the farm or collection point, where the largest proportion of food losses in Nigeria occurs.



The chain continues through **processing and transformation** of raw foods into intermediate or final products, **storage and transportation** through wholesale and distribution networks, **retail and marketing** through formal and informal markets, and finally **household food preparation** and consumption. At each link in the chain, losses in quantity, quality, and nutritional value can occur; interventions must therefore address the entire chain rather than any single point in isolation.

Fill in the blank: The food chain progresses from agricultural production, through post-harvest handling, processing, storage and transportation, retail and marketing, to household food preparation and \_\_\_\_\_.

### 2.1.3 Factors affecting food supply in Nigeria

Multiple factors influence the adequacy and stability of food supply in Nigeria. Agricultural productivity is constrained by limited access to improved seeds and inputs, low mechanisation, land degradation, and the predominantly smallholder farming structure. Climate variability, including irregular rainfall, flooding, and drought, introduces significant year-to-year instability in food production.

**Security challenges** in key producing regions, particularly the north-east and Middle Belt, have disrupted agricultural activities and displaced farming communities. **Infrastructure deficits** in roads, storage, and processing facilities amplify food losses between farm and market. **Policy and governance factors**, including foreign exchange rates affecting input costs, import and export policies, and the effectiveness of agricultural support programmes, also significantly shape national food supply adequacy.

Fill in the blank: Factors affecting food supply in Nigeria include agricultural productivity constraints, climate variability, security challenges, infrastructure deficits, and \_\_\_\_\_ and governance factors including exchange rates and agricultural policies.





Figure 2.1: The food chain from agricultural production to household consumption, with loss points indicated at each stage

### Pilot questions 2.1

1. Define food supply and food distribution and explain the relationship between them. (Linked to SLO 2.1)
2. Describe the characteristic features of Nigeria's food distribution system. (Linked to SLO 2.1)
3. List the stages of the food chain from production to consumption. (Linked to SLO 2.1)
4. Explain at which stage the largest food losses occur in Nigeria and why. (Linked to SLO 2.1)
5. Identify three factors that constrain food supply in Nigeria. (Linked to SLO 2.1)



## 2.2 Food Security and Nutritional Education

### 2.2.1 Defining and measuring food security

**Food security** exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. This definition encompasses four dimensions: **availability** (sufficient food exists in the area), **access** (households can obtain adequate food through production or purchase), **utilisation** (the body can effectively use the food consumed, depending on health status and food preparation), and **stability** (access is maintained over time without risk of disruption).

Food security is measured at multiple levels. At the **national level**, food balance sheets estimate aggregate food availability. At the **household level**, tools such as the Household Food Insecurity Access Scale (HFIAS) assess the frequency and severity of access problems. At the **individual level**, dietary recall and food frequency questionnaires measure actual food intake, while anthropometric indicators such as height-for-age and weight-for-height capture nutritional outcomes at the child level.

Fill in the blank: Food security has four dimensions: availability, access, utilisation, and \_\_\_\_\_; measured at national, household, and individual levels using food balance sheets, HFIAS, and anthropometric indicators.

### 2.2.2 Food insecurity in Nigeria

Nigeria has significant levels of **food insecurity** despite being one of Africa's largest agricultural producers, reflecting the complex interplay of production constraints, distribution failures, income poverty, and conflict that prevents large segments of the population from reliably accessing adequate food. The north-east and north-west regions have some of the highest food insecurity rates, driven by security challenges and displacement of farming communities.

Food insecurity in Nigeria is both **chronic**, affecting poor households year-round due to insufficient income and assets, and **seasonal**, intensifying during the annual **hunger season** between harvests, typically May to August in the north, when food stocks are depleted before



new harvest arrives. Children under five and pregnant and lactating women bear the heaviest nutritional consequences, facing the greatest risk of acute malnutrition during food shortfalls.

Fill in the blank: Food insecurity in Nigeria is both chronic, affecting poor households year-round, and seasonal, intensifying during the \_\_\_\_\_ season between harvests when stocks are depleted.

### 2.2.3 Nutritional education: concept, principles, and methods

**Nutritional education** is a set of educational strategies, accompanied by environmental supports, designed to facilitate the voluntary adoption of food choices and dietary behaviours conducive to health and wellbeing. It is the primary tool through which public health nutrition seeks to translate nutrition knowledge into improved dietary practices at individual and community levels.

Effective nutritional education is guided by several principles: it must be **needs-based**, addressing specific dietary gaps of the target population; **culturally sensitive**, building on existing food practices rather than dismissing them; **practically feasible**, recommending changes achievable given available foods and income; and **multi-channel**, delivered through individual counselling, group education, community events, and mass media. Common methods include nutrition demonstrations, cooking sessions, flip charts, and radio and community announcements.

Fill in the blank: Effective nutritional education is needs-based, culturally sensitive, practically feasible, and \_\_\_\_\_-channel, delivered through individual counselling, group education, community events, and mass media.





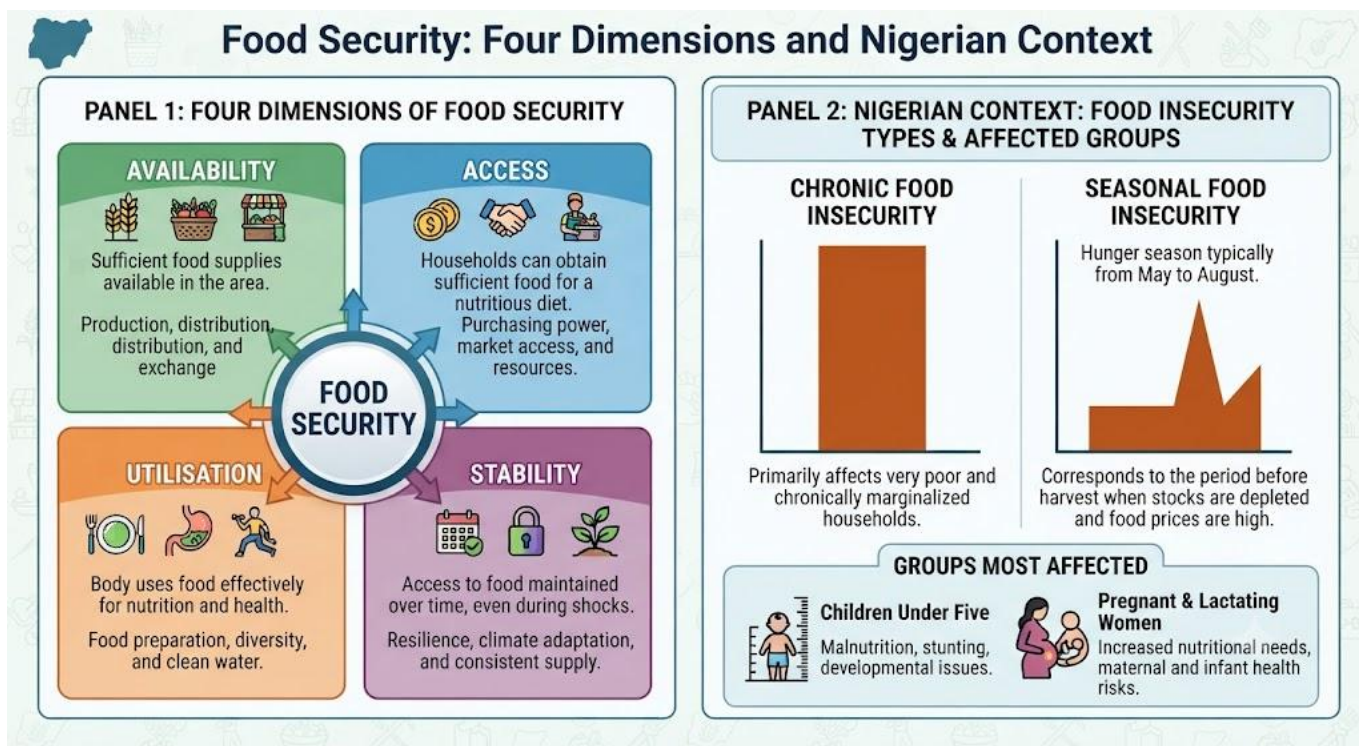


Figure 2.2: The four dimensions of food security and the nature of food insecurity in Nigeria

### Pilot questions 2.2

1. Define food security and describe its four dimensions. (Linked to SLO 2.2)
2. Explain the difference between chronic and seasonal food insecurity in Nigeria. (Linked to SLO 2.2)
3. Identify which groups bear the heaviest nutritional consequences of food insecurity. (Linked to SLO 2.2)
4. Define nutritional education and explain its purpose. (Linked to SLO 2.2)
5. Describe four principles that should guide effective nutritional education. (Linked to SLO 2.2)





## 2.3 Problems Associated with an Unbalanced Diet

### 2.3.1 Protein-energy malnutrition

**Protein-energy malnutrition (PEM)** covers a spectrum of conditions from inadequate protein and energy intake. **Kwashiorkor** results primarily from protein deficiency relative to energy intake and is characterised by oedema, depigmentation of skin and hair, distended abdomen due to fatty liver, irritability, and poor growth. **Marasmus** results from severe deficiency of both protein and energy, producing extreme wasting, absence of subcutaneous fat, and no oedema.

**Marasmic kwashiorkor** combines features of both conditions in the most severe clinical presentation. PEM predominantly affects children under five and is driven by inadequate dietary intake, early cessation of breastfeeding, poor complementary feeding, frequent infections that reduce intake and increase requirements, and household food insecurity. Untreated severe PEM carries a **high case fatality rate** and causes permanent impairment of physical and cognitive development in survivors.

Fill in the blank: PEM includes kwashiorkor (protein deficiency with oedema) and marasmus (severe protein-energy deficiency with extreme wasting); the combined form is called marasmic \_\_\_\_\_.

### 2.3.2 Micronutrient deficiency disorders

**Micronutrient deficiency disorders** arise when the diet fails to provide adequate amounts of specific vitamins or minerals. **Iron-deficiency anaemia** is the most prevalent micronutrient deficiency in Nigeria and globally, arising from inadequate iron intake, poor iron bioavailability from plant-based diets, or increased requirements in pregnancy and growth; it causes fatigue, reduced work capacity, impaired cognitive development, and increased maternal and infant mortality.

**Vitamin A deficiency** is a leading cause of preventable childhood blindness in Nigeria and also impairs immune function, increasing susceptibility to measles and diarrhoea. **Iodine deficiency disorders** include goitre, cretinism in children of severely iodine-deficient mothers, and



subclinical cognitive impairment affecting school performance. **Zinc deficiency** and **vitamin D deficiency** are also significant concerns, affecting immune function and bone health respectively.

Fill in the blank: Common micronutrient deficiency disorders in Nigeria include iron-deficiency anaemia, vitamin A deficiency causing childhood blindness, iodine deficiency causing goitre and \_\_\_\_\_, and zinc and vitamin D deficiencies.

### 2.3.3 Overnutrition and diet-related non-communicable diseases

**Overnutrition** arises when energy intake habitually exceeds expenditure, leading to accumulation of excess body fat and **overweight and obesity**, classified by BMI of 25 or above for overweight and 30 or above for obesity. Nigeria is experiencing rapid increases in overweight and obesity prevalence, particularly among urban women, driven by dietary transitions toward energy-dense processed foods, reduced physical activity, and socioeconomic changes associating larger body size with prosperity.

Overnutrition drives several **diet-related non-communicable diseases**. **Type 2 diabetes mellitus** results from insulin resistance associated with excess adiposity and high refined carbohydrate and sugar consumption. **Cardiovascular diseases**, including hypertension, coronary heart disease, and stroke, are associated with diets high in saturated fats, sodium, and refined carbohydrates. **Certain cancers**, particularly colorectal cancer, are linked to low dietary fibre and high processed meat consumption. These conditions now represent a growing proportion of Nigeria's disease burden.

Fill in the blank: Overnutrition causes overweight and obesity and drives diet-related NCDs including type 2 diabetes, cardiovascular diseases, and certain \_\_\_\_\_, all increasingly prevalent in urban Nigeria.

| <u><b>Undernutrition</b></u>                                   | <b>Adequate Balanced Diet</b>               | <u><b>Overnutrition</b></u>   |
|----------------------------------------------------------------|---------------------------------------------|-------------------------------|
| <b>Protein-Energy Malnutrition<br/>(kwashiorkor, marasmus)</b> | Ensures sufficient but not excessive intake | <b>Overweight and Obesity</b> |
| <b>Iron-Deficiency Anaemia</b>                                 | Provides balanced micronutrients            | <b>Type 2 Diabetes</b>        |



|                                      |                                   |                                |
|--------------------------------------|-----------------------------------|--------------------------------|
| <b>Vitamin A Deficiency</b>          | Supplies essential vitamins       | <b>Cardiovascular Diseases</b> |
| <b>Iodine Deficiency Disorders</b>   | Maintains thyroid health          | <b>Certain Cancers</b>         |
| <b>Zinc and Vitamin D Deficiency</b> | Supports immunity and bone health | —                              |

Table 2.1: Problems of an unbalanced diet, comparing conditions arising from undernutrition and overnutrition

### Pilot questions 2.3

1. Define protein-energy malnutrition and distinguish between kwashiorkor and marasmus. (Linked to SLO 2.3)
2. Describe the causes and consequences of iron-deficiency anaemia in Nigeria. (Linked to SLO 2.3)
3. Explain the public health consequences of vitamin A deficiency. (Linked to SLO 2.3)
4. Define overnutrition and explain how it leads to diet-related non-communicable diseases. (Linked to SLO 2.3)
5. Explain why urban populations in Nigeria are at increasing risk of overnutrition. (Linked to SLO 2.3)



## Series Summary

This Series examined the systems and conditions determining whether populations can access adequate nutritious food, and the consequences when they cannot. Food supply is determined by production, imports, and stocks minus losses, and reaches consumers through a food chain spanning production, post-harvest handling, processing, storage and transportation, retail, and household preparation, with losses at every stage. Nigeria's food distribution relies predominantly on informal markets, and food supply is constrained by agricultural productivity limitations, climate variability, security challenges, infrastructure deficits, and policy factors. Food security requires food to be available, accessible, utilised, and stable; Nigeria experiences both chronic food insecurity among poor households and seasonal insecurity during the hunger season, with children under five and pregnant and lactating women most severely affected. Nutritional education translates knowledge into dietary practice through needs-based, culturally sensitive, practically feasible, and multi-channel approaches.

An unbalanced diet produces a spectrum of nutritional problems. At the undernutrition end, protein-energy malnutrition manifests as kwashiorkor (protein deficiency with oedema), marasmus (severe protein-energy deficiency with extreme wasting), or the combined marasmic kwashiorkor, predominantly affecting young children; micronutrient deficiency disorders include iron-deficiency anaemia (causing fatigue and impaired development), vitamin A deficiency (causing blindness and increased infection susceptibility), and iodine deficiency disorders (causing goitre and cretinism). At the overnutrition end, excessive energy intake drives overweight and obesity and the associated non-communicable diseases of type 2 diabetes, cardiovascular disease, and certain cancers, all rapidly increasing in Nigeria's urban populations, completing the double burden picture introduced in the previous Series.

## Glossary of Terms

1. **Food supply:** the total quantity of food available for consumption within a population, determined by domestic production, imports, stocks, and post-harvest losses.



2. **Food chain:** the sequence of steps from agricultural production through post-harvest handling, processing, distribution, retail, and household preparation to consumption.
3. **Food security:** the condition in which all people at all times have physical, social, and economic access to sufficient, safe, and nutritious food meeting their dietary needs.
4. **Hunger season:** the period between harvests (typically May to August in northern Nigeria) when food stocks are depleted and food insecurity is most severe.
5. **Nutritional education:** educational strategies designed to facilitate voluntary adoption of food choices and dietary behaviours conducive to health and wellbeing.
6. **Protein-energy malnutrition (PEM):** a spectrum of conditions arising from inadequate protein and energy intake, including kwashiorkor, marasmus, and marasmic kwashiorkor.
7. **Kwashiorkor:** a form of PEM caused primarily by protein deficiency, characterised by oedema, skin and hair depigmentation, and distended abdomen.
8. **Marasmus:** a form of PEM caused by severe deficiency of both protein and energy, characterised by extreme wasting and absence of subcutaneous fat.
9. **Iron-deficiency anaemia:** the most prevalent micronutrient deficiency disorder, causing fatigue, reduced work capacity, impaired development, and increased maternal mortality.
10. **Iodine deficiency disorders:** conditions caused by inadequate iodine intake, including goitre, cretinism, and subclinical cognitive impairment.
11. **Non-communicable diseases (NCDs):** chronic diseases not transmitted between persons, including type 2 diabetes, cardiovascular diseases, and certain cancers, increasingly linked to overnutrition.



## Concept Check Questions [Series 2]

### Objective Questions

- Food \_\_\_\_\_ moves food from production through storage, processing, and trade to reach the final consumer. (Linked to SLO 2.1)
- Food security has four dimensions: availability, access, utilisation, and \_\_\_\_\_. (Linked to SLO 2.2)
- Food insecurity intensifies during the \_\_\_\_\_ season between harvests when food stocks are depleted. (Linked to SLO 2.2)
- Effective nutritional education is needs-based, culturally sensitive, practically feasible, and \_\_\_\_\_-channel. (Linked to SLO 2.2)
- Kwashiorkor is caused primarily by \_\_\_\_\_ deficiency and is characterised by oedema, while marasmus results from severe deficiency of both protein and energy. (Linked to SLO 2.3)
- The most prevalent micronutrient deficiency globally and in Nigeria is iron-deficiency \_\_\_\_\_. (Linked to SLO 2.3)

### Short-Answer Questions

- List the stages of the food chain from production to consumption. (Linked to SLO 2.1)
- Distinguish between chronic and seasonal food insecurity in Nigeria. (Linked to SLO 2.2)
- Distinguish between kwashiorkor and marasmus. (Linked to SLO 2.3)

### Long-Answer Questions

- Describe food security in Nigeria, including its dimensions, nature of insecurity, and groups most affected. (Linked to SLO 2.2)
- Enumerate and describe the major problems associated with an unbalanced diet, covering both undernutrition and overnutrition. (Linked to SLO 2.3)



## Answers to Concept Check Questions [Series 2]

### Objective Questions

1. Distribution.
2. Stability.
3. Hunger.
4. Multi.
5. Protein.
6. Anaemia.

### Short-Answer Questions

7. The stages are agricultural production, post-harvest handling, processing and transformation, storage and transportation, retail and marketing, and household preparation and consumption.
8. Chronic food insecurity affects poor households year-round due to insufficient income and assets to meet food needs. Seasonal food insecurity intensifies during the hunger season between harvests when stocks are depleted and new harvest has not yet arrived.
9. Kwashiorkor results primarily from protein deficiency and presents with oedema, skin and hair depigmentation, and distended abdomen. Marasmus results from severe deficiency of both protein and energy, presenting with extreme wasting, absent subcutaneous fat, and no oedema.

### Long-Answer Questions

10. **Basic response:** Food security: all people at all times have access to sufficient, safe, nutritious food. Four dimensions: availability (sufficient food exists), access (households can obtain it), utilisation (body effectively uses food), stability (access maintained over time). Nigerian insecurity: chronic (poor households year-round due to insufficient income) and seasonal (hunger season May to August, stocks depleted). Groups most affected: children under five (highest acute malnutrition risk), pregnant and lactating women (elevated requirements); north-east and north-west populations (conflict-driven displacement).





**Value-added response:** The paradox of food insecurity in a major agricultural producer like Nigeria reflects a systemic disconnect between production capacity and household access, driven by distribution failures, poverty, and conflict; addressing it requires action across the full food system from farm productivity through market infrastructure to household income support, rather than focusing narrowly on production alone.

11. **Basic response:** Undernutrition: PEM (kwashiorkor: protein deficiency, oedema, skin changes; marasmus: protein-energy deficiency, extreme wasting; marasmic kwashiorkor: combined, most severe; predominantly in children under five). Micronutrient deficiencies: iron-deficiency anaemia (fatigue, impaired development, maternal mortality); vitamin A deficiency (childhood blindness, increased infection susceptibility); iodine deficiency disorders (goitre, cretinism, cognitive impairment); zinc deficiency (immune function); vitamin D deficiency (bone health). Overnutrition: overweight and obesity (BMI above 25 and 30); diet-related NCDs: type 2 diabetes (adiposity, refined carbohydrates), cardiovascular disease (saturated fat, sodium), colorectal cancer (low fibre, processed meat); rapidly increasing in urban Nigeria.

**Value-added response:** The coexistence of severe undernutrition and rapidly growing overnutrition illustrates why single-problem framing of Nigeria's nutrition challenge is inadequate; interventions addressing only one burden risk worsening the other, making a comprehensive lifecycle-sensitive approach addressing both simultaneously the only viable long-term strategy.

## Answers to Pilot Questions [Series 2]

### Part 2.1

6. Food supply is the total food available, determined by production, imports, and stocks minus losses. Food distribution moves food from production through storage and markets to the consumer. Distribution determines whether adequate supply actually reaches households.



7. Nigeria's distribution is characterised by predominantly informal markets (open markets, roadside stalls, itinerant traders), limited cold chain and storage infrastructure, significant post-harvest losses, and variable food safety regulation.
8. The stages are agricultural production, post-harvest handling, processing and transformation, storage and transportation, retail and marketing, and household preparation and consumption.
9. The largest losses occur at the post-harvest handling stage because most Nigerian smallholder farmers lack adequate storage facilities, drying equipment, and transport access, causing spoilage and pest infestation before produce reaches market.
10. Three constraining factors are limited agricultural productivity due to poor input access and low mechanisation, infrastructure deficits in roads and storage, and security challenges in key producing regions disrupting farming activities.

## **Part 2.2**

11. Food security exists when all people at all times have access to sufficient, safe, and nutritious food. The four dimensions are availability (food exists in the area), access (households can obtain it), utilisation (the body can use it effectively), and stability (access maintained over time).
12. Chronic food insecurity affects poor households year-round due to insufficient income or assets. Seasonal food insecurity intensifies during the hunger season between harvests, typically May to August in northern Nigeria, when stocks are depleted before new harvest arrives.
13. Children under five face the highest risk of acute malnutrition during food shortfalls, and pregnant and lactating women are most vulnerable due to their elevated nutritional requirements.
14. Nutritional education is a set of educational strategies designed to facilitate voluntary adoption of dietary behaviours conducive to health; its purpose is to translate nutrition knowledge into improved dietary practices at individual and community levels.
15. Four principles are needs-based (addressing specific dietary gaps of the target population), culturally sensitive (building on existing food practices), practically feasible



(recommending changes achievable given available foods and income), and multi-channel (delivered through counselling, demonstrations, and media).

### Part 2.3

1. PEM covers conditions from inadequate protein and energy. Kwashiorkor results primarily from protein deficiency, presenting with oedema, skin and hair depigmentation, and distended abdomen. Marasmus results from severe deficiency of both protein and energy, presenting with extreme wasting, absent subcutaneous fat, and no oedema.
2. Iron-deficiency anaemia is caused by inadequate dietary iron intake, poor iron bioavailability from plant-based diets, or increased requirements in pregnancy and growth. Consequences include fatigue, reduced work and cognitive capacity, impaired child development, and increased maternal and infant mortality.
3. Vitamin A deficiency causes xerophthalmia, which may progress to irreversible blindness, and is a leading cause of preventable childhood blindness in Nigeria. It also impairs immune function, increasing susceptibility to and mortality from measles and diarrhoea.
4. Overnutrition is habitual energy intake exceeding expenditure, leading to excess body fat accumulation. It drives NCDs through insulin resistance causing type 2 diabetes, high saturated fat and sodium intake causing cardiovascular disease, and low fibre with high processed meat intake associated with colorectal cancer.
5. Urban populations are at increasing risk because dietary transitions in cities increase consumption of energy-dense processed and fast foods, sedentary occupations reduce physical activity, and socioeconomic changes associate larger body size with prosperity, reducing motivation to limit intake.



## References and Attributions [Series 2]

### Textual References

6. Food and Agriculture Organization of the United Nations. (2009). The State of Food Insecurity in the World. Rome: FAO.
7. Federal Ministry of Health Nigeria. (2018). National Strategic Plan of Action for Nutrition 2018 to 2022. Abuja: FMOH.
8. Park, K. (2017). Park's Textbook of Preventive and Social Medicine (24th ed.). Jabalpur: Banarsidas Bhanot.
9. Ene-Obong, H. N. (2001). Eating Right: A Nutrition Handbook for the People of Nigeria. Enugu: Chuka Educational Publishers.

### Figures, Plates, Tables, and Boxes

10. Figure 2.1: The Nigerian food chain from production to consumption. AI generation prompt: "Create a clean horizontal flow diagram titled The Nigerian Food Chain, with six boxes connected by arrows: Agricultural Production; Post-Harvest Handling; Processing and Transformation; Storage and Transportation; Retail and Marketing; Household Preparation and Consumption; add a downward Losses arrow beneath each box; clean professional infographic style." Suggested OER search string: "food chain production consumption Nigeria flow diagram food losses".
11. Figure 2.2: The four dimensions of food security and the nature of food insecurity in Nigeria. AI generation prompt: "Create a clean two-panel diagram: left panel shows four-quadrant food security dimensions (Availability, Access, Utilisation, Stability); right panel shows Chronic and Seasonal Food Insecurity with groups most affected noted; clean professional infographic style." Suggested OER search string: "food security four dimensions diagram chronic seasonal insecurity Nigeria".
12. Table 2.1: Problems of an unbalanced diet comparing undernutrition and overnutrition. AI generation prompt: "Create a clean two-column table titled Problems of an Unbalanced Diet; left Undernutrition (PEM, iron-deficiency anaemia, vitamin A deficiency, iodine deficiency, zinc deficiency); right Overnutrition (obesity, type 2 diabetes, cardiovascular disease, certain cancers); central dividing label Adequate



Balanced Diet; professional table design." Suggested OER search string: "malnutrition table undernutrition overnutrition comparison problems unbalanced diet".



**Course code: COM 405**

**Course title: Public Health Nutrition and Rehabilitation**

**Course credit load: 1 Unit**

## **Series 3: Nutrition and Health, Infection, Nutritional Disorders, and Food Policy**

- **Part 3.1: Nutrition and Health, and Infection and Nutrition**
  - Sub Part 3.1.1: The relationship between nutrition and health
  - Sub Part 3.1.2: The infection-malnutrition cycle
  - Sub Part 3.1.3: Nutrition in specific health conditions
- **Part 3.2: Epidemiology and Control of Common Nutritional Disorders in Nigeria**
  - Sub Part 3.2.1: Epidemiology of nutritional disorders in Nigeria
  - Sub Part 3.2.2: Common eating habits and family feeding patterns
  - Sub Part 3.2.3: Control strategies for nutritional disorders
- **Part 3.3: Food Policy, Hygiene, and Toxicology**
  - Sub Part 3.3.1: Food and nutrition policy in Nigeria
  - Sub Part 3.3.2: Food hygiene and safety
  - Sub Part 3.3.3: Food toxicology

### **Introduction**



The relationship between nutrition and health is bidirectional and dynamic: nutritional status profoundly influences the body's capacity to resist and recover from infection and disease, while infections in turn deplete nutritional reserves and worsen nutritional status. Understanding this interplay is essential for designing integrated health and nutrition programmes.

This Series examines the reciprocal relationship between nutrition and health, with particular attention to the infection-malnutrition cycle that drives much of the nutritional disease burden among Nigerian children. It then turns to the epidemiology and control of common nutritional disorders in Nigeria, examining how dietary patterns, eating habits, and family feeding practices shape nutritional outcomes. The Series concludes with food policy, food hygiene, and food toxicology.

Together these topics bridge the biological science of nutrition and its public health implications with the policy and regulatory frameworks needed to protect population nutritional health.

## **Series Learning Outcomes**

Upon completing this Series, you should be able to:

- **SLO 3.1** describe the relationship between nutrition and health, explain the infection-malnutrition cycle, and describe nutritional implications of specific health conditions (Linked to Part 3.1),
- **SLO 3.2** describe the epidemiology of nutritional disorders in Nigeria, analyse eating habits and feeding patterns, and describe control strategies (Linked to Part 3.2), and
- **SLO 3.3** describe food and nutrition policy in Nigeria, explain food hygiene principles, and define food toxicology and common food toxins (Linked to Part 3.3).

### **3.1 Nutrition and Health, and Infection and Nutrition**





### 3.1.1 The relationship between nutrition and health

Nutrition and health are intimately and bidirectionally related. Adequate nutrition supports **normal physical growth, immune system function, cognitive development**, reproductive health, and prevention of both deficiency diseases and chronic non-communicable conditions. Conversely, ill health directly impairs nutritional status by reducing food intake, impairing nutrient absorption, and increasing nutrient losses and requirements.

The concept of the **nutrition transition** is important in Nigeria: as economies develop and urbanise, populations shift from traditional diets high in complex carbohydrates and vegetables to diets high in refined carbohydrates, sugars, fats, and processed foods, contributing to rising obesity and diet-related chronic diseases alongside persistent undernutrition in the same population.

Fill in the blank: Nutrition and health are bidirectionally related; adequate nutrition supports growth, immunity, and cognitive development, while the \_\_\_\_\_ transition describes the dietary shift toward processed foods accompanying urbanisation.

### 3.1.2 The infection-malnutrition cycle

The relationship between infection and malnutrition is mutually reinforcing, creating a **vicious cycle** that is a major driver of childhood mortality in Nigeria. Infections worsen nutritional status by **reducing food intake** through anorexia and vomiting, **impairing nutrient absorption** by damaging intestinal mucosa, **increasing nutrient losses** through fever-driven metabolism, and **diverting nutrients** toward immune responses away from growth.

Conversely, malnutrition impairs immune defences: **protein deficiency** reduces antibody production; **vitamin A deficiency** compromises epithelial barriers and cell-mediated immunity; **zinc deficiency** impairs lymphocyte function. A malnourished child has increased susceptibility to infection and reduced recovery capacity, creating the downward spiral responsible for many cases of severe acute malnutrition in Nigerian children.



Fill in the blank: The infection-malnutrition cycle: infections reduce food intake, impair absorption, and increase losses, while malnutrition \_\_\_\_\_ immune defences, increasing both susceptibility and severity of infection.

### 3.1.3 Nutrition in specific health conditions

Nutritional needs differ across specific health conditions. **Tuberculosis** causes significant weight loss and muscle wasting, and adequate protein and energy support is an important component of management. People living with **HIV/AIDS** have increased energy and micronutrient requirements, reduced intake due to opportunistic infections and antiretroviral side effects, and heightened deficiency risk further compromising immunity.

**Maternal nutrition** during pregnancy and lactation requires increased energy, protein, iron, folate, iodine, and calcium to support foetal development and milk production. **Nutrition in the first 1000 days** from conception to age two has profound and irreversible effects on physical growth, brain development, immune function, and adult disease risk, making this the highest-priority window for nutrition interventions.

Fill in the blank: The first 1000 days from conception to age two is the highest-priority window for nutrition interventions, with deficiencies causing irreversible effects on growth, brain development, and adult \_\_\_\_\_ risk.



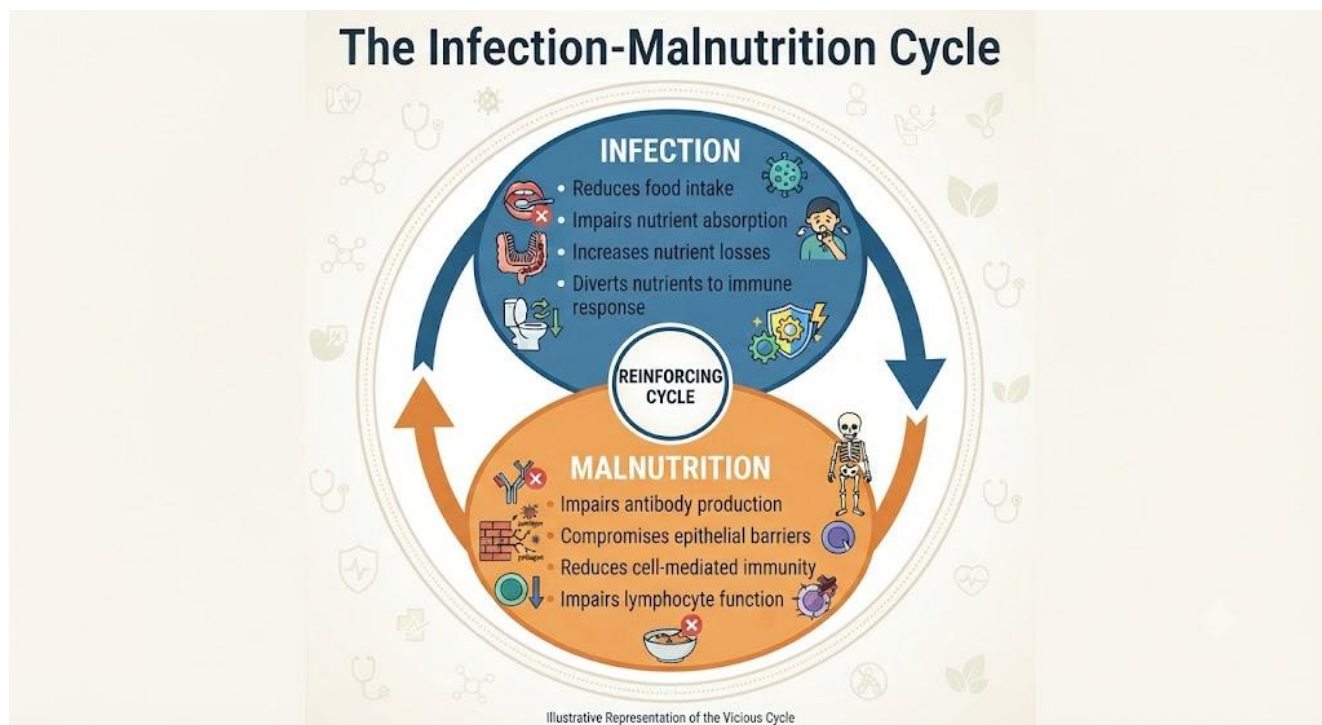


Figure 3.1: The infection-malnutrition cycle, showing how infection worsens nutritional status and malnutrition increases infection susceptibility

### Pilot questions 3.1

1. Explain the bidirectional relationship between nutrition and health. (Linked to SLO 3.1)
2. Define the nutrition transition and explain its relevance to Nigeria. (Linked to SLO 3.1)
3. Describe the mechanisms by which infection worsens nutritional status. (Linked to SLO 3.1)
4. Explain why malnutrition increases both susceptibility to and severity of infection. (Linked to SLO 3.1)
5. Explain why the first 1000 days is the highest-priority window for nutrition intervention. (Linked to SLO 3.1)



## 3.2 Epidemiology and Control of Common Nutritional Disorders in Nigeria

### 3.2.1 Epidemiology of nutritional disorders in Nigeria

The epidemiology of nutritional disorders in Nigeria shows a high and uneven burden. National surveys show high rates of **stunting** (approximately 37 percent of children under five nationally, highest in the north-west and north-east), **wasting** (approximately 7 to 10 percent nationally, with severe acute malnutrition in conflict zones), and **anaemia** (over 70 percent of under-fives in some surveys).

Geographical patterns reflect underlying determinants: the northern zones, with lower agricultural diversity, greater food insecurity, and lower maternal education, consistently show worse indicators. **Urban-rural disparities** are significant, with rural populations experiencing higher undernutrition rates while urban populations increasingly face both undernutrition among the poor and overnutrition among the more affluent.

Fill in the blank: Nigeria's nutritional disorder burden shows high stunting, wasting, and anaemia, with the north-west and north-east zones and \_\_\_\_\_ populations generally showing the worst indicators.

### 3.2.2 Common eating habits and family feeding patterns

Eating habits and family feeding patterns in Nigeria are shaped by cultural tradition, economic constraints, and changing food environments. Traditional Nigerian diets based on carbohydrate staples with soups containing vegetables, legumes, and protein foods can provide adequate nutrition when food is available and dietary diversity is maintained.

Several common patterns compromise nutritional outcomes. Early weaning and inadequate complementary feeding practices, including nutritionally poor weaning foods and insufficient feeding frequency, are major contributors to infant malnutrition. Intra-household food distribution prioritising adult males at the expense of women and young children contributes to higher malnutrition rates in these groups. Seasonal dietary restrictions and food taboos affecting pregnant and lactating women reduce dietary diversity at nutritionally critical periods.



Fill in the blank: Family feeding patterns compromising nutrition include early weaning, inadequate complementary feeding, intra-household distribution favouring adult males, and seasonal dietary \_\_\_\_\_ affecting pregnant and lactating women.

### 3.2.3 Control strategies for nutritional disorders

Control of nutritional disorders requires both **direct nutrition interventions** and **nutrition-sensitive approaches** across sectors. Direct interventions include micronutrient supplementation (iron-folic acid for pregnant women, vitamin A for children, iodised salt), therapeutic and supplementary feeding for acute malnutrition, and promotion of optimal infant and young child feeding practices.

Nutrition-sensitive approaches address underlying determinants through **social protection** increasing household food access, **agricultural interventions** promoting dietary diversity, **water and sanitation improvements** reducing infection burden, and **girls' education and women's empowerment** improving maternal feeding knowledge. Sustained malnutrition reduction requires coordinated action across all these dimensions simultaneously.

Fill in the blank: Nutritional disorder control combines direct interventions (supplementation, therapeutic feeding, IYCF) with nutrition-sensitive approaches including social protection, agricultural improvements, water and sanitation, and women's \_\_\_\_\_.

| <u><a href="#">Direct Interventions</a></u>                                       | <u><a href="#">Nutrition-Sensitive Approaches</a></u>                  |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------|
| <b>Micronutrient Supplementation (iron-folic acid, vitamin A, iodised salt)</b>   | <b>Social Protection</b> (household food access)                       |
| <b>Therapeutic &amp; Supplementary Feeding (management of acute malnutrition)</b> | <b>Agricultural Interventions</b> (dietary diversity)                  |
| <b>IYCF Promotion (exclusive breastfeeding, complementary feeding)</b>            | <b>Water &amp; Sanitation</b> (reducing infection)                     |
| —                                                                                 | <b>Girls' Education &amp; Women's Empowerment</b> (maternal knowledge) |



Table 3.1: Direct nutrition interventions and nutrition-sensitive approaches for controlling nutritional disorders in Nigeria

### Pilot questions 3.2

1. Describe the epidemiological distribution of nutritional disorders in Nigeria. (Linked to SLO 3.2)
2. Explain why northern zones of Nigeria consistently show worse nutritional indicators. (Linked to SLO 3.2)
3. Describe three eating habits or family feeding patterns compromising nutrition in Nigerian communities. (Linked to SLO 3.2)
4. Describe three direct nutrition interventions for controlling nutritional disorders in Nigeria. (Linked to SLO 3.2)
5. Explain why nutrition-sensitive approaches are essential alongside direct nutrition interventions. (Linked to SLO 3.2)

## 3.3 Food Policy, Hygiene, and Toxicology

### 3.3.1 Food and nutrition policy in Nigeria

**Food and nutrition policy** provides the governmental framework guiding the food system toward adequate nutrition and food security. Nigeria's primary instrument is the **National Food and Nutrition Policy**, setting nutritional goals and specifying ministerial roles, complemented by the **National Strategic Plan of Action for Nutrition**, which translates objectives into time-bound costed programmes.

Key policy elements include **food fortification regulations** requiring addition of vitamin A to cooking oil, iron and folic acid to flour, and iodine to salt. **Infant formula marketing regulations** based on the International Code of Marketing of Breast-milk Substitutes protect breastfeeding from commercial undermining. **Agricultural policies** promoting dietary diversity



and stable food supply are integral components of the broader food and nutrition policy framework.

Fill in the blank: Nigeria's food and nutrition policy includes the National Food and Nutrition Policy and the Strategic Plan; key elements include food \_\_\_\_\_ adding vitamins to staples and infant formula marketing restrictions.

### 3.3.2 Food hygiene and safety

**Food hygiene** refers to conditions ensuring the safety and suitability of food at all food chain stages. **Food contamination** may be biological (bacteria, viruses, parasites), chemical (pesticide residues, heavy metals), or physical (foreign bodies) at any point from farm to consumer.

The **WHO Five Keys to Safer Food** provide practical guidance: keep food clean, separate raw and cooked foods to prevent cross-contamination, cook food thoroughly to kill pathogens, keep food at safe temperatures (below 5 degrees Celsius or above 60 degrees Celsius), and use safe water and raw materials. In Nigeria, **foodborne illness** from contaminated food significantly burdens communities, with diarrhoeal disease worsening child nutritional status and directly linking food safety to the infection-malnutrition cycle.

Fill in the blank: The WHO Five Keys to Safer Food include keeping food clean, separating raw and cooked foods, cooking thoroughly, keeping food at safe temperatures, and using safe \_\_\_\_\_ and raw materials.

### 3.3.3 Food toxicology

**Food toxicology** studies harmful substances in food, their mechanisms of harm, toxic doses, and exposure control measures. **Natural toxins** include cyanogenic glycosides in raw cassava (releasing hydrogen cyanide if inadequately processed) and solanine in unripe potatoes.

**Aflatoxins**, produced by *Aspergillus* moulds on improperly stored groundnuts and maize, are potent liver carcinogens of major Nigerian public health concern.

Aflatoxin contamination is particularly problematic in Nigeria because **high humidity and poor storage** create ideal conditions for mould growth, and chronic low-level exposure is associated





with childhood growth faltering, impaired immune function, and liver cancer. **Pesticide residues** and **heavy metal contamination** from industrial and artisanal mining activities are additional concerns. Reducing exposure requires improved storage, appropriate processing, and regulatory monitoring of the food supply.

Fill in the blank: Common food toxins in Nigeria include aflatoxins on stored groundnuts and maize, cyanogenic glycosides in inadequately processed cassava, and \_\_\_\_\_ residues from agricultural chemicals.

| <u>Toxin</u>                 | <u>Source and Context</u>                                                                         | <u>Control Measures</u>                |
|------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|
| <b>Aflatoxins</b>            | <i>Aspergillus</i> mould on stored groundnuts and maize; causes liver cancer and growth faltering | Improved storage and monitoring        |
| <b>Cyanogenic Glycosides</b> | Raw cassava; cyanide release                                                                      | Peeling, soaking, fermenting, cooking  |
| <b>Pesticide Residues</b>    | Agricultural chemicals                                                                            | Regulatory monitoring, washing produce |
| <b>Heavy Metals</b>          | Mining contamination                                                                              | Environmental regulation, monitoring   |

Table 3.2: Common food toxins in Nigeria, their sources, mechanisms of harm, and control measures

### Pilot questions 3.3

1. Define food and nutrition policy and identify two key documents governing it in Nigeria. (Linked to SLO 3.3)
2. Explain what food fortification is and give three examples from Nigeria. (Linked to SLO 3.3)
3. Define food hygiene and list the WHO Five Keys to Safer Food. (Linked to SLO 3.3)
4. Define food toxicology and describe the public health significance of aflatoxins in Nigeria. (Linked to SLO 3.3)



5. Explain how inadequate cassava processing creates a food toxicology hazard and how it is eliminated. (Linked to SLO 3.3)



## Series Summary

This Series examined the interplay between nutrition, health, infection, and the policy frameworks governing food safety. Nutrition and health are bidirectionally related, with adequate nutrition supporting growth, immunity, and cognitive development while ill health impairs nutritional status. The infection-malnutrition cycle describes the mutually reinforcing relationship in which infections worsen nutritional status and malnutrition impairs immune defences; the first 1000 days from conception to age two is the highest-priority intervention window. Nutritional disorder epidemiology shows high stunting, wasting, and anaemia concentrated in northern zones and rural populations, shaped by inadequate complementary feeding, intra-household food distribution disparities, and food taboos affecting women. Control requires direct interventions including micronutrient supplementation, therapeutic feeding, and IYCF promotion, combined with nutrition-sensitive approaches spanning social protection, agricultural diversity, water and sanitation, and women's empowerment.

Nigeria's food and nutrition policy is anchored by the National Food and Nutrition Policy and the National Strategic Plan of Action for Nutrition, with food fortification and infant formula marketing restrictions as key regulatory elements. Food hygiene principles, the WHO Five Keys to Safer Food, protect against biological, chemical, and physical contamination throughout the food chain. Food toxicology addresses hazards including aflatoxins from *Aspergillus* mould on poorly stored groundnuts and maize, cyanogenic glycosides in inadequately processed cassava, and pesticide residues, all of which are managed through improved storage, processing, and regulatory monitoring, completing the comprehensive public health nutrition framework for protecting Nigerian population health.

## Glossary of Terms

1. **Nutrition transition:** the dietary shift from traditional diets toward diets high in refined carbohydrates, sugars, fats, and processed foods, accompanying urbanisation and economic development.



2. **Infection-malnutrition cycle:** the mutually reinforcing relationship in which infections worsen nutritional status and malnutrition impairs immune defences, increasing susceptibility to further infection.
3. **First 1000 days:** the period from conception to age two, the highest-priority window for nutrition intervention due to irreversible developmental effects of nutritional deficiencies.
4. **Therapeutic feeding:** the management of severe acute malnutrition using therapeutic foods and medical protocols in community or clinical settings.
5. **Infant and young child feeding (IYCF):** recommended practices including exclusive breastfeeding for six months and appropriate complementary feeding from six months to age two.
6. **Food and nutrition policy:** the governmental framework of objectives, strategies, and regulations guiding the food system toward adequate nutrition and food security.
7. **Food fortification:** the deliberate addition of micronutrients to commonly consumed staple foods to prevent deficiency disorders at the population level.
8. **Food hygiene:** the conditions and measures ensuring the safety and suitability of food at all stages from production to consumption.
9. **WHO Five Keys to Safer Food:** practical food safety principles: keep clean, separate raw and cooked, cook thoroughly, keep at safe temperatures, and use safe water and raw materials.
10. **Food toxicology:** the study of harmful substances in food, their mechanisms of harm, toxic doses, and measures to limit human exposure.
11. **Aflatoxins:** potent carcinogenic mycotoxins produced by *Aspergillus* moulds on improperly stored groundnuts and maize, causing liver cancer and growth faltering in Nigeria.



## Concept Check Questions [Series 3]

### Objective Questions

- The nutrition \_\_\_\_\_ describes the shift from traditional diets to high refined carbohydrate and processed food diets, accompanying urbanisation. (Linked to SLO 3.1)
- The infection-malnutrition cycle is reinforced by infections worsening nutritional status while malnutrition \_\_\_\_\_ immune defences. (Linked to SLO 3.1)
- The first \_\_\_\_\_ days from conception to age two is the highest-priority period for nutrition intervention. (Linked to SLO 3.1)
- Nigeria's nutritional disorder burden is highest in the north-west and north-east zones and among \_\_\_\_\_ populations. (Linked to SLO 3.2)
- Food \_\_\_\_\_ adds micronutrients such as vitamin A, iron, and iodine to staple foods as a population-wide strategy. (Linked to SLO 3.3)
- \_\_\_\_\_ are mycotoxins produced by *Aspergillus* mould on stored groundnuts and maize, associated with liver cancer in Nigeria. (Linked to SLO 3.3)

### Short-Answer Questions

- Describe the mechanisms by which infection worsens nutritional status. (Linked to SLO 3.1)
- Describe three eating habits or feeding patterns contributing to malnutrition in Nigerian communities. (Linked to SLO 3.2)
- List the WHO Five Keys to Safer Food. (Linked to SLO 3.3)

### Long-Answer Questions

- Explain the infection-malnutrition cycle and describe how it drives childhood malnutrition in Nigeria. (Linked to SLO 3.1)
- Describe the epidemiology and control of common nutritional disorders in Nigeria. (Linked to SLO 3.2)



## Answers to Concept Check Questions [Series 3]

### Objective Questions

1. Transition.
2. Impairs.
3. 1000.
4. Rural.
5. Fortification.
6. Aflatoxins.

### Short-Answer Questions

7. Infections worsen nutritional status by reducing food intake through anorexia and vomiting, impairing nutrient absorption by damaging intestinal mucosa, increasing losses through fever-driven metabolic demands, and diverting nutrients toward acute phase immune responses away from growth.
8. Three patterns are early weaning and inadequate complementary feeding using nutritionally poor weaning foods, intra-household food distribution prioritising adult males at the expense of women and children, and seasonal dietary restrictions and food taboos reducing dietary diversity in pregnant and lactating women.
9. The Five Keys are keep food clean, separate raw and cooked foods, cook food thoroughly, keep food at safe temperatures, and use safe water and raw materials.

### Long-Answer Questions

10. **Basic response:** Cycle mechanisms: infections worsen nutritional status (reduced intake through anorexia and vomiting, impaired absorption from mucosal damage, increased losses through fever, nutrients diverted to immune response). Malnutrition impairs immunity (reduced antibody production from protein deficiency, compromised epithelial barriers from vitamin A deficiency, impaired lymphocyte function from zinc deficiency). Result: malnourished children have increased susceptibility and reduced recovery, creating downward spiral. Nigerian context: diarrhoeal diseases, malaria, respiratory infections, and measles are major drivers, most dangerous for under-fives in high food insecurity and poor WASH settings.



**Value-added response:** The infection-malnutrition cycle is particularly important in Nigeria because many component infections are preventable through vaccination, safe water, sanitation, and hygiene; investments in WASH and immunisation simultaneously reduce infection burden and break the cycle from both ends, so addressing malnutrition without tackling infection drivers will always produce incomplete results.

11. **Basic response:** Epidemiology: stunting approximately 37 percent nationally (highest north-west and north-east); wasting 7 to 10 percent nationally, severe acute malnutrition in conflict zones; anaemia over 70 percent in under-fives in some surveys; rural worse than urban for undernutrition. Determinants: lower agricultural diversity in north, food insecurity, low maternal education, early marriage, security challenges. Eating habits: early weaning, inadequate complementary feeding, intra-household distribution disparities, food taboos in women. Control direct: micronutrient supplementation, therapeutic and supplementary feeding, IYCF promotion. Control nutrition-sensitive: social protection, agricultural interventions, water and sanitation, girls' education and women's empowerment.

**Value-added response:** Persistent high stunting rates despite decades of programmes reflect the inadequacy of narrow nutrition-specific interventions against deep structural determinants including poverty, gender inequality, and food system failures; sustainable reduction requires multi-sectoral action addressing root causes rather than treating malnutrition as only a medical or dietary problem.

## Answers to Pilot Questions [Series 3]

### Part 3.1

6. Adequate nutrition supports physical growth, immune function, cognitive development, reproductive health, and chronic disease prevention; conversely, ill health impairs nutritional status by reducing food intake, impairing absorption, increasing losses and requirements, and diverting nutrients to immune responses.
7. The nutrition transition is the dietary shift from traditional diets to diets high in refined carbohydrates, sugars, fats, and processed foods accompanying urbanisation; in Nigeria it





is driving rising obesity and diet-related NCDs in urban populations alongside persistent undernutrition.

8. Infections worsen nutritional status by reducing food intake through anorexia and vomiting, impairing nutrient absorption by damaging intestinal mucosa, increasing losses through fever-driven metabolic demands, and diverting nutrients toward acute phase immune responses.
9. Malnutrition impairs immune defences by reducing antibody production (protein deficiency), compromising epithelial barrier integrity (vitamin A deficiency), and impairing lymphocyte function (zinc deficiency), increasing both susceptibility to infection and reducing recovery capacity.
10. The first 1000 days is the highest priority because deficiencies during this period cause irreversible damage to physical growth, brain development, immune function, and adult disease risk; interventions after this window cannot fully correct developmental damage from early malnutrition.

### **Part 3.2**

11. Stunting approximately 37 percent nationally (highest in north-west and north-east), wasting 7 to 10 percent with severe cases in conflict zones, anaemia over 70 percent in under-fives in some surveys; rural populations and northern zones consistently show worse indicators.
12. Northern zones show worse indicators due to lower agricultural diversity limiting dietary variety, greater food insecurity, lower maternal education limiting feeding knowledge, higher rates of early marriage increasing vulnerability, and security challenges disrupting production.
13. Three patterns are early weaning and inadequate complementary feeding using nutritionally poor weaning foods, intra-household food distribution prioritising adult males at the expense of women and children, and seasonal dietary restrictions and food taboos reducing diversity in pregnant and lactating women.
14. Three direct interventions are micronutrient supplementation (iron-folic acid for pregnant women, vitamin A for children), therapeutic and supplementary feeding for acute



malnutrition management, and promotion of optimal IYCF including exclusive breastfeeding and appropriate complementary feeding.

15. Nutrition-sensitive approaches address underlying determinants including poverty, food insecurity, poor sanitation, and gender inequality that direct interventions cannot reach; without addressing root causes, malnutrition will recur even when episodes are treated.

### **Part 3.3**

1. Food and nutrition policy is the governmental framework guiding the food system toward adequate nutrition. Two key documents are the National Food and Nutrition Policy and the National Strategic Plan of Action for Nutrition.
2. Food fortification is the deliberate addition of micronutrients to staple foods. Three Nigerian examples are vitamin A added to cooking oil, iron and folic acid added to wheat flour, and iodine added to table salt.
3. Food hygiene refers to conditions ensuring food safety from production to consumption. The Five Keys are keep food clean, separate raw and cooked foods, cook food thoroughly, keep food at safe temperatures, and use safe water and raw materials.
4. Food toxicology studies harmful substances in food and exposure control measures. Aflatoxins from *Aspergillus* mould on poorly stored groundnuts and maize are major concerns in Nigeria because high humidity and poor storage create ideal mould conditions; chronic exposure causes liver cancer, growth faltering, and impaired immunity.
5. Raw cassava contains cyanogenic glycosides releasing hydrogen cyanide; the hazard is eliminated through peeling, soaking, grating, fermenting, and thorough cooking, which allow cyanide to dissipate before consumption.

## **References and Attributions [Series 3]**

### **Textual References**

6. World Health Organization. (2014). Five Keys to Safer Food Manual. Geneva: WHO.



7. Federal Ministry of Health Nigeria. (2018). National Strategic Plan of Action for Nutrition 2018 to 2022. Abuja: FMOH.
8. Park, K. (2017). Park's Textbook of Preventive and Social Medicine (24th ed.). Jabalpur: Banarsidas Bhanot.
9. Ene-Obong, H. N. (2001). Eating Right: A Nutrition Handbook for the People of Nigeria. Enugu: Chuka Educational Publishers.

### Figures, Plates, Tables, and Boxes

10. Figure 3.1: The infection-malnutrition cycle. AI generation prompt: "Create a clean circular cycle diagram titled The Infection-Malnutrition Cycle, with two circles: Infection (top, outward labels: Reduces food intake, Impairs nutrient absorption, Increases nutrient losses, Diverts nutrients to immune response) and Malnutrition (bottom, outward labels: Impairs antibody production, Compromises epithelial barriers, Reduces cell-mediated immunity, Impairs lymphocyte function); bidirectional arrows and central label Reinforcing Cycle; clean professional infographic." Suggested OER search string: "infection malnutrition cycle diagram vicious cycle nutrition immunity".
11. Table 3.1: Direct interventions and nutrition-sensitive approaches for controlling nutritional disorders. AI generation prompt: "Create a clean two-column table titled Control of Nutritional Disorders in Nigeria; Direct Interventions (micronutrient supplementation, therapeutic feeding, IYCF) and Nutrition-Sensitive Approaches (social protection, agriculture, water and sanitation, women's empowerment); professional table design." Suggested OER search string: "nutritional disorder control direct interventions nutrition-sensitive approaches table Nigeria".
12. Table 3.2: Common food toxins in Nigeria, their sources, and control measures. AI generation prompt: "Create a clean three-column table titled Common Food Toxins in Nigeria: Source, Mechanism, and Control; four rows: Aflatoxins, Cyanogenic Glycosides, Pesticide Residues, Heavy Metals; each with source, context, and control measures; professional table design with alternating row shading." Suggested OER search string: "food toxins Nigeria aflatoxins cyanogenic glycosides pesticides table".



**Course code: COM 405**

**Course title: Public Health Nutrition and Rehabilitation**

**Course credit load: 1 Unit**

## **Series 4: Nutritional Status Assessment, Breastfeeding, and Complementary Feeding**

- **Part 4.1: Assessment of Nutritional Status**
  - Sub Part 4.1.1: Definition and purpose of nutritional status assessment
  - Sub Part 4.1.2: Anthropometric assessment
  - Sub Part 4.1.3: Dietary, biochemical, and clinical assessment
- **Part 4.2: Exclusive Breastfeeding**
  - Sub Part 4.2.1: The importance and composition of breast milk
  - Sub Part 4.2.2: Principles and practice of exclusive breastfeeding
  - Sub Part 4.2.3: Barriers to exclusive breastfeeding and their solutions
- **Part 4.3: Complementary Feeding in Children**
  - Sub Part 4.3.1: Definition, timing, and importance of complementary feeding
  - Sub Part 4.3.2: Principles of appropriate complementary feeding
  - Sub Part 4.3.3: Common complementary feeding problems in Nigeria



## Introduction

Knowing whether a child, a community, or a population is well nourished requires systematic assessment using validated methods. Nutritional status assessment is the foundation upon which nutrition programmes are designed, targeted, and evaluated, combining multiple approaches to give a complete picture.

This Series examines methods for assessing nutritional status, covering anthropometric, dietary, biochemical, and clinical approaches. It then examines the two pillars of optimal infant and young child feeding: exclusive breastfeeding during the first six months and complementary feeding from six months, including their importance, principles, barriers, and common Nigerian problems.

Together these topics address the assessment tools that identify nutritional problems and the feeding practices that prevent them during the most nutritionally critical period of human development.

## Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 4.1** define nutritional status assessment and explain its purpose in public health nutrition (Linked to Part 4.1),
- **SLO 4.2** describe anthropometric methods for assessing nutritional status in children, including key indices and their interpretation (Linked to Part 4.1),
- **SLO 4.3** describe dietary, biochemical, and clinical methods of nutritional assessment and explain why comprehensive assessment requires combining all four methods (Linked to Part 4.1),
- **SLO 4.4** explain the composition and importance of breast milk and describe the principles and practice of exclusive breastfeeding (Linked to Part 4.2),



- **SLO 4.5** identify barriers to exclusive breastfeeding in Nigeria and describe strategies to overcome them (Linked to Part 4.2), and
- **SLO 4.6** define complementary feeding, describe principles of appropriate complementary feeding, and identify common complementary feeding problems in Nigeria (Linked to Part 4.3).

## 4.1 Assessment of Nutritional Status

### 4.1.1 Definition and purpose of nutritional status assessment

**Nutritional status assessment** is the systematic evaluation of nutritional condition using indicators of food intake, body composition, and health outcomes, providing evidence to identify malnutrition, classify its type and severity, target interventions, and monitor programme impact over time.

Assessment is conducted at the **individual level** to guide patient management, or at the **population level** through surveys and surveillance to identify priority groups and areas. Comprehensive assessment uses multiple methods together, since no single method captures the full nutritional picture.

Fill in the blank: Nutritional status assessment identifies malnutrition, classifies severity, targets interventions, and \_\_\_\_\_ programme impact; comprehensive assessment combines multiple methods at individual or population level.

### 4.1.2 Anthropometric assessment

**Anthropometric assessment** measures body dimensions to estimate nutritional status. Core indices in children are **weight-for-height (WHZ)** identifying wasting (acute malnutrition) when below minus two standard deviations, **height-for-age (HAZ)** identifying stunting (chronic malnutrition) when below minus two, and **weight-for-age (WAZ)** identifying underweight. Severe forms fall below minus three.



**Mid-upper arm circumference (MUAC)** is a key field tool: below 11.5 centimetres indicates severe acute malnutrition; 11.5 to 12.5 indicates moderate; above 12.5 is acceptable, in children aged 6 to 59 months. In adults, **body mass index (BMI)** is standard, with below 18.5 indicating underweight and above 25 indicating overweight.

Fill in the blank: WHZ identifies wasting, HAZ identifies stunting, and WAZ identifies underweight; MUAC below \_\_\_\_\_ centimetres indicates severe acute malnutrition in children aged 6 to 59 months.

#### 4.1.3 Dietary, biochemical, and clinical assessment

**Dietary assessment** measures food and nutrient intake using the **24-hour dietary recall**, **food frequency questionnaire**, and **dietary diversity scores** counting food groups as a proxy for diet quality. Combining methods improves accuracy.

**Biochemical assessment** measures nutrients in biological samples, such as haemoglobin and serum ferritin for iron, serum retinol for vitamin A, and urinary iodine for iodine status. **Clinical assessment** identifies deficiency signs through physical examination, including oedema (kwashiorkor), Bitot's spots (vitamin A deficiency), goitre (iodine deficiency), and skin and hair changes in severe PEM.

Fill in the blank: Dietary assessment uses 24-hour recall, FFQ, and diversity scores; biochemical measures nutrients in samples; and clinical identifies deficiency signs through physical \_\_\_\_\_.





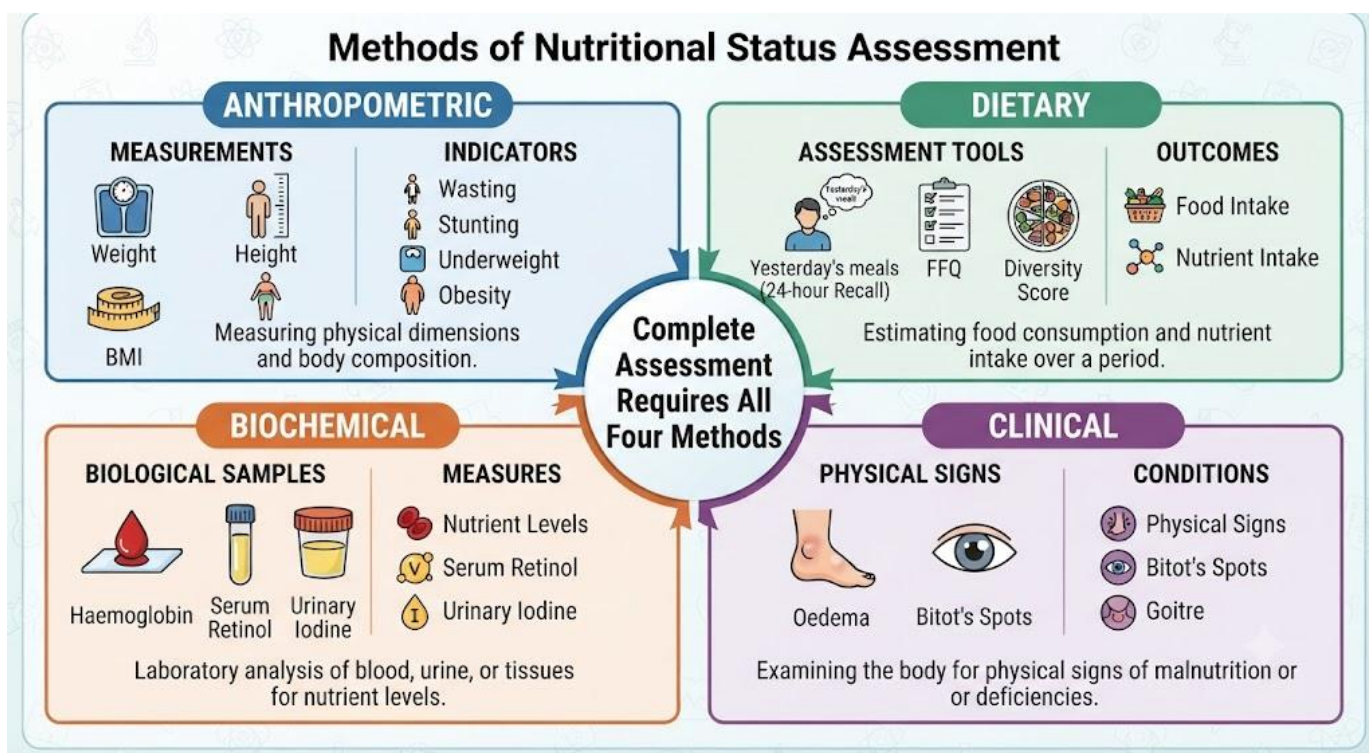


Figure 4.1: The four complementary methods of nutritional status assessment, each capturing a different dimension of nutritional health

#### Pilot questions 4.1

1. Define nutritional status assessment and list four of its purposes. (Linked to SLOs 4.1 to 4.2)
2. Distinguish between weight-for-height, height-for-age, and weight-for-age. (Linked to SLO 4.2)
3. State the MUAC cut-offs for severe and moderate acute malnutrition in children. (Linked to SLO 4.2)
4. Describe the three main methods of dietary assessment. (Linked to SLO 4.3)
5. Give two examples each of biochemical and clinical indicators in nutritional assessment. (Linked to SLO 4.3)





## 4.2 Exclusive Breastfeeding

### 4.2.1 The importance and composition of breast milk

**Breast milk** is the biologically optimal food for human infants. Its composition is **dynamic**, beginning with **colostrum** produced in the first days after birth, rich in secretory IgA, growth factors, and nutrients, of exceptional immunological importance and should never be discarded, progressing to mature milk.

Mature breast milk provides **all energy, protein, fat, carbohydrate, vitamins, and minerals** required for the first six months. It contains **bioactive components** including immunoglobulins, lysozyme, lactoferrin, growth factors, and prebiotics that protect against infection, support gut development, and promote a healthy microbiome.

Fill in the blank: Breast milk changes from \_\_\_\_\_ rich in immunoglobulins to mature milk; bioactive components protect against infection and support gut development throughout the first six months.

### 4.2.2 Principles and practice of exclusive breastfeeding

**Exclusive breastfeeding** means giving the infant only breast milk with no other liquids or solid foods for the **first six months** of life, as recommended by WHO, reflecting breast milk's sufficiency for all infant nutritional needs during this period.

Key supporting practices include **early initiation** within the first hour of birth, **demand feeding** responding to infant hunger cues to ensure adequate milk production, and **correct positioning and attachment** to prevent nipple pain and ensure effective milk transfer. Breastfeeding continues alongside complementary foods until at least two years.

Fill in the blank: Exclusive breastfeeding means giving only breast milk for the first \_\_\_\_\_ months; key practices are early initiation within one hour of birth, demand feeding, and correct positioning and attachment.



### 4.2.3 Barriers to exclusive breastfeeding and their solutions

Many Nigerian mothers face barriers to exclusive breastfeeding. **Cultural beliefs** supporting prelacteal feeds (water, herbal preparations, or animal milk before breastfeeding is established) reflect views that colostrum is harmful or breast milk insufficient, particularly for thirst.

**Workplace pressures** force many employed mothers to return to work before six months without breastfeeding breaks or lactation facilities.

**Inadequate health worker counselling** means many mothers lack practical knowledge to establish and maintain breastfeeding. **Commercial infant formula marketing** undermines confidence in breast milk sufficiency. Solutions include community breastfeeding education, trained lactation support, **Baby-Friendly Hospital Initiative** implementation, and workplace breastfeeding policies.

Fill in the blank: Barriers to EBF in Nigeria include cultural beliefs supporting prelacteal feeds, workplace \_\_\_\_\_, inadequate health worker support, and commercial formula marketing.

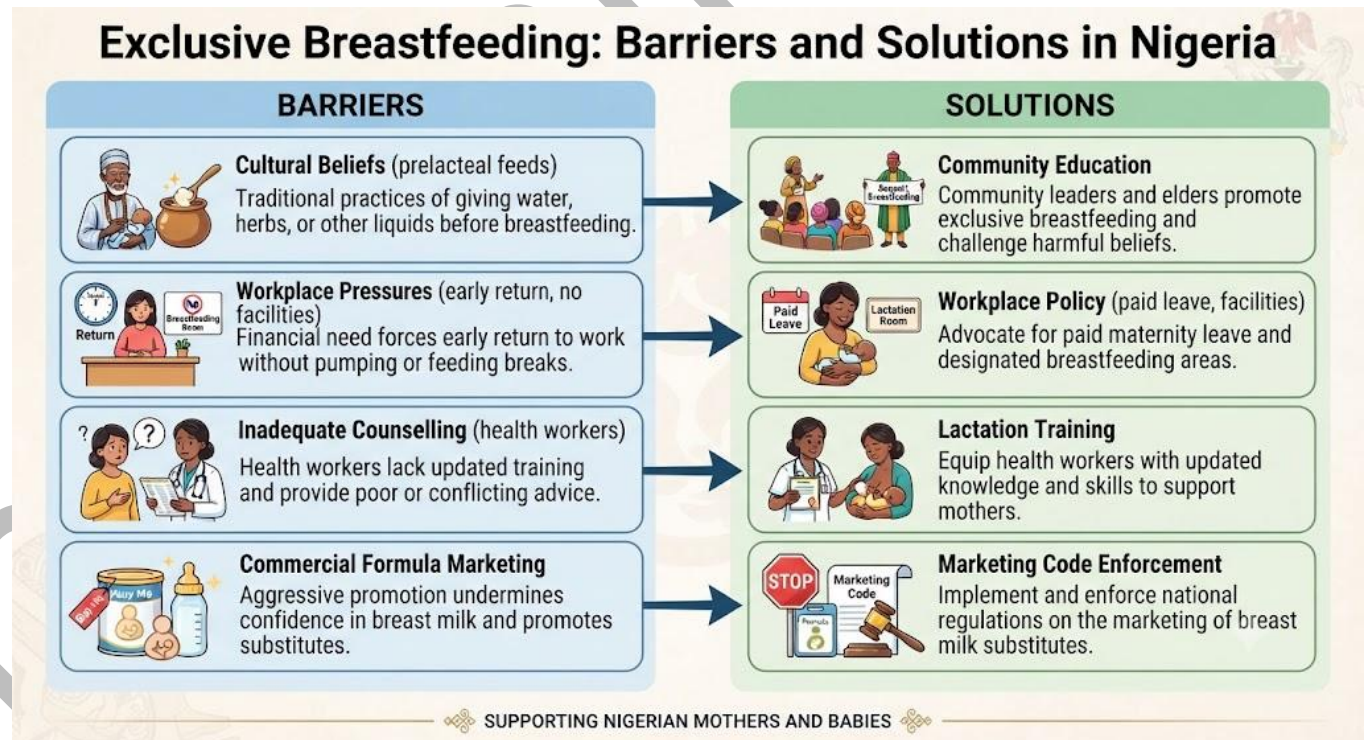


Figure 4.2: Barriers to exclusive breastfeeding in Nigeria and corresponding strategies to overcome them



## Pilot questions 4.2

1. Explain the nutritional and immunological significance of colostrum. (Linked to SLO 4.4)
2. State the WHO definition of exclusive breastfeeding and the recommended duration. (Linked to SLO 4.4)
3. Describe three key practices supporting successful exclusive breastfeeding. (Linked to SLO 4.4)
4. Identify three barriers to exclusive breastfeeding in Nigeria. (Linked to SLO 4.5)
5. Describe three strategies to overcome barriers to exclusive breastfeeding. (Linked to SLO 4.5)

## 4.3 Complementary Feeding in Children

### 4.3.1 Definition, timing, and importance of complementary feeding

**Complementary feeding** is giving foods and liquids in addition to, not instead of, breast milk from six months to meet growing nutritional needs. **Complementary** emphasises these foods add to rather than replace breast milk, which continues to provide nutrition and immunity throughout the second year.

Timing is critical: beginning before six months exposes the immature gut and immune system to allergens and pathogens prematurely and displaces breast milk; beginning after creates an **energy and nutrient gap** that breast milk alone cannot fill, causing growth faltering and stunting. Six months is the recommended age.

Fill in the blank: Complementary foods should be introduced at \_\_\_\_\_ months; earlier risks allergen exposure and displaces breast milk; later creates an energy and nutrient gap causing growth faltering.



### 4.3.2 Principles of appropriate complementary feeding

Appropriate complementary feeding follows the **FADUA framework** covering Frequency, Amount, nutrient Density, Uphold breastfeeding, Active responsive feeding, and Appropriate texture and safety. **Frequency** should be 2 to 3 times at 6 to 8 months and 3 to 4 times at 9 to 23 months; **amounts** increase from 2 to 3 tablespoons at 6 months to half an adult bowl or more by 12 to 23 months.

**Nutrient density** requires a variety of food groups at each meal rather than plain starchy porridge. Feeds must be **safely prepared**, given using **responsive feeding** responding to hunger and satiety cues, and progressively thickened in texture from smooth purees to mashed, minced, and family foods as oral motor skills develop.

Fill in the blank: Appropriate complementary feeding increases in frequency, amount, and nutrient \_\_\_\_\_ as the child grows, with safe preparation, responsive feeding, and progressive texture.

### 4.3.3 Common complementary feeding problems in Nigeria

Several problems undermine complementary feeding quality in Nigeria. **Early introduction** before six months is widespread, reflecting beliefs that breast milk is insufficient. **Poor dietary diversity** is pervasive: diets are dominated by starchy cereal porridges such as ogi from maize, guinea corn, or millet, with inadequate protein foods, fruits, and vegetables.

**Inadequate feeding frequency and quantity**, particularly during illness, leads to insufficient nutrient intake. **Poor food preparation hygiene**, including contaminated water and unwashed hands, exposes infants to pathogens causing diarrhoeal disease that directly triggers the infection-malnutrition cycle, further worsening nutritional status. These problems require community nutrition education, cooking demonstrations, and practical caregiver support.

Fill in the blank: Common complementary feeding problems in Nigeria include early introduction, poor dietary \_\_\_\_\_ with starchy porridge dominance, inadequate feeding frequency, and poor food preparation hygiene.



| <u>Problem</u>                                   | <u>Nutritional Consequence</u>                        |
|--------------------------------------------------|-------------------------------------------------------|
| <b>Early Introduction before six months</b>      | Displaces breast milk, allergen and pathogen exposure |
| <b>Poor Dietary Diversity</b>                    | Micronutrient deficiencies, protein-energy gap        |
| <b>Inadequate Feeding Frequency and Quantity</b> | Insufficient intake, growth faltering                 |
| <b>Poor Food Preparation Hygiene</b>             | Diarrhoeal disease, infection-malnutrition cycle      |

Table 4.1: Common complementary feeding problems in Nigeria and their nutritional consequences

### Pilot questions 4.3

1. Define complementary feeding and explain why the term complementary is used. (Linked to SLO 4.6)
2. Explain the consequences of introducing complementary foods before and after six months. (Linked to SLO 4.6)
3. Describe the principles of appropriate complementary feeding using the FADUA framework. (Linked to SLO 4.6)
4. Identify three common complementary feeding problems in Nigeria. (Linked to SLO 4.6)
5. Explain how poor food preparation hygiene worsens child nutritional status. (Linked to SLO 4.6)



## Series Summary

This Series examined nutritional status assessment and the two foundational pillars of infant and young child feeding. Nutritional status assessment uses four complementary methods: anthropometric (WHZ for wasting, HAZ for stunting, WAZ for underweight, MUAC below 11.5 centimetres for severe acute malnutrition), dietary (24-hour recall, food frequency questionnaire, dietary diversity scores), biochemical (haemoglobin and serum ferritin for iron, serum retinol for vitamin A, urinary iodine), and clinical (oedema, Bitot's spots, goitre). No single method suffices; all four together provide a complete picture. Breast milk is uniquely optimal, changing from immunoglobulin-rich colostrum to mature milk providing all nutrients for the first six months plus bioactive protective components; exclusive breastfeeding for six months is the WHO recommendation, supported by early initiation, demand feeding, and correct attachment.

Barriers to exclusive breastfeeding in Nigeria include cultural beliefs supporting prelacteal feeds, workplace pressures, inadequate health worker counselling, and commercial formula marketing, addressed through community education, lactation support, Baby-Friendly Hospital Initiative, and workplace policy. Complementary foods introduced at exactly six months add foods alongside continued breastfeeding following the FADUA framework principles of adequate frequency, amount, and nutrient density, safe preparation, responsive feeding, and progressive texture. Common Nigerian problems of early introduction, poor dietary diversity with starchy porridge dominance, inadequate feeding frequency, and poor preparation hygiene all contribute to Nigeria's high rates of childhood stunting and micronutrient deficiency.

## Glossary of Terms

1. **Nutritional status assessment:** the systematic evaluation of nutritional condition using anthropometric, dietary, biochemical, and clinical methods.
2. **Wasting:** low weight-for-height (WHZ below minus two), indicating acute malnutrition.
3. **Stunting:** low height-for-age (HAZ below minus two), indicating chronic malnutrition.
4. **MUAC:** mid-upper arm circumference; below 11.5 centimetres indicates severe acute malnutrition in children aged 6 to 59 months.



5. **24-hour dietary recall:** a dietary assessment method asking subjects to recall all food and drink consumed in the previous 24 hours.
6. **Colostrum:** the yellowish fluid produced in the first days after birth, rich in secretory IgA, providing the newborn's first immunological protection.
7. **Exclusive breastfeeding:** giving an infant only breast milk, with no other liquids or solid foods, for the first six months of life.
8. **Complementary feeding:** giving foods and liquids alongside breast milk from six months to meet the growing infant's nutritional needs.
9. **FADUA framework:** the principles of appropriate complementary feeding: Frequency, Amount, nutrient Density, Uphold breastfeeding, Active responsive feeding, Appropriate texture.
10. **Ogi:** fermented cereal porridge from maize, guinea corn, or millet; a common but nutritionally inadequate sole complementary food in Nigeria.
11. **Responsive feeding:** feeding practices responding to the child's hunger and satiety cues, promoting appropriate intake and healthy feeding relationships.





## Concept Check Questions [Series 4]

### Objective Questions

- Nutritional status assessment uses anthropometric, dietary, biochemical, and \_\_\_\_\_ methods. (Linked to SLOs 4.1, 4.3)
- WHZ identifies \_\_\_\_\_, HAZ identifies stunting, and WAZ identifies underweight. (Linked to SLO 4.2)
- MUAC below \_\_\_\_\_ centimetres indicates severe acute malnutrition in children aged 6 to 59 months. (Linked to SLO 4.2)
- Exclusive breastfeeding means giving only breast milk for the first \_\_\_\_\_ months of life. (Linked to SLO 4.4)
- \_\_\_\_\_ is the yellowish fluid rich in immunoglobulins produced in the first days after birth. (Linked to SLO 4.4)
- Complementary foods should be introduced at \_\_\_\_\_ months; earlier displaces breast milk and later creates a nutrient gap. (Linked to SLO 4.6)

### Short-Answer Questions

- Distinguish between wasting, stunting, and underweight as anthropometric indices. (Linked to SLO 4.2)
- Explain the nutritional and immunological importance of exclusive breastfeeding. (Linked to SLO 4.4)
- Identify three common complementary feeding problems in Nigeria. (Linked to SLO 4.6)

### Long-Answer Questions

- Describe the four methods of nutritional status assessment and explain why comprehensive assessment requires combining them. (Linked to SLOs 4.1 to 4.3)
- Discuss exclusive breastfeeding, including its importance, barriers in Nigeria, and strategies to overcome them. (Linked to SLOs 4.4 to 4.5)





## Answers to Concept Check Questions [Series 4]

### Objective Questions

1. Clinical.
2. Wasting.
3. 11.5.
4. Six.
5. Colostrum.
6. Six.

### Short-Answer Questions

7. Wasting is low WHZ indicating acute malnutrition. Stunting is low HAZ indicating chronic malnutrition. Underweight is low WAZ reflecting combined acute and chronic malnutrition.
8. Breast milk provides all nutrients for the first six months; bioactive components including secretory IgA, lactoferrin, and lysozyme protect against infection and support gut development, reducing infant morbidity and mortality.
9. Three problems: early introduction before six months; poor dietary diversity with dominance of starchy ogi porridges and inadequate protein and vegetables; poor food preparation hygiene exposing infants to pathogens causing diarrhoeal disease.

### Long-Answer Questions

10. **Basic response:** Anthropometric: WHZ (wasting), HAZ (stunting), WAZ (underweight), MUAC (SAM screening), BMI (adults). Dietary: 24-hour recall (previous day intake), FFQ (habitual intake), diversity scores (food group variety). Biochemical: haemoglobin and ferritin (iron), serum retinol (vitamin A), urinary iodine. Clinical: oedema (kwashiorkor), Bitot's spots (vitamin A), goitre (iodine). Why combine: anthropometry shows overall status not cause; dietary data shows intake not absorption; biochemical is precise but costly; clinical signs appear late; all four together provide a complete picture.

**Value-added response:** Relying on only one assessment method will always miss dimensions of malnutrition: anthropometry alone misses hidden micronutrient hunger, dietary data alone misses absorption deficits, and clinical signs appear only after visible



damage; combining all four methods ensures that the full spectrum of nutritional problems, from obvious wasting to subtle micronutrient deficiency, is detected and appropriately addressed.

11. **Basic response:** Importance: breast milk provides all nutrients for six months; colostrum is rich in secretory IgA providing passive immunity; bioactive components (immunoglobulins, lactoferrin, lysozyme, growth factors, prebiotics) protect against infection and support gut and immune development. Barriers: cultural beliefs supporting prelacteal feeds; workplace pressures without maternity leave; inadequate health worker counselling; commercial formula marketing. Strategies: community breastfeeding education; health worker lactation training; Baby-Friendly Hospital Initiative; workplace policies including paid maternity leave; enforcement of infant formula marketing code.
- Value-added response:** Sustainable improvement in EBF rates requires policy action beyond education, including maternity protection legislation, enforcement of the International Code of Marketing of Breast-milk Substitutes, and robust health system support at every antenatal and postnatal contact, since workplace pressure and commercial marketing require structural responses that individual counselling alone cannot address.

## Answers to Pilot Questions [Series 4]

### Part 4.1

6. Nutritional status assessment is the systematic evaluation of nutritional condition using multiple indicators. Four purposes are identifying malnutrition, classifying its type and severity, targeting interventions to those most in need, and monitoring programme impact over time.
7. WHZ identifies wasting (acute malnutrition); HAZ identifies stunting (chronic malnutrition); WAZ identifies underweight, reflecting combined acute and chronic malnutrition.
8. MUAC below 11.5 centimetres indicates severe acute malnutrition; 11.5 to 12.5 indicates moderate; above 12.5 is generally acceptable.



9. 24-hour dietary recall asks subjects to recall all food consumed in the previous 24 hours; food frequency questionnaire assesses habitual frequency of specific foods; dietary diversity score counts food groups consumed as a proxy for diet quality.
10. Biochemical: haemoglobin or serum ferritin for iron; serum retinol for vitamin A.  
Clinical: oedema indicating kwashiorkor; Bitot's spots indicating vitamin A deficiency.

#### **Part 4.2**

11. Colostrum is produced in the first days after birth, rich in secretory IgA providing passive immunity and growth factors; it should never be discarded because it provides the newborn's first immunological protection.
12. WHO defines exclusive breastfeeding as giving the infant only breast milk with no other liquids or solid foods except ORS, vitamins, minerals, or medicines where necessary, for the first six months of life.
13. Three practices: early initiation within the first hour of birth; demand feeding responding to infant hunger cues; correct positioning and attachment to prevent nipple pain and ensure effective milk transfer.
14. Three barriers: cultural beliefs supporting prelacteal feeds; workplace pressures forcing return before six months without facilities; inadequate health worker counselling at antenatal and postnatal contacts.
15. Three strategies: community breastfeeding education addressing cultural beliefs; health worker lactation training; Baby-Friendly Hospital Initiative and workplace policies including paid maternity leave and breastfeeding breaks.

#### **Part 4.3**

1. Complementary feeding is giving foods and liquids in addition to breast milk from six months; complementary emphasises these foods add to rather than replace breast milk, which continues to provide nutrition and immunity.
2. Before six months: gut and immune system not ready, risk of allergen and pathogen exposure, breast milk displaced prematurely. After six months: energy and nutrient gap breast milk alone cannot fill, causing growth faltering and stunting.



3. FADUA: Frequency (2 to 3 at 6 to 8 months, 3 to 4 at 9 to 23 months); Amount (2 to 3 tablespoons increasing to half adult bowl or more); Density (variety of food groups); Uphold breastfeeding; Active responsive feeding (hunger and satiety cues); Appropriate safe preparation and progressive texture.
4. Three problems: early introduction before six months; poor dietary diversity with starchy food dominance and inadequate protein and vegetables; poor food preparation hygiene exposing infants to pathogens.
5. Poor hygiene introduces pathogens causing diarrhoeal disease, triggering the infection-malnutrition cycle: diarrhoea reduces intake, damages intestinal mucosa impairing absorption, and increases nutrient losses, worsening nutritional status.



## References and Attributions [Series 4]

### Textual References

6. World Health Organization. (2008). Indicators for Assessing Infant and Young Child Feeding Practices. Geneva: WHO.
7. World Health Organization. (2009). Infant and Young Child Feeding: Model Chapter for Textbooks. Geneva: WHO.
8. Federal Ministry of Health Nigeria. (2018). National Strategic Plan of Action for Nutrition 2018 to 2022. Abuja: FMOH.
9. Park, K. (2017). Park's Textbook of Preventive and Social Medicine (24th ed.). Jabalpur: Banarsidas Bhanot.

### Figures, Plates, Tables, and Boxes

10. Figure 4.1: The four methods of nutritional status assessment. AI generation prompt: "Create a clean four-panel diagram titled Methods of Nutritional Status Assessment; panels: Anthropometric (weight, height, MUAC, BMI; wasting, stunting, underweight, obesity), Dietary (24-hour recall, FFQ, diversity score), Biochemical (haemoglobin, serum retinol, urinary iodine), Clinical (oedema, Bitot's spots, goitre); central label Complete Assessment Requires All Four Methods; clean professional infographic style." Suggested OER search string: "nutritional assessment methods four panel diagram".
11. Figure 4.2: Barriers to EBF and solutions. AI generation prompt: "Create a clean two-column flow diagram titled Exclusive Breastfeeding: Barriers and Solutions; Barriers column: Cultural Beliefs, Workplace Pressures, Inadequate Counselling, Commercial Marketing; Solutions column: Community Education, Workplace Policy, Lactation Training, Marketing Code Enforcement; arrows connecting each pair; clean professional infographic style." Suggested OER search string: "exclusive breastfeeding barriers solutions Nigeria diagram".
12. Table 4.1: Common complementary feeding problems and nutritional consequences. AI generation prompt: "Create a clean two-column table titled Common Complementary Feeding Problems in Nigeria; columns Problem and Nutritional Consequence; four rows: Early Introduction, Poor Dietary Diversity, Inadequate Feeding Frequency, Poor Food



Preparation Hygiene; alternating row shading." Suggested OER search string:  
"complementary feeding problems Nigeria table nutritional consequences".



**Course code: COM 405**

**Course title: Public Health Nutrition and Rehabilitation**

**Course credit load: 1 Unit**

## **Series 5: Rehabilitation, Handicaps, Disaster Relief, and Social Welfare Services**

- **Part 5.1: Rehabilitation: Concepts and Principles**
  - Sub Part 5.1.1: Definition and goals of rehabilitation
  - Sub Part 5.1.2: Types and levels of rehabilitation
  - Sub Part 5.1.3: The rehabilitation team and community-based rehabilitation
- **Part 5.2: Handicaps and Disaster Relief Nutrition**
  - Sub Part 5.2.1: Handicaps: definitions, types, and nutritional implications
  - Sub Part 5.2.2: Nutrition in disaster and emergency situations
  - Sub Part 5.2.3: General food ration and therapeutic feeding in emergencies
- **Part 5.3: Social Welfare Services and Their Interface with Nutrition**
  - Sub Part 5.3.1: Social welfare services: definition and scope
  - Sub Part 5.3.2: Social welfare services relevant to nutrition in Nigeria
  - Sub Part 5.3.3: Integration of nutrition into social welfare programmes

### **Introduction**





Nutrition does not operate in isolation from the broader health and social systems that support human wellbeing. People whose health has been impaired by disease, injury, or disability require rehabilitation to restore function and quality of life. People displaced by disasters and emergencies face acute nutritional crises requiring organised and evidence-based responses. And people living in poverty, disability, or social vulnerability require social welfare services that, when integrated with nutrition, can address both the immediate and underlying causes of malnutrition simultaneously.

This final Series brings together the concepts of rehabilitation, handicap, disaster relief nutrition, and social welfare services as they relate to public health nutrition. It examines the principles and levels of rehabilitation, the rehabilitative management of nutritional disorders, the specific nutritional needs and challenges facing people with disabilities, the evidence-based approach to nutrition in disasters and emergencies, and the range of social welfare services through which Nigeria addresses the needs of its most vulnerable populations.

Together these topics complete the public health nutrition curriculum, connecting the nutritional science and programme approaches of earlier Series with the broader human welfare context within which nutrition ultimately finds its meaning.

## Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 5.1** define rehabilitation and describe its goals, types, and levels (Linked to Part 5.1),
- **SLO 5.2** describe the composition and roles of the rehabilitation team and explain the principles of community-based rehabilitation (Linked to Part 5.1),
- **SLO 5.3** define handicap, classify its types, and describe its nutritional implications (Linked to Part 5.2),
- **SLO 5.4** describe the nutritional needs and responses in disaster and emergency situations, including general food rations and therapeutic feeding (Linked to Part 5.2),



- **SLO 5.5** define social welfare services and describe their scope in Nigeria (Linked to Part 5.3), and
- **SLO 5.6** describe the social welfare services most relevant to nutrition and explain how nutrition can be integrated into social welfare programmes (Linked to Part 5.3).

## 5.1 Rehabilitation: Concepts and Principles

### 5.1.1 Definition and goals of rehabilitation

**Rehabilitation** is the process of helping an individual who has experienced disease, injury, disability, or nutritional disorder to achieve and maintain the maximum possible level of physical, mental, social, and vocational functioning and independence. It is not merely the restoration of a previous condition but an active process of enabling individuals to live with dignity and participate fully in family and community life, adapted to whatever residual capacity they retain.

The primary goals of rehabilitation are to **restore function** to the greatest extent possible, to **prevent secondary complications** such as contractures, pressure sores, and psychological deterioration that arise from prolonged inactivity or disability, to **promote independence** in daily activities and reduce dependence on others, and to support **social reintegration** enabling the individual to return to productive participation in family and community life.

Fill in the blank: Rehabilitation aims to restore function, prevent secondary complications, promote independence, and support social \_\_\_\_\_ of individuals who have experienced disease, injury, or disability.

### 5.1.2 Types and levels of rehabilitation

Rehabilitation encompasses several distinct but complementary types. **Medical rehabilitation** focuses on treating underlying conditions, managing complications, and using medical interventions to restore physiological function. **Physical rehabilitation** uses physiotherapy, occupational therapy, and exercise to restore physical capacity, mobility, and the ability to



perform daily activities. **Nutritional rehabilitation** addresses the restoration of nutritional status in individuals with PEM, micronutrient deficiencies, or disease-related malnutrition through appropriate dietary management and supplementation.

**Psychological rehabilitation** addresses mental health consequences of disability and chronic illness, including depression, anxiety, and loss of self-esteem. **Vocational rehabilitation** helps individuals with disabilities acquire or regain skills enabling economic participation and employment. Rehabilitation is provided at three levels: **institutional rehabilitation** in hospitals and specialised centres; **outpatient or day care rehabilitation** allowing individuals to receive services while living at home; and **community-based rehabilitation (CBR)** delivered within the individual's own community.

Fill in the blank: Rehabilitation types include medical, physical, nutritional, psychological, and \_\_\_\_\_ rehabilitation; provided at institutional, outpatient, and community-based levels.

### 5.1.3 The rehabilitation team and community-based rehabilitation

Effective rehabilitation requires a **multidisciplinary team** whose composition matches the needs of the individual. Core members typically include a **physician or medical officer** leading clinical management, a **physiotherapist** addressing physical function and mobility, an **occupational therapist** focusing on activities of daily living, a **nutritionist or dietitian** managing nutritional rehabilitation, a **social worker** addressing social reintegration, and a **psychologist or counsellor** supporting mental health.

**Community-based rehabilitation (CBR)** is a strategy for enhancing the quality of life of people with disabilities by improving service delivery and creating more inclusive and supportive communities. In Nigeria, CBR is particularly important given the limited reach of institutional rehabilitation services, and involves training family members and community volunteers as **primary rehabilitation agents**, supported by health workers who provide supervision, supplies, and technical guidance. CBR enables people with disabilities to receive rehabilitation support within their own communities rather than requiring costly and often inaccessible institutional care.



Fill in the blank: Community-based rehabilitation trains family members and community volunteers as primary rehabilitation agents, supported by health workers, enabling people with disabilities to receive support within their own \_\_\_\_\_.

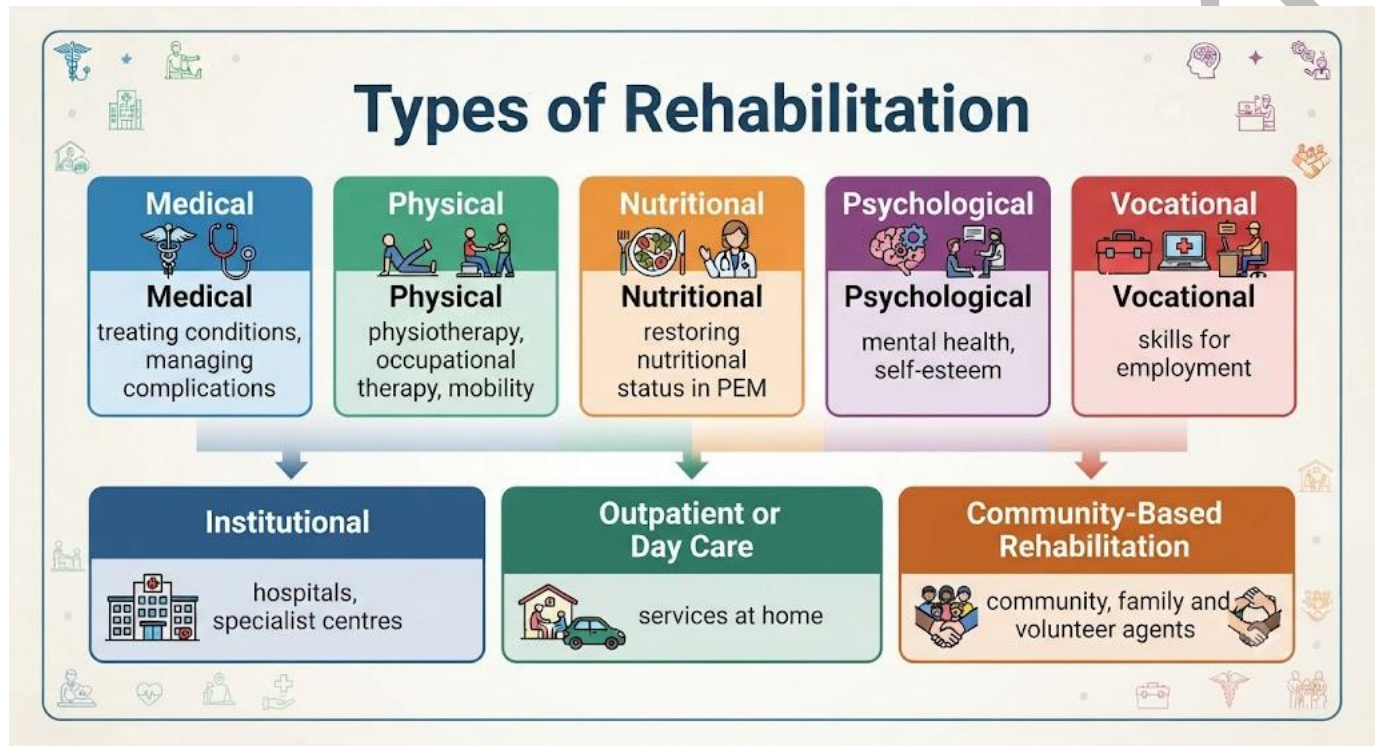


Figure 5.1: Types of rehabilitation and the levels at which services are provided

### Pilot questions 5.1

1. Define rehabilitation and state its four main goals. (Linked to SLOs 5.1 to 5.2)
2. Describe five types of rehabilitation and give an example of each. (Linked to SLO 5.1)
3. List the members of a typical rehabilitation team and state the role of each. (Linked to SLO 5.2)
4. Define community-based rehabilitation and explain its importance in Nigeria. (Linked to SLO 5.2)
5. Explain what nutritional rehabilitation involves and who requires it. (Linked to SLOs 5.1 to 5.2)



## 5.2 Handicaps and Disaster Relief Nutrition

### 5.2.1 Handicaps: definitions, types, and nutritional implications

A **handicap** in the traditional public health classification refers to the social and environmental disadvantage experienced by an individual as a result of an impairment or disability that limits or prevents fulfilment of a normal role. The WHO International Classification of Impairments, Disabilities, and Handicaps (ICIDH) distinguished between **impairment** (a structural or functional loss), **disability** (restriction in activity resulting from impairment), and **handicap** (the social disadvantage resulting from disability). More recent classifications emphasise participation and environmental barriers.

Types of handicap include **physical handicaps** affecting mobility and motor function, **sensory handicaps** affecting vision and hearing, **intellectual handicaps** affecting cognitive function, **communication handicaps**, and **psychological handicaps**. The nutritional implications are significant: physical and neurological handicaps may impair **chewing, swallowing, and self-feeding**; intellectual handicaps may limit understanding of dietary requirements; poverty associated with disability reduces food access; and immobility alters energy expenditure, requiring dietary adjustment.

Fill in the blank: Handicap types include physical, sensory, intellectual, communication, and psychological; nutritional implications include impaired chewing and swallowing, reduced food \_\_\_\_\_ due to poverty, and altered energy needs from immobility.

### 5.2.2 Nutrition in disaster and emergency situations

**Disasters and emergencies** create acute nutritional crises by simultaneously destroying food supplies, disrupting livelihoods and purchasing power, displacing populations from their homes and normal food sources, overwhelming health systems, and creating the crowding and poor sanitation conditions that drive infectious disease, further worsening nutritional status through the infection-malnutrition cycle.

The nutritional response to emergencies follows a defined sequence. An initial **rapid nutritional assessment** determines the severity and nature of nutritional crisis among the affected



population. **Nutrition surveillance** using anthropometric screening, particularly MUAC, identifies individuals requiring immediate treatment. Targeted interventions include **blanket supplementary feeding** for all vulnerable groups during acute crisis phases, and **selective feeding programmes** for identified cases of acute malnutrition. Coordination of nutrition with water and sanitation, health, and shelter responses is essential since these sectors are deeply interdependent.

Fill in the blank: Emergency nutrition responses include rapid nutritional assessment, MUAC-based \_\_\_\_\_ surveillance, blanket supplementary feeding for vulnerable groups, and selective feeding for identified acute malnutrition cases.

### 5.2.3 General food ration and therapeutic feeding in emergencies

The **general food ration (GFR)** in humanitarian emergencies is the standardised minimum food basket provided to all affected individuals regardless of nutritional status. The international standard general ration provides approximately **2100 kilocalories per person per day**, with adequate protein and fat content, typically composed of staple cereal (usually wheat or maize flour), pulses (beans or lentils), vegetable oil, and salt, often supplemented with a blended fortified food such as **corn-soya blend** to address micronutrient gaps.

**Therapeutic feeding** in emergencies addresses severe acute malnutrition (SAM) using a two-phase protocol. The **stabilisation phase** manages medical complications including hypoglycaemia, hypothermia, infection, and severe dehydration using F-75 therapeutic milk formula at restricted intake, with careful refeeding to avoid refeeding syndrome. The **rehabilitation phase** transitions to F-100 therapeutic milk or **ready-to-use therapeutic food (RUTF)** to rebuild tissues and restore weight. Community-based management of acute malnutrition (CMAM) enables uncomplicated SAM cases to be treated at home with RUTF.

Fill in the blank: The general food ration provides approximately 2100 kilocalories per person per day; therapeutic feeding for SAM uses a stabilisation phase with F-75 and a rehabilitation phase with F-100 or \_\_\_\_\_ therapeutic food.





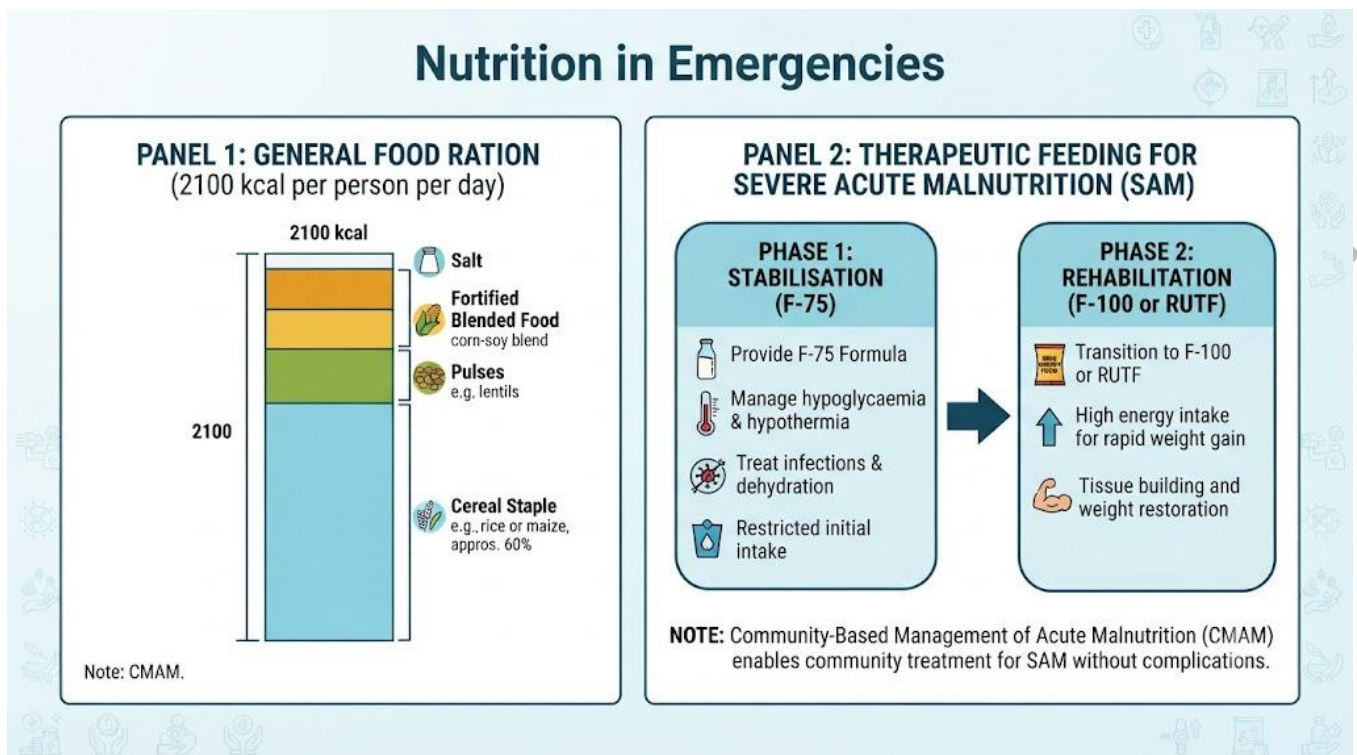


Figure 5.2: The general food ration and two-phase therapeutic feeding protocol for severe acute malnutrition in emergencies

### Pilot questions 5.2

1. Distinguish between impairment, disability, and handicap as defined by the WHO ICIDH. (Linked to SLO 5.3)
2. Describe four nutritional implications of handicap. (Linked to SLO 5.3)
3. Explain how disasters simultaneously create nutritional crises through multiple pathways. (Linked to SLO 5.4)
4. Describe the components of a general food ration in humanitarian emergencies. (Linked to SLO 5.4)
5. Describe the two phases of therapeutic feeding for severe acute malnutrition. (Linked to SLO 5.4)



## 5.3 Social Welfare Services and Their Interface with Nutrition

### 5.3.1 Social welfare services: definition and scope

**Social welfare services** are the organised programmes and institutions through which government and civil society provide support to individuals and families who are unable to meet their own basic needs due to poverty, disability, age, illness, or social exclusion. They represent the social protection dimension of the health and development system, addressing the root causes of vulnerability rather than only treating their immediate manifestations.

The scope of social welfare services is broad, encompassing **income support and cash transfers** for poor households, **institutional care** for orphans, the elderly, and people with severe disabilities, **community-based support programmes** including home care and day centres, **child protection services**, family support and counselling, **vocational training** for people with disabilities and other vulnerable groups, and coordination with health, education, and nutrition services to address the multiple dimensions of vulnerability simultaneously.

Fill in the blank: Social welfare services provide support to vulnerable individuals through income support, institutional care, community programmes, child protection, vocational training, and coordination with \_\_\_\_\_, education, and nutrition services.

### 5.3.2 Social welfare services relevant to nutrition in Nigeria

Several specific social welfare programmes in Nigeria are directly relevant to nutritional outcomes. The **National Social Investment Programme (NSIP)** has included cash transfer components such as the **Conditional Cash Transfer (CCT)** programme targeting the poorest households, which can increase household food purchasing power and improve dietary diversity when combined with nutrition education. The **National Home-Grown School Feeding Programme** provides daily cooked meals to primary school children, improving enrolment, attendance, and dietary diversity for school-age children.

Services for **people with disabilities** through the **Federal Ministry of Humanitarian Affairs** and state social welfare departments include provision of assistive devices, institutional care, community-based rehabilitation support, and vocational training enabling economic





participation. **Child nutrition services** linked to social welfare include programmes for orphans and vulnerable children (OVC) that combine nutritional support with health, education, and psychosocial services. **Maternal and child welfare centres** provide combined health, nutrition, and social support to pregnant women, lactating mothers, and young children in many states.

Fill in the blank: Nigerian social welfare programmes relevant to nutrition include the Conditional Cash Transfer, the National Home-Grown School Feeding Programme, disability services, OVC programmes, and maternal and child \_\_\_\_\_ centres.

### 5.3.3 Integration of nutrition into social welfare programmes

Integrating nutrition into social welfare programmes requires moving beyond treating nutrition as a separate sectoral concern toward embedding **nutrition-sensitive approaches** within all welfare service delivery. Cash transfer programmes become more nutrition-effective when combined with **behaviour change communication** that guides how additional income is spent on food and when linked to **conditional incentives** such as requiring beneficiaries to attend nutrition education sessions or bring children for growth monitoring.

**School feeding programmes** can be designed to maximise nutritional impact by diversifying menus to include protein foods, fruits, and vegetables beyond the cereal-only rations that often dominate, and by sourcing food locally to simultaneously support agricultural livelihoods. **Social protection programmes for the elderly** should address nutritional needs specific to ageing populations, including increased protein requirements to prevent sarcopenia and micronutrient needs for bone health. Effective integration requires **inter-ministerial coordination** between welfare, health, agriculture, and education departments, and strong community participation to ensure services reach and are accepted by intended beneficiaries.

Fill in the blank: Integrating nutrition into social welfare requires nutrition-sensitive approaches including behaviour change communication with cash transfers, diversified \_\_\_\_\_ feeding menus, and inter-ministerial coordination.



| <u>Programme or Service</u>                         | <u>Nutritional Relevance</u>                                                                  |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <b>Conditional Cash Transfer</b>                    | Increases purchasing power, dietary diversity with behaviour change communication (BCC)       |
| <b>National Home-Grown School Feeding Programme</b> | Provides daily meals, improves dietary diversity, boosts school attendance                    |
| <b>Services for People with Disabilities</b>        | Assistive devices, community-based rehabilitation (CBR), vocational training reducing poverty |
| <b>OVC Programme</b>                                | Nutritional support alongside health and education for orphans and vulnerable children        |
| <b>Maternal and Child Welfare Centres</b>           | Combined health, nutrition, and social support services                                       |

Table 5.1: Social welfare services in Nigeria and their relevance to nutritional outcomes

### Pilot questions 5.3

1. Define social welfare services and describe their scope. (Linked to SLO 5.5)
2. Describe the National Home-Grown School Feeding Programme and explain its nutritional significance. (Linked to SLO 5.6)
3. Explain how Conditional Cash Transfer programmes can improve nutritional outcomes. (Linked to SLO 5.6)
4. Describe the welfare services available for people with disabilities in Nigeria. (Linked to SLOs 5.5 to 5.6)
5. Explain why inter-ministerial coordination is essential for integrating nutrition into social welfare. (Linked to SLO 5.6)



## Series Summary

This final Series examined rehabilitation, handicaps, disaster relief nutrition, and social welfare services as they connect with public health nutrition. Rehabilitation is the active process of helping individuals achieve maximum function and independence after disease, injury, or disability, encompassing medical, physical, nutritional, psychological, and vocational types delivered at institutional, outpatient, and community-based levels. The multidisciplinary rehabilitation team includes physicians, physiotherapists, occupational therapists, nutritionists, social workers, and counsellors, while community-based rehabilitation extends services into communities by training family members and volunteers as primary rehabilitation agents supervised by health workers. Handicaps, understood through the WHO distinction between impairment, disability, and handicap, carry significant nutritional implications including impaired feeding mechanics, poverty-related food insecurity, and altered energy requirements.

Emergency and disaster situations create acute nutritional crises through simultaneous destruction of food supplies, displacement, livelihood loss, and increased infection; responses include rapid nutritional assessment, MUAC-based surveillance, blanket supplementary feeding, and selective therapeutic feeding using the two-phase stabilisation (F-75) and rehabilitation (F-100 or RUTF) protocol for severe acute malnutrition. Social welfare services in Nigeria encompass income support, institutional care, child protection, vocational training, and community programmes; those most relevant to nutrition include the Conditional Cash Transfer, the National Home-Grown School Feeding Programme, disability services, OVC programmes, and maternal and child welfare centres. Effective integration of nutrition into social welfare requires nutrition-sensitive programming through behaviour change communication with cash transfers, diversified school menus, and inter-ministerial coordination, ensuring that welfare delivery simultaneously addresses the immediate and underlying determinants of malnutrition across all vulnerable populations.



## Glossary of Terms

1. **Rehabilitation:** the active process of helping individuals achieve maximum function, independence, and social participation after disease, injury, disability, or nutritional disorder.
2. **Community-based rehabilitation (CBR):** a strategy extending rehabilitation services into communities by training family members and volunteers as primary rehabilitation agents supervised by health workers.
3. **Impairment:** a structural or functional loss at the level of body organ or system.
4. **Disability:** a restriction in activity resulting from an impairment.
5. **Handicap:** the social and environmental disadvantage experienced as a result of an impairment or disability that limits fulfilment of a normal role.
6. **General food ration (GFR):** the standardised minimum food basket provided in humanitarian emergencies, supplying approximately 2100 kilocalories per person per day.
7. **Ready-to-use therapeutic food (RUTF):** a peanut-based energy-dense fortified food used in the rehabilitation phase of community-based management of acute malnutrition.
8. **Community-based management of acute malnutrition (CMAM):** the approach enabling uncomplicated severe acute malnutrition to be treated at home using RUTF without hospital admission.
9. **Social welfare services:** organised programmes providing support to individuals and families unable to meet their own basic needs due to poverty, disability, age, or social exclusion.
10. **Conditional Cash Transfer (CCT):** a social protection programme providing cash to poor households conditional on meeting defined behavioural requirements such as attending nutrition education or health services.
11. **National Home-Grown School Feeding Programme:** a Nigerian programme providing daily cooked meals to primary school children, improving attendance, enrolment, and dietary diversity.



## Concept Check Questions [Series 5]

### Objective Questions

- Rehabilitation aims to restore function, prevent secondary complications, promote independence, and support social \_\_\_\_\_ of individuals after disease or disability. (Linked to SLO 5.1)
- Community-based rehabilitation trains family members and community volunteers as primary rehabilitation agents supervised by \_\_\_\_\_ workers. (Linked to SLO 5.2)
- WHO ICIDH distinguishes impairment (structural loss), disability (restricted activity), and \_\_\_\_\_ (social disadvantage from disability). (Linked to SLO 5.3)
- The general food ration in humanitarian emergencies provides approximately \_\_\_\_\_ kilocalories per person per day. (Linked to SLO 5.4)
- Therapeutic feeding for SAM uses a stabilisation phase with F-75 and a rehabilitation phase with F-100 or ready-to-use \_\_\_\_\_ food. (Linked to SLO 5.4)
- The National Home-Grown School \_\_\_\_\_ Programme provides daily cooked meals to primary school children in Nigeria. (Linked to SLO 5.6)

### Short-Answer Questions

- Describe five types of rehabilitation. (Linked to SLO 5.1)
- Describe four nutritional implications of handicap. (Linked to SLO 5.3)
- Explain how the Conditional Cash Transfer programme can improve nutritional outcomes. (Linked to SLO 5.6)

### Long-Answer Questions

- Discuss rehabilitation in the context of public health nutrition, covering its goals, types, levels, and the role of community-based rehabilitation. (Linked to SLOs 5.1 to 5.2)
- Describe the nutritional response to disasters and emergencies, including assessment, general food rations, and therapeutic feeding. (Linked to SLO 5.4)



## Answers to Concept Check Questions [Series 5]

### Objective Questions

1. Reintegration.
2. Health.
3. Handicap.
4. 2100.
5. Therapeutic.
6. Feeding.

### Short-Answer Questions

7. Medical rehabilitation (treating underlying conditions); physical rehabilitation (physiotherapy, occupational therapy, mobility); nutritional rehabilitation (restoring nutritional status in PEM and deficiency); psychological rehabilitation (mental health consequences of disability); vocational rehabilitation (skills for employment and economic participation).
8. Four implications: impaired chewing, swallowing, and self-feeding in physical and neurological handicaps; intellectual handicaps limiting dietary understanding; poverty associated with disability reducing food access; immobility altering energy expenditure and requiring dietary adjustment.
9. CCT programmes increase household food purchasing power, enabling purchase of more diverse and nutritious foods; when combined with behaviour change communication they guide how additional income is spent on food; and when linked to conditional incentives such as nutrition education attendance or growth monitoring, they simultaneously strengthen nutrition knowledge and practice.

### Long-Answer Questions

10. **Basic response:** Goals: restore function, prevent secondary complications, promote independence, support social reintegration. Types: medical (treat conditions, manage complications), physical (physiotherapy, occupational therapy), nutritional (restore



nutritional status in PEM and deficiency), psychological (mental health, self-esteem), vocational (skills for employment). Levels: institutional (hospitals, specialist centres), outpatient or day care (services while living at home), community-based rehabilitation (within own community). CBR: strategy extending services into communities; trains family members and volunteers as primary agents; supervised by health workers; important in Nigeria because institutional services have limited reach; enables rehabilitation for people who cannot access hospital-based care.

**Value-added response:** Community-based rehabilitation represents a fundamental shift in how rehabilitation is conceptualised, from a service delivered to passive recipients in specialist institutions to a process that communities own and implement for their members; this shift is not only more equitable and accessible but ultimately more sustainable, because it builds the community's own capacity to support people with disabilities rather than creating permanent dependence on externally delivered professional services.

11. **Basic response:** Disaster nutrition crisis pathways: destruction of food supplies; displacement from homes and food sources; loss of livelihoods and purchasing power; health system overwhelm; crowding and poor sanitation driving infection; infection-malnutrition cycle worsening status. Response sequence: rapid nutritional assessment (determine severity and nature); MUAC-based screening and surveillance (identify individuals for treatment); blanket supplementary feeding (all vulnerable groups during acute crisis). General food ration: approximately 2100 kilocalories per person per day; cereal, pulses, vegetable oil, salt, and fortified blended food. Therapeutic feeding: stabilisation phase (F-75, medical complications management, avoid refeeding syndrome); rehabilitation phase (F-100 or RUTF for tissue rebuilding and weight restoration); CMAM for uncomplicated SAM at community level.

**Value-added response:** The community-based management of acute malnutrition model, which allows uncomplicated SAM to be treated at home with RUTF, has transformed emergency nutrition response by dramatically increasing coverage and reducing the burden on hospital systems; before CMAM, only a fraction of SAM cases could be treated because therapeutic feeding required inpatient admission, but CMAM has shown





that the majority of cases can be successfully treated in the community, making large-scale response to acute malnutrition crises feasible for the first time.

## **Answers to Pilot Questions [Series 5]**

### **Part 5.1**

6. Rehabilitation is the process of helping individuals achieve maximum function and independence after disease, injury, or disability. Its four goals are restoring function, preventing secondary complications, promoting independence in daily activities, and supporting social reintegration.
7. Five types: medical (treating underlying conditions and managing complications); physical (physiotherapy and occupational therapy for mobility and daily activities); nutritional (restoring nutritional status in PEM and deficiency); psychological (mental health consequences of disability); vocational (skills for employment and economic participation).
8. Core team members: physician or medical officer (clinical management), physiotherapist (physical function and mobility), occupational therapist (daily living activities), nutritionist or dietitian (nutritional rehabilitation), social worker (social reintegration), and psychologist or counsellor (mental health support).
9. CBR is a strategy extending rehabilitation into communities by training family members and volunteers as primary rehabilitation agents supervised by health workers. It is important in Nigeria because institutional services have limited reach, particularly in rural areas, and CBR enables people with disabilities to receive support within their own communities.
10. Nutritional rehabilitation involves restoring nutritional status through appropriate dietary management and supplementation in individuals with PEM including kwashiorkor and marasmus, micronutrient deficiencies, or disease-related malnutrition such as that associated with TB, HIV, and chronic illness.

### **Part 5.2**



11. Impairment is a structural or functional loss at organ or system level. Disability is the restriction in activity resulting from impairment. Handicap is the social and environmental disadvantage experienced as a result of disability that prevents fulfilment of a normal social role.
12. Four nutritional implications: impaired chewing, swallowing, and self-feeding in physical and neurological handicaps reducing food intake; intellectual handicaps limiting dietary knowledge and compliance with feeding recommendations; poverty associated with disability reducing household food purchasing power; immobility reducing energy expenditure, requiring dietary caloric adjustment.
13. Disasters simultaneously create nutritional crises by destroying food supplies and infrastructure, displacing populations from food sources, destroying livelihoods and purchasing power, overwhelming health systems, and creating crowding and sanitation failures that drive infectious disease, which triggers the infection-malnutrition cycle and worsens nutritional status.
14. The general food ration provides approximately 2100 kilocalories per person per day, comprising staple cereal (wheat or maize flour), pulses (beans or lentils), vegetable oil, salt, and often a fortified blended food such as corn-soya blend to address micronutrient gaps.
15. Stabilisation phase: manages medical complications (hypoglycaemia, hypothermia, infection, dehydration) using F-75 therapeutic milk at restricted intake, avoiding refeeding syndrome. Rehabilitation phase: transitions to F-100 therapeutic milk or RUTF for tissue rebuilding and weight restoration; CMAM enables uncomplicated SAM to be treated at home with RUTF.

### **Part 5.3**

1. Social welfare services are organised programmes providing support to individuals and families unable to meet basic needs due to poverty, disability, age, illness, or social exclusion. Scope includes income support, institutional care, community programmes, child protection, family counselling, vocational training, and coordination with health, nutrition, and education.



2. The National Home-Grown School Feeding Programme provides daily cooked meals to primary school children. Its nutritional significance includes improving dietary diversity for school-age children, reducing hunger that impairs learning, incentivising school attendance and enrolment, and when designed well, providing protein, vegetables, and fruits beyond starchy staples.
3. CCT programmes improve nutrition by increasing household food purchasing power; when combined with behaviour change communication they guide expenditure toward nutritious foods; when linked to conditional incentives such as nutrition education or growth monitoring attendance, they simultaneously improve nutritional knowledge and health service utilisation.
4. Welfare services for people with disabilities in Nigeria include provision of assistive devices (wheelchairs, crutches, hearing aids), institutional care for those with severe disabilities, community-based rehabilitation support, and vocational training enabling economic participation and reducing poverty-related food insecurity.
5. Inter-ministerial coordination is essential because nutrition outcomes depend on actions across health, agriculture, education, social welfare, and finance ministries; no single ministry controls all the determinants of nutritional vulnerability, and fragmented delivery with each sector acting independently produces duplicated effort, missed populations, and insufficient impact.



## References and Attributions [Series 5]

### Textual References

6. World Health Organization. (2010). Community-Based Rehabilitation: CBR Guidelines. Geneva: WHO.
7. Sphere Project. (2018). Humanitarian Charter and Minimum Standards in Humanitarian Response. Geneva: Sphere.
8. Federal Ministry of Humanitarian Affairs, Disaster Management and Social Development Nigeria. (2021). National Social Investment Programme Report. Abuja: FMHDSD.
9. Park, K. (2017). Park's Textbook of Preventive and Social Medicine (24th ed.). Jabalpur: Banarsidas Bhanot.

### Figures, Plates, Tables, and Boxes

10. Figure 5.1: Types and levels of rehabilitation. AI generation prompt: "Create a clean diagram titled Types of Rehabilitation, showing five boxes in a row: Medical (treating conditions, managing complications), Physical (physiotherapy, occupational therapy, mobility), Nutritional (restoring nutritional status in PEM), Psychological (mental health, self-esteem), Vocational (skills for employment); below them three level boxes: Institutional (hospitals, specialist centres), Outpatient or Day Care (services while at home), Community-Based Rehabilitation (community, family and volunteer agents); clean professional infographic style." Suggested OER search string: "types of rehabilitation medical physical nutritional vocational community-based diagram".
11. Figure 5.2: General food ration and therapeutic feeding for SAM. AI generation prompt: "Create a clean two-panel diagram titled Nutrition in Emergencies: left panel stacked bar General Food Ration (2100 kcal; Cereal Staple, Pulses, Vegetable Oil, Salt, Fortified Blended Food); right panel two-phase flowchart Therapeutic Feeding for SAM (Phase 1 Stabilisation with F-75; Phase 2 Rehabilitation with F-100 or RUTF; note CMAM community treatment); clean professional infographic style." Suggested OER search string: "emergency nutrition general food ration therapeutic feeding SAM F-75 F-100 RUTF diagram".
12. Table 5.1: Social welfare services in Nigeria relevant to nutrition. AI generation prompt: "Create a clean two-column table titled Social Welfare Services in Nigeria Relevant to



Nutrition; five rows: Conditional Cash Transfer, School Feeding Programme, Disability Services, OVC Programme, Maternal and Child Welfare Centres; each with nutritional relevance; alternating row shading." Suggested OER search string: "social welfare services Nigeria nutrition table CCT school feeding disability OVC".

