

HTM201

INTRODUCTION TO NUTRITION AND FOOD PRODUCTION



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Course Title: Introduction to Nutrition and food production

Course Code: HMT 201

Course Unit: 2 Units

- Foundations and History of Nutrition Science
- Food Constituents: Sources, Digestion, and Roles
- Human Physiology and Dietary Relevance
- Tourists' Nutrition: Seasonal and Health Variations
- Nutrient Requirements, Deficiencies, and Absorption Process

Suggested outline for series 1: Foundations and History of Nutrition Science

- **Part 1: Definition and Scope of Nutrition Science**
 - Meaning of Nutrition
 - Scope and Relevance of Nutrition to Human Existence
- **Part 2: Historical Development of Nutrition Science**
 - Early Concepts of Food and Health
 - Milestones in the Study of Nutrients
 - Modern Advances in Nutrition
- **Part 3: Importance of Nutrition in Food Production**
 - Role of Nutrition in Food Preparation and Processing
 - Link between Nutrition and Dietary Intake
- **Part 4: Nutrition as a Foundation for Tourism and Hospitality**
 - Nutrition in Hospitality Services
 - Nutrition as a Basis for Tourist Health and Satisfaction

Introduction

Food is central to human survival, yet the scientific study of nutrition as we know it today has developed gradually over centuries. Early societies recognised the importance of food for strength and wellbeing, but they lacked the systematic knowledge that modern nutrition science provides. By tracing the foundations and history of this discipline, you will appreciate how nutrition has evolved into a cornerstone of food production and hospitality, shaping the way we eat, prepare meals, and care for health.

The aim of this Series is to introduce you to the origins and development of nutrition science, highlighting its definition, scope, and relevance to food production and tourism. It seeks to build a strong conceptual base that will support your learning in subsequent Series.



We shall commence this Series by examining the definition and scope of nutrition science, clarifying its meaning and significance. Next, we will explore the historical development of nutrition, beginning with early ideas about food and health, then moving on to key milestones and modern advances. Following that, we will consider the importance of nutrition in food production, focusing on its role in preparation, processing, and dietary intake. Finally, we will round off the Series by linking nutrition to tourism and hospitality, showing how it underpins the health and satisfaction of travellers.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 1.1** define the concept of nutrition and explain its scope in relation to human existence,
- **SLO 1.2** analyse the historical development of nutrition science by identifying key milestones and modern advances,
- **SLO 1.3** explain the importance of nutrition in food production, focusing on its role in preparation, processing, and dietary intake, and
- **SLO 1.4** evaluate the relevance of nutrition to tourism and hospitality, particularly in promoting health and satisfaction among travellers.

1.1 Definition And Scope Of Nutrition Science

1.1.1 Meaning of nutrition

Nutrition is the science that studies **food** and how the body uses it for growth, maintenance, and health. It involves the processes of ingestion, digestion, absorption, and utilisation of nutrients. In simple terms, nutrition explains how what we eat influences our physical wellbeing and daily performance.

Food is made up of different **nutrients**, which are chemical substances found in food that provide energy, build and repair tissues, and regulate body processes. Examples include carbohydrates, proteins, fats, vitamins, minerals, and water. Each nutrient plays a unique role, and together they sustain life.

Fill in the blank: Nutrition is the science that studies _____ and how the body uses it.



FOOD → NUTRENTS → BODY FUNCTIONS

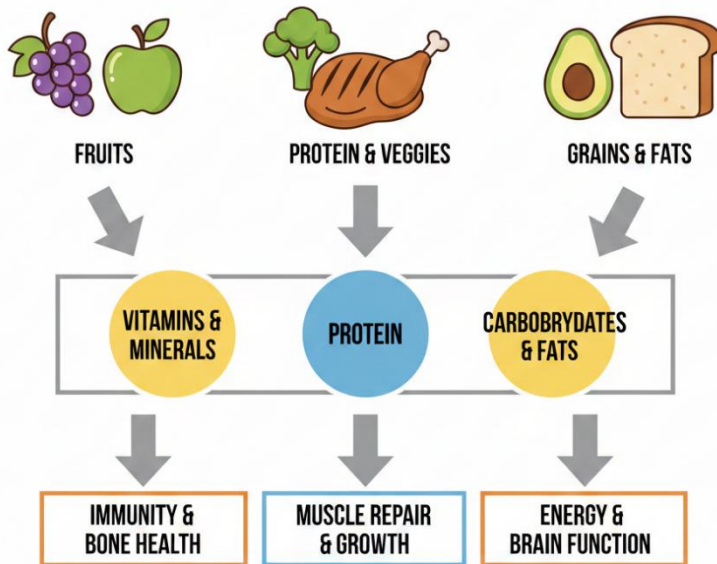


Diagram showing the relationship between food, nutrients, and body functions

Figure 1.1: The link between food and nutrition

Search string: “nutrition science diagram food nutrients OER”

1.1.2 Scope and relevance of nutrition to human existence

The **scope of nutrition** extends beyond simply eating food. It covers the study of nutrient **composition**, their sources, how they are digested and absorbed, and their roles in maintaining health. Nutrition also examines the consequences of deficiencies and excesses, making it a vital field for both individuals and societies.

The relevance of nutrition is seen in its impact on growth, immunity, energy levels, and disease prevention. For instance, adequate protein intake supports tissue repair, while vitamins and minerals regulate body functions such as vision, blood clotting, and bone strength. Nutrition also influences productivity, as a well-nourished person is more energetic and efficient.

Fill in the blank: The scope of nutrition includes the study of nutrient _____, sources, digestion, absorption, and roles in health.

Examples of nutrition in daily life Nutrition affects everyday activities such as choosing balanced meals, preventing illnesses, and supporting recovery from disease. For example, eating



fruits rich in vitamin C helps the body resist infections, while consuming enough carbohydrates provides energy for work and leisure.

What You Do	Key Nutrient	Why It Matters
Eat Berries & Spinach	Vitamins & Antioxidants	Immune Shield: Strengthens your "biological armor" to fight off germs and stay in class.
Snack on Chicken or Lentils	Protein	The Builder: Acts like "bricks" to repair muscles and tissues after gym class or sports.
Sip Water Frequently	Hydration (SH_2OS)	Brain Fuel: Improves focus and prevents the "afternoon slump" or headaches.
Eat Oats or Brown Rice	Complex Carbs	Steady Power: Provides long-lasting energy so you don't crash before the final bell.
Drink Milk or Fortified Soy	Calcium & Vitamin D	Bone Strength: Builds a strong skeletal frame while you are still growing.

Box 1.1: Examples of nutrition in daily life

- Eating fruits and vegetables to boost immunity
- Consuming protein-rich foods for tissue repair
- Drinking sufficient water for hydration

Search string: “nutrition daily life examples OER”

Pilot questions 1.1

1. Nutrition can be defined as the science that studies _____.
2. Which nutrient is primarily responsible for tissue repair?
3. The scope of nutrition includes studying nutrient composition, sources, _____, absorption, and roles.
4. Give one example of how nutrition supports daily life activities.
5. Which vitamin is important for boosting immunity?

1.2 Historical Development Of Nutrition Science

1.2.1 Early concepts of food and health

In ancient times, people recognised that food was essential for survival, but their explanations were often based on tradition or belief rather than science. For example, early civilisations linked certain foods with strength, fertility, or healing powers. The Greeks believed in the balance of the four **humours**, associating food with bodily fluids that influenced health. Although these ideas



were not scientifically accurate, they marked the beginning of attempts to explain the relationship between diet and wellbeing.

Fill in the blank: Ancient Greek medicine linked food with the balance of the four _____.

Image showing ancient food practices such as bread, fruits, and herbs used for healing

Plate 1.1: Early food practices in ancient civilizations

Search string: “ancient food practices nutrition OER”

1.2.2 Milestones in the study of nutrients

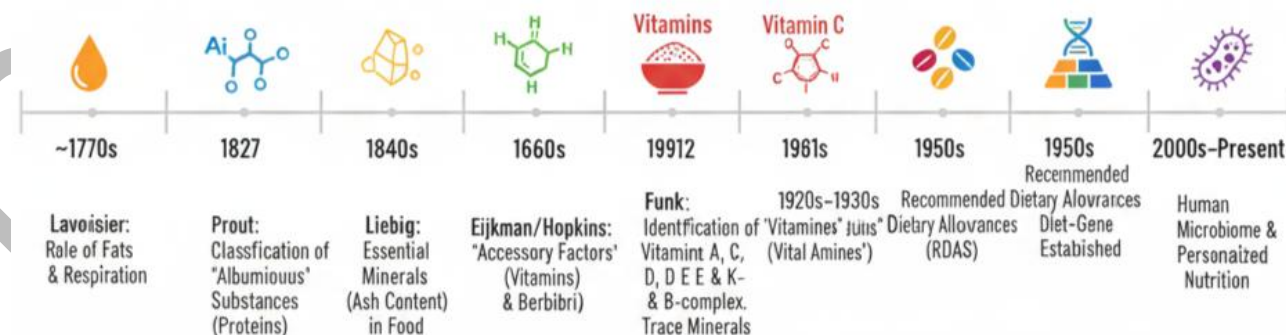
The scientific study of nutrition began to take shape during the Renaissance and Enlightenment periods, when scholars started to investigate the chemical composition of food. The discovery of **carbohydrates** (sugars and starches that provide energy), **proteins** (molecules that build and repair tissues), and **fats** (substances that store energy and support cell structure) marked important milestones. Later, the identification of **vitamins** and **minerals** revealed their crucial roles in preventing diseases such as **scurvy** and rickets.

By the nineteenth century, nutrition science had become more systematic, with experiments showing how nutrients were digested and absorbed. This period laid the foundation for modern dietary guidelines.

Fill in the blank: The discovery of vitamins helped prevent diseases such as _____ and rickets.

MILESTONES IN NUTRITION SCIENCE

A Journey of Discovery: From Macronutrients to Micronutrients



Timeline diagram showing milestones in nutrition science: discovery of carbohydrates, proteins, fats, vitamins, and minerals

Figure 1.2: Key milestones in nutrition science

Search string: “nutrition science history timeline OER”

1.2.3 Modern advances in nutrition

In the twentieth and twenty-first centuries, nutrition science expanded rapidly with the development of laboratory techniques and medical research. Scientists now study how nutrients interact at the molecular level, how genetics influences dietary needs, and how nutrition affects chronic diseases such as diabetes and heart disease. The concept of **balanced diet**, defined as a diet that provides all essential nutrients in the right **proportions**, became central to public health campaigns.

Modern nutrition also considers social and cultural factors, recognising that food choices are influenced by availability, tradition, and lifestyle. This holistic approach ensures that nutrition science remains relevant to diverse populations.

Fill in the blank: A balanced diet provides all essential nutrients in the right _____.

Feature	Source	Role in the Body
Steady Energy	Carbohydrates & Fats	Provides the "fuel" for physical activity and the glucose your brain needs to concentrate.
Growth & Repair	Proteins	Acts as the building blocks for muscles, skin, and organs; essential for growth spurts.
Vital Regulation	Vitamins & Minerals	These micronutrients act as "spark plugs," helping with bone strength, eyesight, and immune defense.
System Flow	Water (Hydration)	Transports nutrients, regulates body temperature, and keeps your brain from feeling "foggy."

Box 1.2: Features of a balanced diet

- Adequate energy from carbohydrates and fats
- Sufficient protein for growth and repair
- Essential vitamins and minerals for regulation
- Enough water for hydration

Search string: “balanced diet features OER”

Pilot questions 1.2

1. Early civilisations believed food influenced health through the balance of the four _____.



2. Which nutrient is primarily responsible for building and repairing tissues?
3. The discovery of vitamins helped prevent diseases such as scurvy and _____.
4. What is the central concept of modern nutrition that ensures all nutrients are provided in correct proportions?
5. Name one chronic disease that modern nutrition science helps to address.

1.3 Importance Of Nutrition In Food Production

1.3.1 Role of nutrition in food preparation and processing

Nutrition plays a central role in **food preparation**, which refers to the methods used to make food safe, palatable, and nutritious. Cooking techniques such as boiling, steaming, and grilling influence the nutrient content of food. For example, steaming vegetables helps retain vitamins, while excessive frying may reduce nutrient quality and add unhealthy fats.

In **food processing**, which involves transforming raw ingredients into consumable products, nutrition guides decisions to preserve or enhance nutrient value. Processes such as **fortification**, where nutrients are added to foods like flour or milk, help prevent deficiencies in populations. Thus, nutrition ensures that food preparation and processing not only meet taste preferences but also support health.

Fill in the blank: Adding nutrients to foods during processing is called _____.

COOKING METHODS & NUTRIENT IMPACT

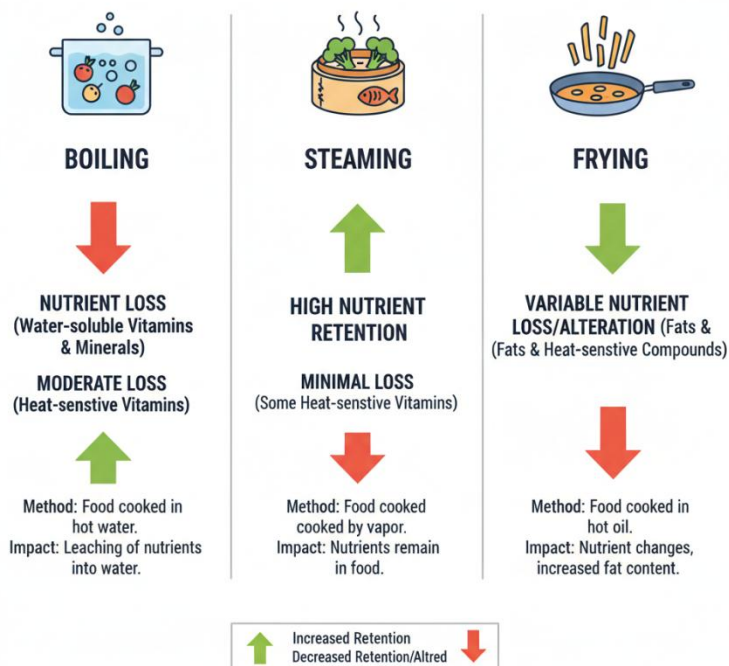


Diagram showing food preparation methods (boiling, steaming, frying) and their impact on nutrients

Figure 1.3: Food preparation methods and nutrient retention

Search string: “food preparation methods nutrition OER”

1.3.2 Link between nutrition and dietary intake

Dietary intake refers to the amount and type of food consumed **daily**. Nutrition provides the framework for determining what constitutes a balanced diet, ensuring that meals supply adequate energy and essential nutrients. For instance, carbohydrates provide fuel for daily activities, proteins support growth and repair, and vitamins regulate body functions.

The link between nutrition and dietary intake is evident in meal planning. A well-designed diet considers age, activity level, and health status. For example, children require more protein for growth, while adults may need more fibre to aid digestion. Nutrition therefore guides dietary choices to promote wellbeing across different life stages.

Fill in the blank: Dietary intake refers to the amount and type of food consumed _____.

Age Group	Nutritional Priority	Best Food Examples	Health Goal
Children	High-Quality Protein	Eggs, lean meats, beans, dairy, and nuts.	Growth & Development: Provides the building blocks for muscles, organs, and a growing brain.
Adults	Dietary Fiber	Whole grains (oats, quinoa), leafy greens, lentils, and apples.	Metabolic Health: Supports healthy digestion, stabilizes blood sugar, and aids in weight management.
Elderly	Calcium & Vitamin D	Fortified milk, sardines, kale, yogurt, and almonds.	Bone Density: Counteracts bone loss to prevent fractures and maintain skeletal strength.

Box 1.3: Examples of nutrition-guided dietary intake

- Children: protein-rich foods for growth
- Adults: fibre-rich foods for digestion
- Elderly: calcium-rich foods for bone strength

Search string: “nutrition dietary intake examples OER”

Pilot questions 1.3



1. Which cooking method helps retain vitamins in vegetables?
2. Adding nutrients to foods during processing is called _____.
3. What term refers to the amount and type of food consumed daily?
4. Give one example of how nutrition guides dietary intake for children.
5. Which nutrient is essential for bone strength in the elderly?

1.4 Nutrition As A Foundation For Tourism And Hospitality

1.4.1 Nutrition in hospitality services

In the hospitality industry, **nutrition** is the science of providing food that meets the dietary needs of guests while ensuring **satisfaction** and wellbeing. Hotels, restaurants, and resorts must consider nutritional balance when designing menus, as guests often come from diverse backgrounds with varying health requirements. For example, offering vegetarian options, low-fat meals, or high-protein dishes ensures inclusivity and promotes health.

Nutrition also influences the quality of service. A well-planned menu not only enhances the guest experience but also reflects the professionalism of the hospitality provider. In this way, nutrition becomes a tool for building reputation and customer loyalty.

Fill in the blank: In hospitality, nutrition ensures that food meets dietary needs while promoting guest _____.

Diagram showing the relationship between hospitality services, menu planning, and guest satisfaction *Figure 1.4: Nutrition in hospitality services*

Search string: “hospitality nutrition menu planning OER”

1.4.2 Nutrition as a basis for tourist health and satisfaction

Tourists often travel across regions with different climates, cultures, and food availability. Nutrition plays a vital role in maintaining their health during these journeys. For instance, tourists visiting hot climates may require more water and **electrolytes**, while those in colder regions may need energy-dense foods.

Providing nutritionally balanced meals helps prevent fatigue, illness, and dissatisfaction. Tourists who receive appropriate nutrition are more likely to enjoy their experiences and recommend destinations. Thus, nutrition is not only a matter of health but also a factor in tourism success.

Fill in the blank: Tourists in hot climates require more water and _____ to maintain health.



Environment	Nutritional Focus	Food & Drink Examples	The Goal
Hot Climates	Hydration & Electrolytes	Water, coconut water, citrus fruits, and light salty snacks.	Heat Regulation: Replaces minerals lost through sweat and prevents heat exhaustion.
Cold Climates	Energy-Dense Foods	Whole grains, nuts, seeds, avocados, and warm stews.	Thermoregulation: Provides the "slow-burn" calories needed to generate body heat.
Long Travel	Balanced Micronutrients	Lean protein wraps, fresh fruit, and magnesium-rich nuts.	Fatigue Prevention: Keeps blood sugar stable and prevents "brain fog" during transit.

Box 1.4: Examples of nutrition needs in tourism

- Hot climates: hydration and electrolytes
- Cold climates: energy-dense foods
- Long travel: balanced meals to prevent fatigue

Search string: "tourist nutrition needs OER"

Pilot questions 1.4

1. Nutrition in hospitality ensures food meets dietary needs and promotes guest _____.
2. Why is menu planning important in hospitality services?
3. Tourists in hot climates require more water and _____.
4. Give one example of nutrition needs for tourists in cold climates.
5. How does nutrition contribute to tourism success?

Series Summary

This Series introduced the foundations and history of nutrition science. We defined nutrition, explored its scope, traced historical development, examined its role in food production, and evaluated its relevance to tourism and hospitality. We began by clarifying what nutrition means and how it extends beyond food consumption to include digestion, absorption, and the roles of nutrients. We then traced the historical development of nutrition science, from early concepts of food and health to key milestones such as the discovery of carbohydrates, proteins, fats, vitamins, and minerals, before considering modern advances. Following that, we examined the importance of nutrition in food preparation and processing, linking it to dietary intake and



balanced diets. Finally, we explored how nutrition underpins hospitality services and tourism, ensuring guest satisfaction and traveller health.

By completing this Series, you should now be able to define nutrition and explain its scope (SLO 1.1), analyse the historical development of nutrition science (SLO 1.2), explain the importance of nutrition in food production (SLO 1.3), and evaluate its relevance to tourism and hospitality (SLO 1.4). These outcomes provide you with a strong foundation for the subsequent Series, where we will build on this knowledge to explore food constituents and their roles in greater detail.

Glossary of Terms

- **Balanced diet:** A diet that provides all essential nutrients in the right proportions to maintain health and wellbeing.
- **Dietary intake:** The amount and type of food consumed daily, which determines the supply of energy and nutrients to the body.
- **Food preparation:** The methods used to make food safe, palatable, and nutritious, such as boiling, steaming, or frying.
- **Food processing:** The transformation of raw ingredients into consumable products, often guided by nutrition to preserve or enhance nutrient value.
- **Hospitality services:** The provision of food and accommodation in hotels, restaurants, and resorts, where nutrition plays a role in menu planning and guest satisfaction.
- **Nutrition:** The science that studies food and how the body uses it for growth, maintenance, and health.
- **Nutrients:** Chemical substances in food that provide energy, build and repair tissues, and regulate body processes, including carbohydrates, proteins, fats, vitamins, minerals, and water.
- **Scope of nutrition:** The range of areas covered by nutrition science, including nutrient composition, sources, digestion, absorption, and roles in health.
- **Tourism nutrition:** The application of nutrition principles to meet the dietary needs of travellers, ensuring health and satisfaction during journeys.
- **Vitamin:** An organic compound required in small amounts to regulate body functions and prevent deficiency diseases such as scurvy and rickets.

Concept Check Questions

Objective questions

1. Nutrition can be defined as the science that studies _____ and how the body uses it (Linked to SLO 1.1).



2. Which nutrient is primarily responsible for building and repairing tissues? (Linked to SLO 1.2).
3. Adding nutrients to foods during processing is called _____ (Linked to SLO 1.3).
4. Tourists in hot climates require more water and _____ to maintain health (Linked to SLO 1.4).

Short-answer questions

5. Define the term “balanced diet” and explain why it is important (Linked to SLO 1.2).
6. State one way in which food preparation methods can affect nutrient retention (Linked to SLO 1.3).
7. Give one example of how nutrition supports hospitality services (Linked to SLO 1.4).

Long-answer questions

8. Analyse the historical development of nutrition science, highlighting at least three key milestones (Linked to SLO 1.2).
9. Evaluate the relevance of nutrition to tourism and hospitality, explaining how it contributes to guest satisfaction and tourist health (Linked to SLO 1.4).

Answers to Concept Check Questions [Series 1]

Objective questions

1. Food.
2. Protein.
3. Fortification.
4. Electrolytes.

Short-answer questions

5. A balanced diet is one that provides all essential nutrients in the right proportions. It is important because it maintains health, prevents deficiencies, and supports body functions.
6. Steaming vegetables helps retain vitamins, while frying may reduce nutrient quality.
7. Nutrition supports hospitality services by guiding menu planning to meet diverse dietary needs, thereby improving guest satisfaction.

Long-answer questions

8. **Basic response:** Nutrition science developed from early beliefs about food and health, such as the Greek theory of humours. Later, discoveries of carbohydrates, proteins, and fats marked important milestones. The identification of vitamins and minerals in the nineteenth and



twentieth centuries further advanced the field. **Value-added response:** Outstanding learners may add that modern advances include molecular studies of nutrients, the role of genetics in dietary needs, and the application of nutrition to chronic disease prevention. These developments show how nutrition evolved from traditional beliefs to a scientific discipline.

9. **Basic response:** Nutrition is relevant to tourism and hospitality because it ensures that guests receive meals that meet their dietary needs, promoting health and satisfaction. **Value-added response:** Outstanding learners may expand by explaining that nutrition contributes to tourism success by preventing fatigue and illness, adapting meals to different climates, and enhancing the reputation of hospitality providers. This demonstrates how nutrition is both a health necessity and a business advantage.

Answers to Pilot Questions

Answers to Pilot Questions 1.1

1. Food
2. Nutrients
3. Composition
4. Eating fruits rich in vitamin C helps resist infections
5. Vitamin C

Answers to Pilot Questions 1.2

1. Humours
2. Protein
3. Scurvy
4. Balanced diet
5. Diabetes

Answers to Pilot Questions 1.3

1. Steaming
2. Fortification
3. Daily
4. Protein-rich foods for growth
5. Calcium



Answers to Pilot Questions 1.4

1. Satisfaction
2. It ensures menus meet diverse dietary needs and improves guest experience
3. Electrolytes
4. Energy-dense foods
5. By promoting health, preventing fatigue, and enhancing tourism success

References and Attributions

All references and attributions below are presented in APA style for clarity and consistency. They include suggested sources for illustrations, open educational resources (OERs), and AI-generated prompts used in the Series.

Figures and Plates

- *Figure 1.1: The link between food and nutrition* AI-generated suggestion: “Create a simple educational diagram showing food items connected to nutrients and body functions.” Suggested OER search string: “nutrition science diagram food nutrients OER.”
- *Plate 1.1: Early food practices in ancient civilisations* AI-generated suggestion: “Generate an illustration of ancient food practices with bread, fruits, and herbs used for healing.” Suggested OER search string: “ancient food practices nutrition OER.”
- *Figure 1.2: Key milestones in nutrition science* AI-generated suggestion: “Create a timeline diagram showing milestones in nutrition science including carbohydrates, proteins, fats, vitamins, minerals.” Suggested OER search string: “nutrition science history timeline OER.”
- *Figure 1.3: Food preparation methods and nutrient retention* AI-generated suggestion: “Create a diagram showing boiling, steaming, and frying with arrows indicating nutrient retention or loss.” Suggested OER search string: “food preparation methods nutrition OER.”
- *Figure 1.4: Nutrition in hospitality services* AI-generated suggestion: “Create a diagram showing hospitality services linked to nutrition, menu planning, and guest satisfaction.” Suggested OER search string: “hospitality nutrition menu planning OER.”

Boxes

- *Box 1.1: Examples of nutrition in daily life* AI-generated suggestion: “Generate a simple text box listing examples of nutrition in daily life for students.” Suggested OER search string: “nutrition daily life examples OER.”



- *Box 1.2: Features of a balanced diet* AI-generated suggestion: “Generate a text box listing features of a balanced diet for students.” Suggested OER search string: “balanced diet features OER.”
- *Box 1.3: Examples of nutrition-guided dietary intake* AI-generated suggestion: “Generate a text box listing examples of nutrition-guided dietary intake for different age groups.” Suggested OER search string: “nutrition dietary intake examples OER.”
- *Box 1.4: Examples of nutrition needs in tourism* AI-generated suggestion: “Generate a text box listing examples of nutrition needs for tourists in different climates.” Suggested OER search string: “tourist nutrition needs OER.”

General References

- Whitney, E., & Rolfes, S. R. (2019). *Understanding Nutrition* (15th ed.). Cengage Learning.
- Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. (2019). *Introduction to Human Nutrition* (3rd ed.). Wiley-Blackwell.
- World Health Organization. (2020). *Healthy diet*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/healthy-diet> (who.int in Bing)

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2 Food Constituents: Sources, Digestion, and Roles

Series outline

- **Part 1: Major Food Constituents and Their Sources**
 - Carbohydrates: sources and functions



- Proteins: sources and functions
- Fats and oils: sources and functions
- Vitamins and minerals: sources and functions
- Water and fibre: sources and functions
- **Part 2: Digestion and Absorption of Food Constituents**
 - Digestive processes for carbohydrates, proteins, and fats
 - Absorption of vitamins, minerals, and water
 - Role of enzymes in digestion
- **Part 3: Physiological Roles of Food Constituents**
 - Energy provision and metabolism
 - Growth, repair, and regulation of body functions
 - Disease prevention and immunity
- **Part 4: Practical Applications in Diet and Food Production**
 - Balanced diet formulation
 - Food fortification and supplementation
 - Nutrition in food service and hospitality

Introduction

Food is more than just a source of enjoyment; it is the foundation of life and health. Every meal we consume contains different **constituents**, such as carbohydrates, proteins, fats, vitamins, minerals, water, and fibre, each playing a unique role in the body. Understanding these constituents, where they come from, how they are digested, and the roles they perform is essential for anyone studying nutrition and food production. This Series will help you connect the science of nutrients with practical applications in diet and hospitality.

The aim of this Series is to equip you with knowledge of the major food constituents, their sources, digestion, and physiological roles, while also showing how this knowledge is applied in food production and service.

We shall commence this Series by identifying the major food constituents and their sources, including carbohydrates, proteins, fats, vitamins, minerals, water, and fibre. Next, we will explore how these constituents are digested and absorbed, with particular attention to the role of enzymes. Following that, we will examine their physiological roles in energy provision, growth, repair, regulation, and disease prevention. Finally, we will wrap up by considering practical applications such as balanced diet formulation, food fortification, and the relevance of nutrition in food service and hospitality.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 2.1** define the major food constituents and identify their primary sources,



- **SLO 2.2** explain the processes of digestion and absorption for carbohydrates, proteins, fats, vitamins, minerals, and water,
- **SLO 2.3** analyse the physiological roles of food constituents in energy provision, growth, repair, regulation, and disease prevention, and
- **SLO 2.4** apply nutrition principles to practical contexts such as balanced diet formulation, food fortification, and menu planning in food service and hospitality.

2.1 Major Food Constituents And Their Sources

2.1.1 Carbohydrates: sources and functions

Carbohydrates are organic compounds made up of carbon, hydrogen, and oxygen. They are the body's main source of energy. Carbohydrates are found in foods such as cereals, bread, rice, potatoes, fruits, and vegetables. They are classified into simple sugars (like glucose and fructose), complex carbohydrates (like starch), and dietary fibre.

Carbohydrates provide quick and sustained energy, support brain function, and aid digestion when consumed as fibre.

Fill in the blank: The body's main source of energy is _____.

CARBOHYDRATE FOOD SOURCES

Fueling Your Body with Healthy Carbs



Diagram showing examples of carbohydrate sources (bread, rice, fruits, vegetables)



Figure 2.1: Common sources of carbohydrates

Search string: “carbohydrate food sources diagram OER”

2.1.2 Proteins: sources and functions

Proteins are large molecules made up of amino acids. They are essential for growth, tissue repair, and the production of enzymes and hormones. Protein-rich foods include meat, fish, eggs, milk, legumes, and nuts.

Proteins are often called the body’s building blocks because they support muscle development and repair damaged tissues.

Fill in the blank: Proteins are made up of smaller units called _____.

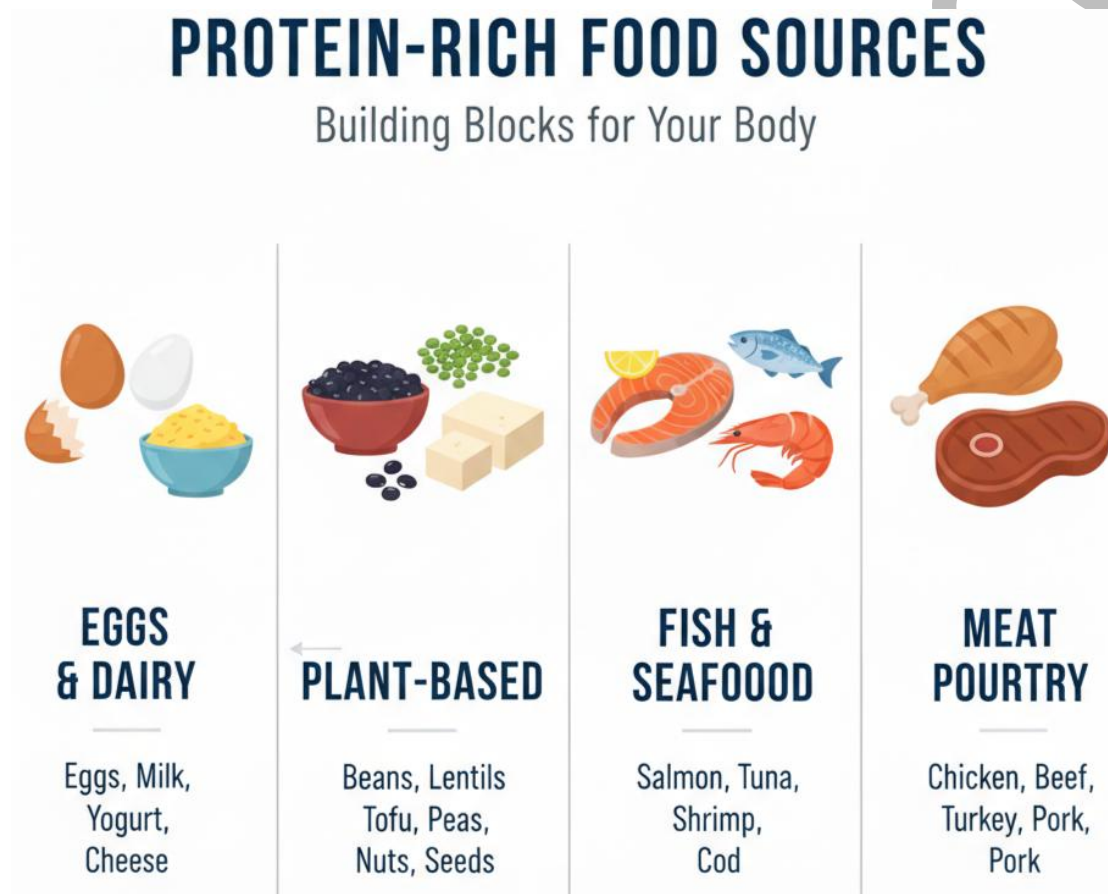


Image showing protein-rich foods such as eggs, beans, fish, and meat

Plate 2.1: Protein-rich food sources

Search string: “protein food sources OER”

2.1.3 Fats and oils: sources and functions

Fats and oils are concentrated sources of energy. They are composed of fatty acids and glycerol. Sources include butter, margarine, vegetable oils, nuts, seeds, and fatty fish.



Fats provide insulation, protect organs, and help absorb fat-soluble vitamins (A, D, E, and K). While essential, excessive intake of unhealthy fats can lead to health problems such as obesity and heart disease.

Fill in the blank: Fats help the body absorb _____-soluble vitamins.

HEALTHY FATS vs. UNHEALTHY FATS

Making Smarter Dietary Choices

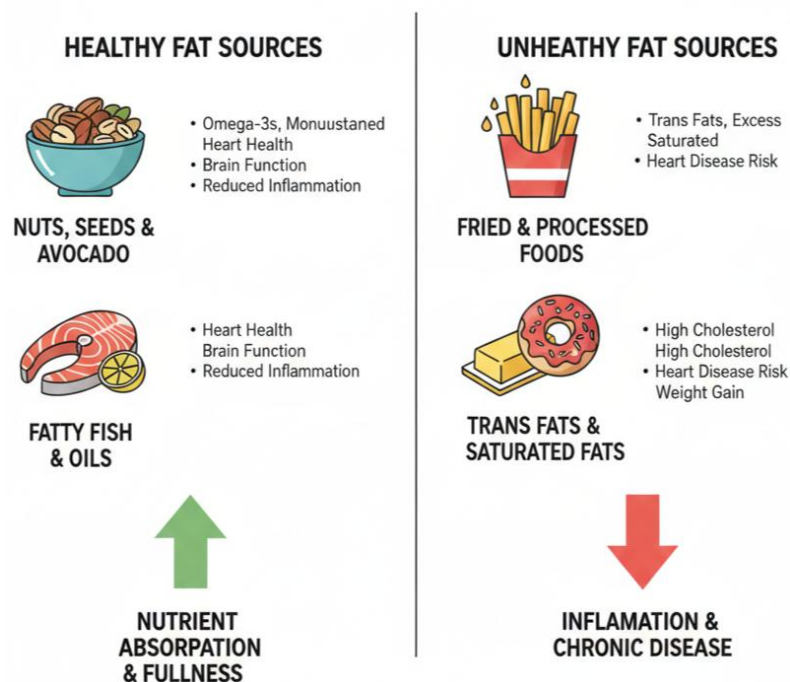


Diagram showing healthy fat sources (nuts, seeds, fish) versus unhealthy fat sources (fried foods, processed snacks)

Figure 2.2: Healthy and unhealthy fat sources

Search string: “healthy vs unhealthy fats OER”

2.1.4 Vitamins and minerals: sources and functions

Vitamins are organic compounds required in small amounts to regulate body processes. Examples include vitamin C (found in citrus fruits) and vitamin D (from sunlight and fortified foods). **Minerals** are inorganic elements such as calcium, iron, and iodine, which are vital for bone strength, blood formation, and thyroid function.

Together, vitamins and minerals prevent deficiency diseases and support overall health.

Fill in the blank: Calcium is a mineral that strengthens _____.



Nutrient	Primary Sources	Key Function	Deficiency Risk
Vitamin C	Citrus fruits, bell peppers, strawberries	Immune Defense: Helps heal wounds and repairs tissues.	Scurvy: Leading to weakness and gum disease.
Vitamin D	Sunlight, fatty fish, fortified milk	Bone Support: Helps the body absorb calcium effectively.	Rickets/Osteoporosis: Weak or brittle bones.
Calcium	Milk, cheese, yogurt, leafy greens	Structural Strength: Builds and maintains strong bones and teeth.	Bone Loss: Increased risk of fractures over time.
Iron	Red meat, spinach, beans, lentils	Oxygen Transport: Essential for making hemoglobin in red blood cells.	Anemia: Causes extreme fatigue and weakness.

Box 2.1: Examples of vitamins and minerals with sources

- Vitamin C: citrus fruits, prevents scurvy
- Vitamin D: sunlight, supports bone health
- Calcium: milk, strengthens bones
- Iron: red meat, supports blood formation

Search string: “vitamins minerals sources OER”

2.1.5 Water and fibre: sources and functions

Water is essential for hydration, temperature regulation, and transport of nutrients. It is obtained from drinking fluids and water-rich foods such as fruits and vegetables.

Fibre is a type of carbohydrate that cannot be digested. It is found in whole grains, fruits, and vegetables. Fibre aids digestion, prevents constipation, and supports gut health.

Fill in the blank: Fibre is a type of carbohydrate that cannot be _____.



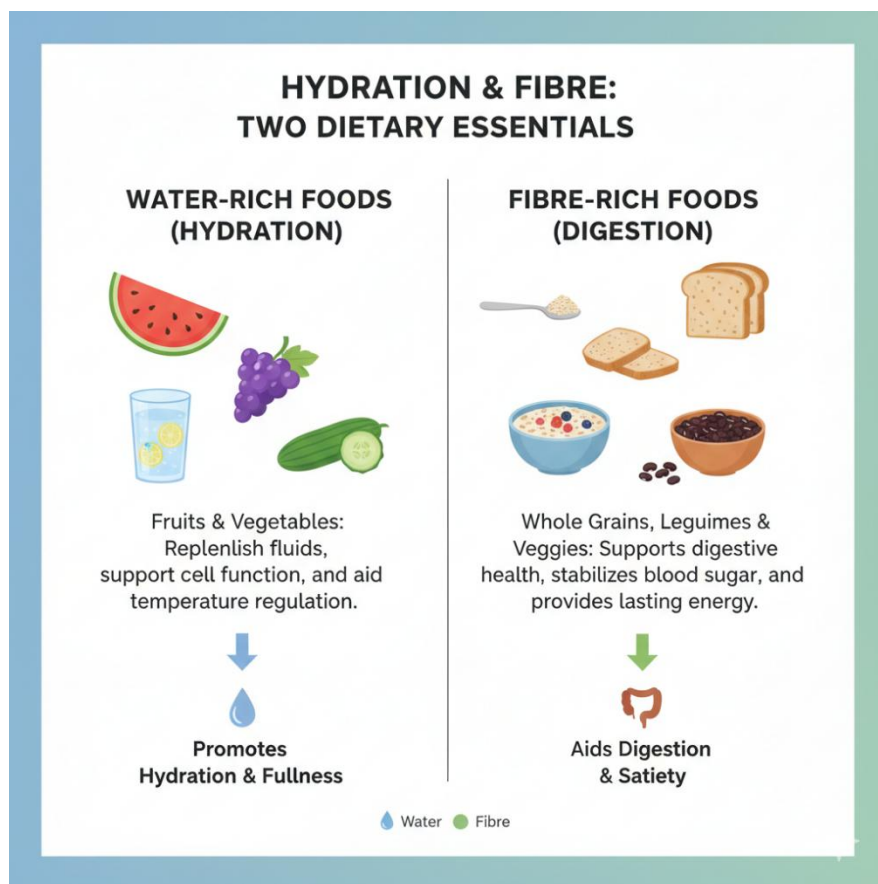


Image showing water-rich foods (fruits, vegetables) and fibre-rich foods (whole grains, leafy greens)

Plate 2.2: Sources of water and fibre

Search string: “water fibre food sources OER”

Pilot questions 2.1

1. What is the body’s main source of energy?
2. Proteins are made up of smaller units called _____.
3. Fats help the body absorb _____-soluble vitamins.
4. Calcium is a mineral that strengthens _____.
5. Fibre is a type of carbohydrate that cannot be _____.

2.2 Digestion And Absorption Of Food Constituents

2.2.1 Digestive processes for carbohydrates, proteins, and fats

Digestion is the process by which food is broken down into smaller, absorbable components. Carbohydrates are broken down into simple sugars such as glucose, proteins into amino acids,



and fats into fatty acids and glycerol. This process begins in the mouth, continues in the stomach, and is completed in the small intestine.

Enzymes play a crucial role in digestion. For example, **amylase** is an enzyme that breaks down starch into sugars, **pepsin** breaks down proteins into peptides, and **lipase** breaks down fats into fatty acids. Each enzyme is specific to a nutrient type, ensuring efficient digestion.

Fill in the blank: The enzyme that breaks down starch into sugars is called _____.

DIGESTION OF MACRONUTRIENTS

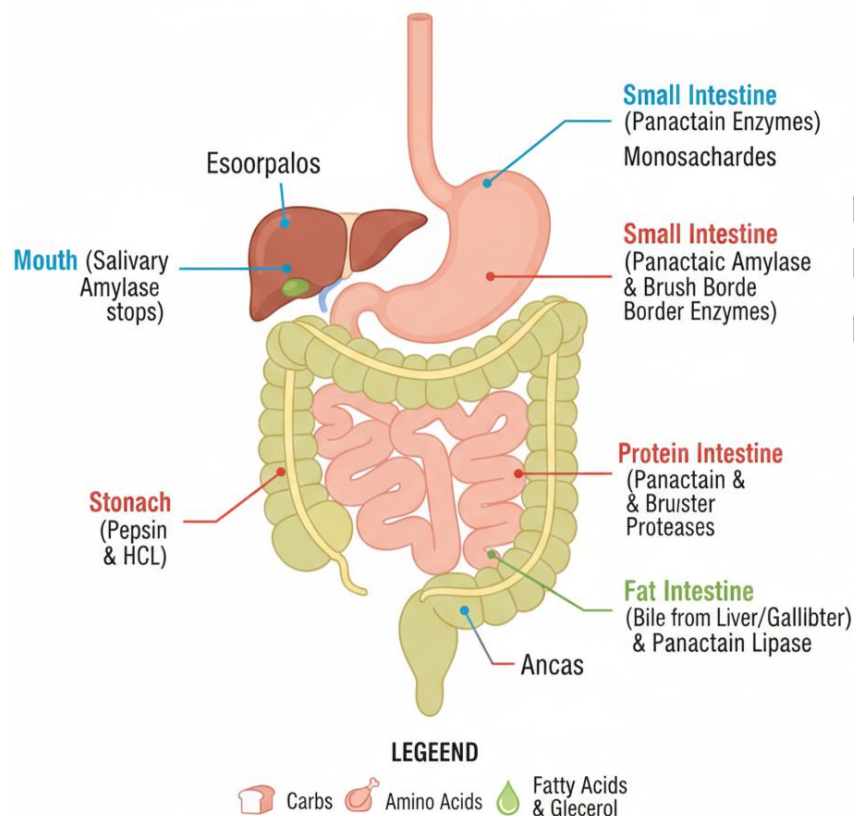


Diagram showing the digestive tract with arrows indicating where carbohydrates, proteins, and fats are digested

Figure 2.1: Digestive processes for major nutrients

Search string: “digestive system nutrient digestion diagram OER”

2.2.2 Absorption of vitamins, minerals, and water

Absorption is the process by which digested nutrients pass into the bloodstream or lymph for use by the body. Most absorption occurs in the small intestine, which has finger-like projections called **villi** that increase the surface area for nutrient uptake.

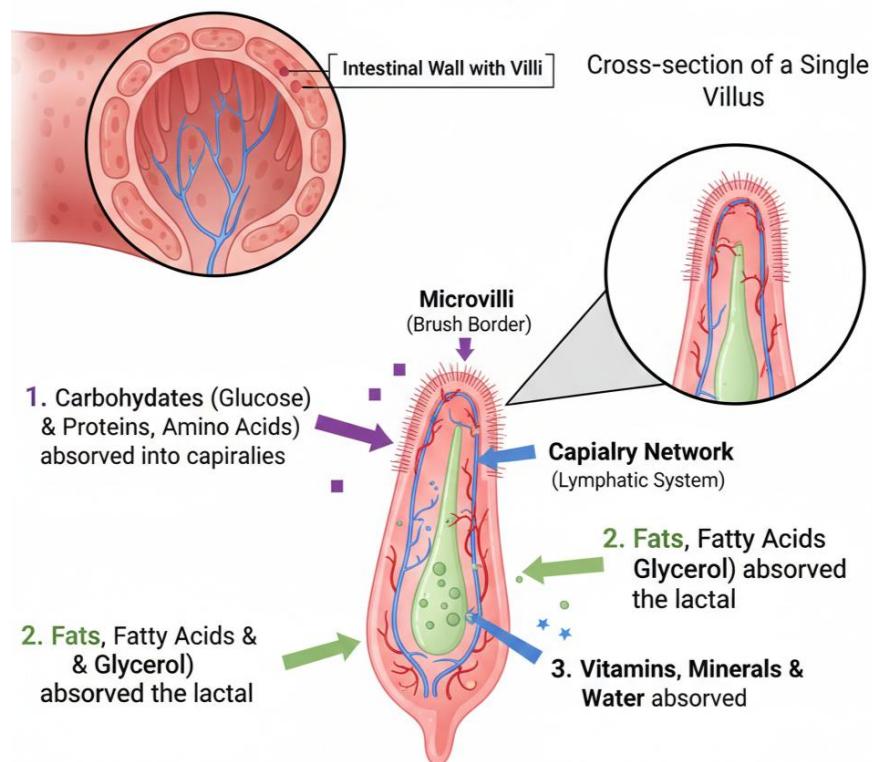
Water-soluble vitamins such as vitamin C and B-complex vitamins are absorbed directly into the bloodstream, while fat-soluble vitamins (A, D, E, and K) are absorbed with fats into the



lymphatic system. Minerals are absorbed in varying amounts depending on body needs, while water is absorbed mainly in the large intestine to maintain hydration.

Fill in the blank: The small intestine contains finger-like projections called _____ that aid absorption.

NUTRENT ABSORPTION IN THE SMALL INTESTINE: The Role of Villi



Villi increase surface area for efficient nutrient transfer into the bloodstream and lymphatic system.

Image showing villi in the small intestine

Plate 2.1: Villi in the small intestine aiding absorption

Search string: “small intestine villi absorption OER”

2.2.3 Role of enzymes in digestion

Enzymes are biological catalysts that speed up chemical reactions in the body. In digestion, they break down complex food molecules into simpler forms that can be absorbed. Each enzyme is highly specific, acting only on a particular nutrient.

Examples include **amylase** for carbohydrates, **protease** for proteins, and **lipase** for fats. Without enzymes, digestion would be too slow to meet the body’s needs. Enzymes therefore ensure that nutrients are available quickly and efficiently for energy, growth, and repair.

Fill in the blank: The enzyme that breaks down proteins into peptides is called _____.



Enzyme Type	Target Nutrient	The Result (Monomers)	Primary Location
Amylase	Starch (Carbohydrates)	Simple Sugars (Glucose)	Mouth (Saliva) & Small Intestine
Protease	Proteins	Peptides & Amino Acids	Stomach & Small Intestine
Lipase	Fats (Lipids)	Fatty Acids & Glycerol	Small Intestine

Box 2.1: Examples of digestive enzymes and their functions

- Amylase: breaks down starch into sugars
- Protease: breaks down proteins into peptides
- Lipase: breaks down fats into fatty acids and glycerol

Search string: “digestive enzymes functions OER”

Pilot questions 2.2

1. Which enzyme breaks down starch into sugars?
2. What are proteins broken down into during digestion?
3. The small intestine contains finger-like projections called _____.
4. Name one fat-soluble vitamin absorbed with fats.
5. Why are enzymes important in digestion?

2.3 Physiological Roles Of Food Constituents

2.3.1 Energy provision and metabolism

Energy provision refers to the supply of fuel that the body needs to perform daily activities. Carbohydrates are the primary energy source, while fats provide concentrated energy reserves. Proteins can also be used for energy when carbohydrate and fat intake is insufficient.

Metabolism is the set of chemical processes that convert food into energy and other useful products. It includes catabolism (breaking down molecules to release energy) and anabolism (building up molecules for growth and repair).

Fill in the blank: The body’s primary source of energy is _____.



NUTRIENT METABOLISM: THE ATP PRODUCTION FACTORY

Converting Food into Cellular Energy

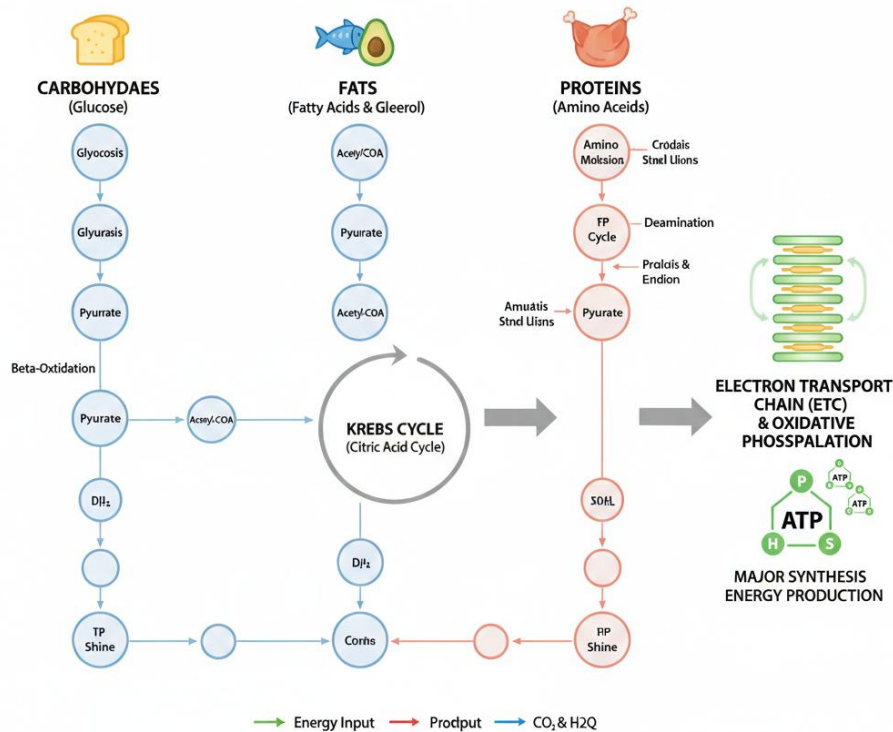


Diagram showing energy pathways from carbohydrates, fats, and proteins into ATP production

Figure 2.3: Energy provision and metabolism

Search string: “energy metabolism nutrients diagram OER”

2.3.2 Growth, repair, and regulation of body functions

Growth requires nutrients such as proteins, vitamins, and minerals to build tissues and organs.

Repair involves replacing damaged cells and tissues, which is supported by protein intake.

Regulation of body functions is achieved through vitamins and minerals. For example, vitamin A supports vision, vitamin K aids blood clotting, and calcium regulates muscle contraction. These nutrients ensure that the body operates smoothly and adapts to changing conditions.

Fill in the blank: Vitamin K plays a key role in _____ clotting.



GROWTH & REGULATION: Essential Nutrients

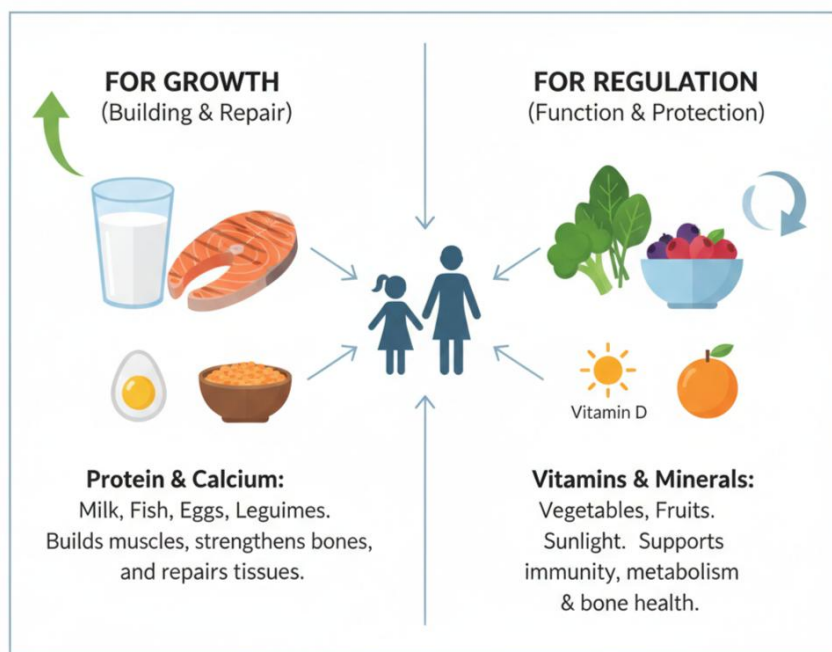


Image showing foods that support growth and repair (milk, fish, vegetables)

Plate 2.3: Foods supporting growth and regulation

Search string: “foods for growth and repair OER”

2.3.3 Disease prevention and immunity

Nutrition strengthens the body’s **immune system**, which defends against infections and diseases. Vitamins such as vitamin C and minerals like zinc enhance immunity. Fibre also contributes by supporting gut health, which is closely linked to immune function.

Adequate nutrition prevents deficiency diseases such as scurvy (lack of vitamin C), rickets (lack of vitamin D), and anaemia (lack of iron). It also reduces the risk of chronic diseases like diabetes and heart disease.

Fill in the blank: A lack of vitamin D can lead to the disease called _____.

Nutrient	Primary Role	Disease Prevention
Vitamin C	Boosts the immune system and aids collagen production.	Prevents Scurvy: Protects against gum disease, skin hemorrhages, and poor wound healing.
Vitamin D	Regulates calcium and phosphate levels in the body.	Prevents Rickets: Essential for preventing soft or brittle bones (osteomalacia/rickets) and supporting bone density.



Nutrient	Primary Role	Disease Prevention
Iron	Vital for the production of hemoglobin, which carries oxygen.	Prevents Anaemia: Reduces risk of iron-deficiency anaemia, which causes chronic fatigue and heart strain.
Fibre	Regulates digestive speed and feeds beneficial gut bacteria.	Reduces Chronic Risk: Lowers the risk of type 2 diabetes, heart disease, and colorectal cancers by supporting gut health.

Box 2.2: Examples of nutrients in disease prevention

- Vitamin C: prevents scurvy and boosts immunity
- Vitamin D: prevents rickets and supports bone health
- Iron: prevents anaemia and supports blood formation
- Fibre: supports gut health and reduces chronic disease risk

Search string: “nutrients disease prevention OER”

Pilot questions 2.3

1. What is the body’s primary source of energy?
2. Define metabolism and name its two main processes.
3. Vitamin K plays a key role in _____ clotting.
4. Which nutrient prevents anaemia?
5. Name one chronic disease that adequate nutrition helps to reduce.

2.4 Practical Applications In Diet And Food Production

2.4.1 Balanced diet formulation

A **balanced diet** is one that provides all essential nutrients in the right proportions to maintain health and wellbeing. In practice, this means combining foods from different groups such as carbohydrates, proteins, fats, vitamins, minerals, and water. Balanced diets vary depending on age, activity level, and health status. For example, children require more protein for growth, while adults may need more fibre to aid digestion.

Fill in the blank: A diet that provides all essential nutrients in the right proportions is called a _____ diet.



THE BALANCED PLATE

Fuel Your Body Right

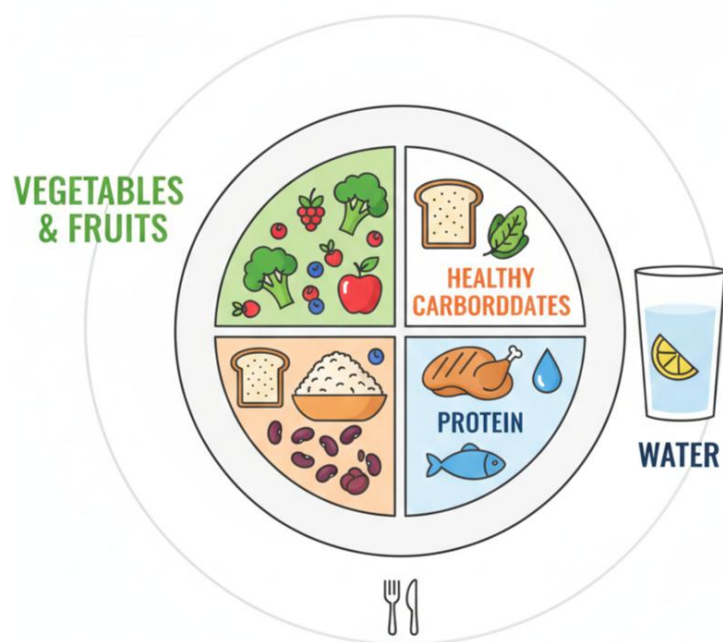


Diagram showing a balanced plate with carbohydrates, proteins, vegetables, fruits, and water

Figure 2.4: Components of a balanced diet

Search string: “balanced diet plate diagram OER”

2.4.2 Food fortification and supplementation

Fortification is the process of adding nutrients to foods to prevent deficiencies. Common examples include adding iodine to salt, vitamin D to milk, and iron to flour. **Supplementation** involves providing nutrients in concentrated forms such as tablets or capsules, often used when dietary intake is insufficient.

These practices are especially important in public health, as they help reduce widespread deficiencies and improve population wellbeing.

Fill in the blank: Adding iodine to salt is an example of food _____.

Strategy	Nutrient	Food/Product Example	Health Goal
Fortification	Iodine	Iodized Table Salt	Prevents Goitre: Essential for thyroid hormone production, which regulates metabolism and growth.



Strategy	Nutrient	Food/Product Example	Health Goal
Fortification	Vitamin D	Fortified Milk & Cereals	Prevents Rickets: Supports calcium absorption for strong bones, crucial during childhood and into adulthood.
Fortification	Iron	Fortified Flour (Bread/Cereals)	Prevents Anaemia: Reduces the risk of iron-deficiency anaemia, common globally, especially in women and children.
Supplementation	Vitamin C	Vitamin C Tablets/Gummies	Boosts Immunity: While present in many foods, supplements are used to ensure adequate intake, especially during illness or when dietary intake is low, and to prevent scurvy.

Box 2.3: Examples of food fortification and supplementation

- Iodine in salt: prevents goitre
- Vitamin D in milk: prevents rickets
- Iron in flour: prevents anaemia
- Vitamin C tablets: boost immunity

Search string: “food fortification supplementation examples OER”

2.4.3 Nutrition in food service and hospitality

In food service and hospitality, nutrition guides menu planning to meet diverse dietary needs. Hotels, restaurants, and catering services must consider balanced meals, cultural preferences, and health requirements. Offering vegetarian options, low-fat meals, or nutrient-rich dishes enhances guest satisfaction and promotes wellbeing.

Nutrition also supports tourism by ensuring travellers remain healthy and energised during their journeys. This makes nutrition not only a health necessity but also a business advantage in hospitality.

Fill in the blank: In hospitality, nutrition guides _____ planning to meet diverse dietary needs.





Image showing a hotel buffet with diverse food options including fruits, vegetables, proteins, and grains

Plate 2.4: Nutrition in hospitality menu planning

Search string: “hospitality menu planning nutrition OER”

Pilot questions 2.4

1. What is a diet that provides all essential nutrients in the right proportions called?
2. Adding iodine to salt is an example of food _____.
3. Give one example of supplementation.
4. In hospitality, nutrition guides _____ planning to meet diverse dietary needs.
5. Why is nutrition considered a business advantage in tourism and hospitality?

Series Summary

This Series has explored the essential food constituents, their sources, digestion, absorption, and physiological roles, while also considering practical applications in diet and food production. We began by identifying the major nutrients such as carbohydrates, proteins, fats, vitamins, minerals, water, and fibre, and examined where they are found in everyday foods. We then moved on to the processes of digestion and absorption, highlighting the role of enzymes and the importance of structures such as villi in nutrient uptake. Following that, we analysed how these constituents contribute to energy provision, growth, repair, regulation, and disease prevention. Finally, we



concluded with practical applications, including balanced diet formulation, food fortification, and the relevance of nutrition in hospitality and tourism.

By completing this Series, you should now be able to define the major food constituents and identify their sources (SLO 2.1), explain how they are digested and absorbed (SLO 2.2), analyse their physiological roles in maintaining health (SLO 2.3), and apply nutrition principles to practical contexts such as diet planning and food service (SLO 2.4). These outcomes provide you with a strong foundation for understanding how nutrients function in the body and how this knowledge is applied in real-world settings

Glossary of Terms

- **Absorption:** The process by which digested nutrients pass into the bloodstream or lymph for use by the body.
- **Amino acids:** The smaller units that make up proteins, essential for growth, repair, and regulation of body functions.
- **Balanced diet:** A diet that provides all essential nutrients in the right proportions to maintain health and wellbeing.
- **Carbohydrates:** Organic compounds that serve as the body's main source of energy, found in foods such as cereals, bread, rice, fruits, and vegetables.
- **Enzymes:** Biological catalysts that speed up chemical reactions, including the breakdown of food during digestion.
- **Fats and oils:** Concentrated sources of energy composed of fatty acids and glycerol, which also help absorb fat-soluble vitamins.
- **Fibre:** A type of carbohydrate that cannot be digested, found in whole grains, fruits, and vegetables, and important for healthy digestion.
- **Fortification:** The process of adding nutrients to foods to prevent deficiencies, such as iodine added to salt.
- **Metabolism:** The chemical processes in the body that convert food into energy and useful products, including catabolism and anabolism.
- **Minerals:** Inorganic elements such as calcium, iron, and iodine that regulate body functions and support growth and health.
- **Proteins:** Large molecules made up of amino acids, essential for growth, tissue repair, and the production of enzymes and hormones.
- **Supplementation:** Providing nutrients in concentrated forms such as tablets or capsules when dietary intake is insufficient.
- **Villi:** Finger-like projections in the small intestine that increase the surface area for nutrient absorption.



- **Vitamins:** Organic compounds required in small amounts to regulate body processes and prevent deficiency diseases.
- **Water:** An essential nutrient for hydration, temperature regulation, and transport of other nutrients in the body.

Concept Check Questions

Objective questions

1. Carbohydrates are the body's primary source of _____ (Linked to SLO 2.1).
2. Proteins are made up of smaller units called _____ (Linked to SLO 2.1).
3. The small intestine contains finger-like projections called _____ that aid absorption (Linked to SLO 2.2).
4. Vitamin K plays a key role in _____ clotting (Linked to SLO 2.3).
5. Adding iodine to salt is an example of food _____ (Linked to SLO 2.4).

Short-answer questions

6. Define fibre and explain its role in digestion (Linked to SLO 2.1).
7. Describe the role of enzymes in digestion, giving one example (Linked to SLO 2.2).
8. State one way in which nutrition contributes to disease prevention (Linked to SLO 2.3).
9. Give one example of supplementation and explain why it is used (Linked to SLO 2.4).

Long-answer questions

10. Analyse the processes of digestion and absorption for carbohydrates, proteins, and fats, highlighting the role of enzymes (Linked to SLO 2.2).
11. Evaluate the practical applications of nutrition in food production and hospitality, explaining how they support health and business success (Linked to SLO 2.4).

Answers to Concept Check Questions

Objective questions

1. Energy
2. Amino acids
3. Villi
4. Blood
5. Fortification



Short-answer questions

6. Fibre is a type of carbohydrate that cannot be digested. It aids digestion by adding bulk to food, preventing constipation, and supporting gut health.
7. Enzymes are biological catalysts that break down food into absorbable forms. For example, amylase breaks down starch into sugars.
8. Adequate intake of vitamin C prevents scurvy and boosts immunity.
9. Vitamin C tablets are an example of supplementation, used to boost immunity when dietary intake is insufficient.

Long-answer questions

10. **Basic response:** Digestion breaks down carbohydrates into sugars, proteins into amino acids, and fats into fatty acids and glycerol. Enzymes such as amylase, protease, and lipase facilitate these processes. Absorption occurs mainly in the small intestine, aided by villi. **Value-added response:** Outstanding learners may add that water-soluble vitamins are absorbed directly into the bloodstream, while fat-soluble vitamins are absorbed with fats into the lymph. They may also explain how minerals are absorbed according to body needs, and highlight the importance of enzyme specificity in efficient digestion.
11. **Basic response:** Nutrition is applied in food production through balanced diet formulation and fortification to prevent deficiencies. In hospitality, it guides menu planning to meet diverse dietary needs. **Value-added response:** Outstanding learners may expand by explaining that fortification and supplementation improve public health, while nutrition in hospitality enhances guest satisfaction and supports tourism success. They may also discuss how nutrition contributes to business reputation and customer loyalty.

Answers to Pilot Questions

Answers to Pilot Questions 2.1

1. Carbohydrates
2. Amino acids
3. Fat
4. Bones
5. Digested

Answers to Pilot Questions 2.2

1. Amylase
2. Amino acids
3. Villi



4. Vitamin A, D, E, or K (any one)
5. They speed up digestion and make nutrients available quickly

Answers to Pilot Questions 2.3

1. Carbohydrates
2. Metabolism is the chemical process of converting food into energy and useful products. Its two main processes are catabolism and anabolism.
3. Blood
4. Iron
5. Diabetes or heart disease (any one)

Answers to Pilot Questions 2.4

1. Balanced diet
2. Fortification
3. Vitamin C tablets (or any nutrient supplement)
4. Menu
5. Because it improves guest satisfaction, prevents illness, and enhances reputation in tourism and hospitality

References and Attributions

All references and attributions below are presented in APA style for clarity and consistency. They include suggested sources for illustrations, open educational resources (OERs), and AI-generated prompts used in the Series.

Figures and Plates

- *Figure 2.1: Common sources of carbohydrates* AI-generated suggestion: “Create a diagram showing carbohydrate food sources such as bread, rice, fruits, and vegetables.” Suggested OER search string: “carbohydrate food sources diagram OER.”
- *Plate 2.1: Protein-rich food sources* AI-generated suggestion: “Generate an image showing protein-rich foods such as eggs, beans, fish, and meat.” Suggested OER search string: “protein food sources OER.”
- *Figure 2.2: Healthy and unhealthy fat sources* AI-generated suggestion: “Create a diagram comparing healthy fat sources like nuts and fish with unhealthy fat sources like fried foods.” Suggested OER search string: “healthy vs unhealthy fats OER.”



- *Box 2.1: Examples of vitamins and minerals with sources* AI-generated suggestion: “Generate a text box listing vitamins and minerals with sources and functions.” Suggested OER search string: “vitamins minerals sources OER.”
- *Plate 2.2: Sources of water and fibre* AI-generated suggestion: “Generate an image showing water-rich foods like fruits and fibre-rich foods like whole grains.” Suggested OER search string: “water fibre food sources OER.”
- *Figure 2.3: Energy provision and metabolism* AI-generated suggestion: “Create a diagram showing carbohydrates, fats, and proteins being converted into ATP through metabolism.” Suggested OER search string: “energy metabolism nutrients diagram OER.”
- *Plate 2.3: Foods supporting growth and regulation* AI-generated suggestion: “Generate an image showing foods like milk, fish, and vegetables that support growth and regulation.” Suggested OER search string: “foods for growth and repair OER.”
- *Box 2.2: Examples of nutrients in disease prevention* AI-generated suggestion: “Generate a text box listing nutrients and their roles in disease prevention.” Suggested OER search string: “nutrients disease prevention OER.”
- *Figure 2.4: Components of a balanced diet* AI-generated suggestion: “Create a diagram of a balanced plate showing carbohydrates, proteins, vegetables, fruits, and water.” Suggested OER search string: “balanced diet plate diagram OER.”
- *Box 2.3: Examples of food fortification and supplementation* AI-generated suggestion: “Generate a text box listing examples of food fortification and supplementation.” Suggested OER search string: “food fortification supplementation examples OER.”
- *Plate 2.4: Nutrition in hospitality menu planning* AI-generated suggestion: “Generate an image showing a hotel buffet with diverse food options including fruits, vegetables, proteins, and grains.” Suggested OER search string: “hospitality menu planning nutrition OER.”

General References

- Whitney, E., & Rolfes, S. R. (2019). *Understanding Nutrition* (15th ed.). Cengage Learning.
- Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. (2019). *Introduction to Human Nutrition* (3rd ed.). Wiley-Blackwell.
- World Health Organization. (2020). *Healthy diet*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/healthy-diet> (who.int in Bing)

Course Title: Introduction to Nutrition and food production



Course Code: HMT 201

Course Unit: 2 Units

- Foundations and History of Nutrition Science
- Food Constituents: Sources, Digestion, and Roles
- Human Physiology and Dietary Relevance
- Tourists' Nutrition: Seasonal and Health Variations
- Nutrient Requirements, Deficiencies, and Absorption Process

Series 3: Human Physiology And Dietary Relevance

Suggested Outline

- **Part 1: Overview of Human Physiology in Nutrition**
 - The digestive system and nutrient utilisation
 - Circulatory and transport systems in nutrition
 - Excretory processes and waste elimination
- **Part 2: Nutrient Functions in Body Systems**
 - Carbohydrates and energy metabolism
 - Proteins in growth and repair
 - Fats in energy storage and insulation
 - Vitamins and minerals in regulation and immunity
- **Part 3: Dietary Relevance to Health and Performance**
 - Nutrition in childhood, adolescence, and adulthood
 - Dietary relevance in physical activity and work performance
 - Nutrition in ageing and disease prevention
- **Part 4: Practical Implications for Food Service and Hospitality**
 - Menu planning based on physiological needs
 - Dietary considerations for special groups (e.g., vegetarians, diabetics)
 - Nutrition as a tool for enhancing guest satisfaction

Introduction

In the last Series, we examined food constituents, their sources, digestion, and physiological roles. Building on that foundation, we now turn our attention to the human body itself. Nutrition is not only about what we eat but also about how our body systems process and use these nutrients. By understanding human physiology, you will be able to see the direct link between diet and health, and appreciate why dietary choices matter for growth, performance, and wellbeing.



The aim of this Series is to explain the physiological systems involved in nutrition and to highlight the dietary relevance of nutrients across different life stages, health conditions, and practical contexts.

We shall commence this Series by exploring the digestive, circulatory, and excretory systems to understand how nutrients are utilised. Next, we will examine the specific functions of carbohydrates, proteins, fats, vitamins, and minerals in body systems. Following that, we will consider dietary relevance across childhood, adolescence, adulthood, ageing, and physical activity, with attention to disease prevention. Finally, we will wrap up by applying this knowledge to food service and hospitality, focusing on menu planning, special dietary needs, and nutrition as a tool for enhancing guest satisfaction.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 3.1** describe the major physiological systems involved in nutrition, including the digestive, circulatory, and excretory systems,
- **SLO 3.2** explain the specific functions of carbohydrates, proteins, fats, vitamins, and minerals in supporting body systems,
- **SLO 3.3** analyse the dietary relevance of nutrients across different life stages and health contexts, including childhood, adolescence, adulthood, ageing, and physical activity,
- **SLO 3.4** apply nutrition principles to practical contexts in food service and hospitality, such as menu planning and dietary considerations for special groups.

3.1 Overview Of Human Physiology In Nutrition

3.1.1 The digestive system and nutrient utilisation

The **digestive system** is the group of organs responsible for breaking down food into smaller components that the body can use. It includes the mouth, oesophagus, stomach, small intestine, and large intestine. Digestion begins in the mouth with chewing and the action of saliva, continues in the stomach where food is mixed with gastric juices, and is completed in the small intestine where most nutrients are absorbed.

The small intestine plays a central role in nutrient utilisation, as its lining contains **villi**, which are finger-like projections that increase the surface area for absorption. Nutrients such as glucose, amino acids, fatty acids, vitamins, and minerals pass into the bloodstream or lymph for distribution throughout the body.

Fill in the blank: The small intestine contains finger-like projections called _____ that increase the surface area for absorption.



Diagram showing the human digestive system with arrows indicating nutrient breakdown and absorption

Figure 3.1: Digestive system and nutrient utilization

Search string: “digestive system nutrient absorption diagram OER”

3.1.2 Circulatory and transport systems in nutrition

The **circulatory system** consists of the heart, blood, and blood vessels. Its main role in nutrition is to transport absorbed nutrients to different parts of the body. Glucose is carried to cells for energy, amino acids are delivered for tissue repair, and fatty acids are transported for energy storage and insulation.

The **lymphatic system** also plays a role in transporting fats and fat-soluble vitamins. Together, these systems ensure that nutrients reach the tissues where they are needed.

Fill in the blank: The system that transports fats and fat-soluble vitamins is the _____ system

Image showing blood vessels and the heart, with arrows indicating nutrient transport

Plate 3.1: Circulatory system transporting nutrients

Search string: “circulatory system nutrient transport OER”

3.1.3 Excretory processes and waste elimination

The **excretory system** removes waste products from the body to maintain balance and prevent harm. The kidneys filter blood to remove excess water, salts, and urea, which are excreted as urine. The large intestine eliminates undigested food and fibre as faeces.

This process ensures that the body maintains homeostasis, which is the stable internal environment needed for proper functioning. Without effective excretion, waste products would accumulate and damage body systems.

Fill in the blank: The kidneys filter blood to remove excess water, salts, and _____.

Organ	Waste Products Removed	Excretory Form	The Health Goal
Kidneys	Urea, uric acid, salts, and excess water	Urine	Blood Filtration: Regulates blood pressure and maintains the body's chemical and water balance.
Large Intestine	Undigested food, fiber, and bacteria	Feces	Solid Waste Removal: Prevents the buildup of toxic materials in the digestive tract.



Organ	Waste Products Removed	Excretory Form	The Health Goal
Skin	Water, salts, and small amounts of urea	Sweat	Thermoregulation: Primarily cools the body while removing excess salts and minerals through pores.
Lungs	Carbon dioxide (CO ₂) and water vapor	Exhaled Air	Gas Exchange: Removes the gaseous byproduct of cellular respiration.

Box 3.1: Examples of excretory processes

- Kidneys: remove urea, salts, and excess water
- Large intestine: eliminates undigested food and fibre
- Skin: excretes sweat containing water and salts

Search string: “excretory system processes OER”

Pilot questions 3.1

1. The small intestine contains finger-like projections called _____.
2. Which system transports fats and fat-soluble vitamins?
3. What do the kidneys remove from the blood?
4. Name one organ involved in digestion.
5. Why is excretion important for maintaining homeostasis?

3.2 Nutrient Functions In Body Systems

3.2.1 Carbohydrates and energy metabolism

Carbohydrates are the body’s primary source of energy. They are broken down into glucose, which enters the bloodstream and is transported to cells. Inside the cells, glucose is converted into **ATP (adenosine triphosphate)**, the energy currency of the body. This process is known as **energy metabolism**, and it fuels activities such as movement, thinking, and maintaining body temperature.

Fill in the blank: The energy currency of the body is called _____.

Diagram showing glucose being converted into ATP in cells

Figure 3.2: Carbohydrates in energy metabolism

Search string: “carbohydrate metabolism ATP diagram OER”



3.2.2 Proteins in growth and repair

Proteins are essential for building and repairing tissues. They are made up of amino acids, which are used to form muscles, enzymes, hormones, and antibodies. During growth, proteins support the development of new tissues, while in repair they replace damaged cells.

Proteins also play a role in regulating body processes, such as maintaining fluid balance and supporting immune function.

Fill in the blank: Proteins are made up of smaller units called _____.

Image showing protein-rich foods such as eggs, beans, fish, and meat

Plate 3.2: Protein sources for growth and repair

Search string: “protein food sources OER”

3.2.3 Fats in energy storage and insulation

Fats provide concentrated energy and serve as long-term energy storage. They are stored in adipose tissue, which also acts as insulation to maintain body temperature and protect organs.

Fats are important for absorbing fat-soluble vitamins (A, D, E, and K) and for producing hormones. Healthy fats, such as those from nuts, seeds, and fish, support cardiovascular health, while excessive intake of unhealthy fats can lead to disease.

Fill in the blank: Fats help the body absorb _____-soluble vitamins.

Diagram showing fat storage in adipose tissue and its role in insulation

Figure 3.3: Fats in energy storage and insulation

Search string: “fat storage adipose tissue diagram OER”

3.2.4 Vitamins and minerals in regulation and immunity

Vitamins are organic compounds needed in small amounts to regulate body processes. For example, vitamin A supports vision, vitamin D strengthens bones, and vitamin C boosts immunity.

Minerals are inorganic elements such as calcium, iron, and iodine. Calcium supports bone strength, iron helps form haemoglobin in blood, and iodine regulates thyroid function. Together, vitamins and minerals prevent deficiency diseases and strengthen the immune system.

Fill in the blank: Iron is a mineral that helps form _____ in blood.



Nutrient	Primary Function	Why It Matters
Vitamin A	Supports Vision	Essential for maintaining healthy eyesight and a strong immune system.
Vitamin D	Strengthens Bones	Helps the body absorb calcium; critical for bone density and growth.
Vitamin C	Boosts Immunity	Acts as an antioxidant and helps the body repair tissues and heal wounds.
Calcium	Strengthens Bones	The primary mineral used to build and maintain the structure of bones and teeth.
Iron	Forms Haemoglobin	Necessary for creating the protein in red blood cells that carries oxygen to your tissues.

Box 3.2: Examples of vitamins and minerals with functions

- Vitamin A: supports vision
- Vitamin D: strengthens bones
- Vitamin C: boosts immunity
- Calcium: strengthens bones
- Iron: forms haemoglobin in blood

Search string: “vitamins minerals functions OER”

Pilot questions 3.2

1. The energy currency of the body is called _____.
2. Proteins are made up of smaller units called _____.
3. Fats help the body absorb _____-soluble vitamins.
4. Iron is a mineral that helps form _____ in blood.
5. Name one function of vitamin C.

yes

3.3 Dietary Relevance To Health And Performance

3.3.1 Nutrition in childhood, adolescence, and adulthood



Nutrition needs vary across life stages. In **childhood**, nutrients such as proteins, calcium, and vitamins are vital for growth and development. During **adolescence**, energy and protein requirements increase to support rapid growth and hormonal changes. In **adulthood**, the focus shifts to maintaining health, preventing disease, and balancing energy intake with activity levels.

Fill in the blank: During adolescence, energy and _____ requirements increase to support rapid growth.

Image showing foods suitable for children, adolescents, and adults (milk, fruits, cereals, proteins)

Plate 3.3: Nutrition across life stages

Search string: “nutrition childhood adolescence adulthood OER”

3.3.2 Dietary relevance in physical activity and work performance

Nutrition plays a key role in **physical activity** and **work performance**. Carbohydrates provide quick energy for exercise, proteins support muscle repair, and water prevents dehydration. Athletes and physically active individuals require higher energy intake, while workers in demanding jobs benefit from balanced meals that sustain energy throughout the day.

Fill in the blank: Carbohydrates provide quick _____ for exercise.

Diagram showing energy needs for athletes and workers, highlighting carbohydrates, proteins, and water

Figure 3.4: Nutrition in physical activity and work performance

Search string: “nutrition physical activity work performance OER”

3.3.3 Nutrition in ageing and disease prevention

As people age, nutrient needs change. Older adults require more calcium and vitamin D to maintain bone strength, and fibre to support digestion. Reduced energy requirements mean meals should be nutrient-dense rather than calorie-heavy.

Nutrition also plays a role in **disease prevention**. Adequate intake of vitamins and minerals reduces the risk of chronic diseases such as diabetes, heart disease, and osteoporosis. Balanced diets help maintain immunity and overall wellbeing in later life.

Fill in the blank: Older adults require more calcium and vitamin _____ to maintain bone strength.



Box 3.3: Key nutrients in ageing and disease prevention

- Calcium and vitamin D: maintain bone strength
- Fibre: supports digestion
- Vitamin C and zinc: boost immunity
- Balanced diet: reduces risk of chronic diseases

Search string: “nutrition ageing disease prevention OER”

Pilot questions 3.3

1. During adolescence, energy and _____ requirements increase to support rapid growth.
2. Carbohydrates provide quick _____ for exercise.
3. Older adults require more calcium and vitamin _____ to maintain bone strength.
4. Name one nutrient that supports digestion in older adults.
5. Give one example of a chronic disease that nutrition can help prevent

3.4 Practical Implications For Food Service And Hospitality

3.4.1 Menu planning based on physiological needs

Menu planning in food service and hospitality involves designing meals that meet the nutritional requirements of different groups. For example, children may need protein-rich meals for growth, while older adults benefit from calcium and fibre. Balanced menus ensure that guests receive adequate energy, essential nutrients, and variety.

Fill in the blank: Menu planning in hospitality ensures meals meet _____ requirements of different groups.

Diagram showing a sample balanced menu with food groups aligned to physiological needs

Figure 3.5: Menu planning based on physiological needs

Search string: “menu planning nutrition hospitality OER”

3.4.2 Dietary considerations for special groups

Special groups such as vegetarians, diabetics, and individuals with allergies require tailored dietary options. **Vegetarians** need plant-based protein sources such as legumes and nuts.

Diabetics benefit from meals low in refined sugars and high in fibre. Guests with allergies must be offered safe alternatives that avoid common allergens like nuts, gluten, or dairy.

Providing these options demonstrates sensitivity to health needs and enhances guest satisfaction.

Fill in the blank: Guests with allergies must be offered safe alternatives that avoid common _____.

Image showing vegetarian meals, diabetic-friendly options, and allergen-free dishes



Plate 3.5: Dietary considerations for special groups

Search string: “special dietary needs hospitality OER”

3.4.3 Nutrition as a tool for enhancing guest satisfaction

Nutrition is not only a health requirement but also a business advantage in hospitality. Offering nutritious meals improves guest wellbeing, builds trust, and encourages repeat visits. Hotels and restaurants that provide balanced, appealing, and health-conscious menus often gain a competitive edge.

By aligning nutrition with service quality, hospitality providers can enhance both customer satisfaction and business reputation.

Fill in the blank: Offering nutritious meals improves guest wellbeing and encourages _____ visits.

Box 3.4: Benefits of nutrition in hospitality

- Improves guest wellbeing
- Builds trust and loyalty
- Encourages repeat visits
- Enhances business reputation AI prompt suggestion:

Search string: “nutrition hospitality guest satisfaction OER”

Pilot questions 3.4

1. Menu planning in hospitality ensures meals meet _____ requirements of different groups.
2. Guests with allergies must be offered safe alternatives that avoid common _____.
3. Name one plant-based protein source suitable for vegetarians.
4. Why are fibre-rich meals important for diabetics?
5. Offering nutritious meals improves guest wellbeing and encourages _____ visits.

Series Summary

This Series has focused on the relationship between human physiology and nutrition, showing how the body’s systems process and use nutrients, and why dietary choices matter for health and performance. We began by examining the digestive, circulatory, and excretory systems to understand how food is broken down, absorbed, transported, and eliminated. We then explored the specific functions of carbohydrates, proteins, fats, vitamins, and minerals in supporting growth, repair, energy storage, regulation, and immunity. Following that, we considered dietary relevance across life stages, physical activity, and ageing, highlighting nutrition’s role in disease



prevention. Finally, we applied these concepts to food service and hospitality, looking at menu planning, special dietary needs, and nutrition as a tool for enhancing guest satisfaction.

By completing this Series, you should now be able to describe the physiological systems involved in nutrition (SLO 3.1), explain the functions of nutrients in body systems (SLO 3.2), analyse dietary relevance across life stages and health contexts (SLO 3.3), and apply nutrition principles to practical contexts in hospitality and food service (SLO 3.4). These outcomes provide you with both the scientific understanding and the practical skills needed to connect nutrition with human physiology and everyday dietary relevance.

Glossary of Terms

- **Adipose tissue:** The body's fat storage tissue that provides insulation and protects organs.
- **ATP (adenosine triphosphate):** The energy currency of the body, produced during metabolism to fuel cellular activities.
- **Balanced menu:** A planned selection of meals that provides essential nutrients in appropriate proportions for different groups.
- **Circulatory system:** The system made up of the heart, blood, and blood vessels that transports nutrients and oxygen throughout the body.
- **Digestive system:** The group of organs that break down food into smaller components for absorption, including the mouth, stomach, and intestines.
- **Excretory system:** The system responsible for removing waste products from the body, including the kidneys, large intestine, and skin.
- **Homeostasis:** The stable internal environment maintained by the body to ensure proper functioning.
- **Lymphatic system:** A network of vessels that transports fats and fat-soluble vitamins, and supports immune function.
- **Menu planning:** The process of designing meals to meet the nutritional and physiological needs of different groups.
- **Metabolism:** The chemical processes in the body that convert food into energy and useful products, including catabolism and anabolism.
- **Nutrient-dense foods:** Foods that provide high levels of essential nutrients relative to their calorie content.
- **Proteins:** Large molecules made up of amino acids, essential for growth, repair, and regulation of body processes.
- **Villi:** Finger-like projections in the small intestine that increase the surface area for nutrient absorption.



- **Vitamins:** Organic compounds required in small amounts to regulate body processes and prevent deficiency diseases.
- **Minerals:** Inorganic elements such as calcium, iron, and iodine that support growth, regulation, and immunity.

Concept Check Questions

Objective questions

1. The small intestine contains finger-like projections called _____ (Linked to SLO 3.1).
2. The energy currency of the body is _____ (Linked to SLO 3.2).
3. Fats help the body absorb _____-soluble vitamins (Linked to SLO 3.2).
4. During adolescence, energy and _____ requirements increase (Linked to SLO 3.3).
5. Menu planning in hospitality ensures meals meet _____ requirements of different groups (Linked to SLO 3.4).

Short-answer questions

6. Define homeostasis and explain its importance in nutrition (Linked to SLO 3.1).
7. Describe one function of proteins in growth and repair (Linked to SLO 3.2).
8. State one nutrient that supports digestion in older adults and explain its role (Linked to SLO 3.3).
9. Give one example of a dietary consideration for vegetarians in hospitality (Linked to SLO 3.4).

Long-answer questions

10. Analyse the processes of digestion, absorption, and transport of nutrients, highlighting the role of the digestive, circulatory, and lymphatic systems (Linked to SLO 3.1).
11. Evaluate the dietary relevance of nutrition across life stages and physical activity, explaining how nutrient needs change and why disease prevention is important (Linked to SLO 3.3).
12. Apply nutrition principles to food service and hospitality by designing a sample menu that meets the needs of children, adults, and special groups such as diabetics (Linked to SLO 3.4).

Answers to Concept Check Questions

Objective questions

1. Villi
2. ATP (adenosine triphosphate)



3. Fat
4. Protein
5. Nutritional

Short-answer questions

6. Homeostasis is the stable internal environment maintained by the body. It is important in nutrition because it ensures proper functioning and balance of nutrients.
7. Proteins build and repair tissues, for example, supporting muscle development.
8. Fibre supports digestion in older adults by preventing constipation and maintaining gut health.
9. Vegetarians require plant-based protein sources such as legumes, nuts, or soy products.

Long-answer questions

10. **Basic response:** Digestion breaks food into smaller molecules. Carbohydrates become glucose, proteins become amino acids, and fats become fatty acids and glycerol. These nutrients are absorbed in the small intestine, aided by villi. The circulatory system transports glucose and amino acids, while the lymphatic system transports fats and fat-soluble vitamins. **Value-added response:** Outstanding learners may add that enzymes such as amylase, protease, and lipase are specific to each nutrient, and that absorption pathways differ for water-soluble versus fat-soluble nutrients. They may also explain how the liver regulates nutrient distribution.
11. **Basic response:** Nutrient needs vary across life stages. Children require proteins and calcium for growth, adolescents need more energy and protein, adults focus on balance and disease prevention, and older adults need calcium, vitamin D, and fibre. Physical activity increases energy and protein requirements. **Value-added response:** Outstanding learners may expand by linking nutrition to chronic disease prevention, explaining how balanced diets reduce risks of diabetes, heart disease, and osteoporosis. They may also discuss hydration and micronutrient needs in athletes.
12. **Basic response:** A sample menu might include milk and eggs for children, balanced meals with proteins and fibre for adults, and sugar-controlled meals for diabetics. **Value-added response:** Outstanding learners may design a detailed menu with portion sizes, nutrient balance, and allergen-free options. They may also explain how menu planning enhances guest satisfaction and supports business reputation in hospitality.

Answers to Pilot Questions

Answers to Pilot Questions 3.1

1. Villi
2. Lymphatic system
3. Urea



4. Stomach (or any digestive organ such as mouth, oesophagus, small intestine)
5. To maintain homeostasis and prevent harmful accumulation of waste

Answers to Pilot Questions 3.2

1. ATP (adenosine triphosphate)
2. Amino acids
3. Fat
4. Haemoglobin
5. Boosts immunity

Answers to Pilot Questions 3.3

1. Protein
2. Energy
3. D
4. Fibre
5. Diabetes (or any chronic disease such as heart disease, osteoporosis)

Answers to Pilot Questions 3.4

1. Nutritional
2. Allergens
3. Legumes (or nuts, soy products)
4. They help regulate blood sugar and prevent spikes
5. Repeat

References and Attributions

All references and attributions below are presented in APA style for clarity and consistency. They include suggested sources for illustrations, open educational resources (OERs), and AI-generated prompts used in the Series.

Figures and Plates

- *Figure 3.1: Digestive system and nutrient utilisation* AI-generated suggestion: “Create a labelled diagram of the human digestive system showing nutrient breakdown and absorption.” Suggested OER search string: “digestive system nutrient absorption diagram OER.”



- *Plate 3.1: Circulatory system transporting nutrients* AI-generated suggestion: “Generate an educational image showing the circulatory system transporting nutrients to body tissues.” Suggested OER search string: “circulatory system nutrient transport OER.”
- *Box 3.1: Examples of excretory processes* AI-generated suggestion: “Generate a text box listing examples of excretory processes in the human body.” Suggested OER search string: “excretory system processes OER.”
- *Figure 3.2: Carbohydrates in energy metabolism* AI-generated suggestion: “Create a diagram showing glucose being converted into ATP in cells.” Suggested OER search string: “carbohydrate metabolism ATP diagram OER.”
- *Plate 3.2: Protein sources for growth and repair* AI-generated suggestion: “Generate an image showing protein-rich foods such as eggs, beans, fish, and meat.” Suggested OER search string: “protein food sources OER.”
- *Figure 3.3: Fats in energy storage and insulation* AI-generated suggestion: “Create a diagram showing adipose tissue storing fats and insulating the body.” Suggested OER search string: “fat storage adipose tissue diagram OER.”
- *Box 3.2: Examples of vitamins and minerals with functions* AI-generated suggestion: “Generate a text box listing vitamins and minerals with their functions.” Suggested OER search string: “vitamins minerals functions OER.”
- *Plate 3.3: Nutrition across life stages* AI-generated suggestion: “Generate an image showing foods suitable for children, adolescents, and adults, such as milk, fruits, cereals, and proteins.” Suggested OER search string: “nutrition childhood adolescence adulthood OER.”
- *Figure 3.4: Nutrition in physical activity and work performance* AI-generated suggestion: “Create a diagram showing nutrition needs for athletes and workers, highlighting carbohydrates, proteins, and water.” Suggested OER search string: “nutrition physical activity work performance OER.”
- *Box 3.3: Key nutrients in ageing and disease prevention* AI-generated suggestion: “Generate a text box listing key nutrients for ageing and disease prevention.” Suggested OER search string: “nutrition ageing disease prevention OER.”
- *Figure 3.5: Menu planning based on physiological needs* AI-generated suggestion: “Create a diagram showing a balanced menu aligned to different physiological needs such as children, adults, and elderly.” Suggested OER search string: “menu planning nutrition hospitality OER.”
- *Plate 3.5: Dietary considerations for special groups* AI-generated suggestion: “Generate an image showing vegetarian meals, diabetic-friendly options, and allergen-free dishes.” Suggested OER search string: “special dietary needs hospitality OER.”



- *Box 3.4: Benefits of nutrition in hospitality* AI-generated suggestion: “Generate a text box listing benefits of nutrition in hospitality.” Suggested OER search string: “nutrition hospitality guest satisfaction OER.”

General References

- Whitney, E., & Rolfes, S. R. (2019). *Understanding Nutrition* (15th ed.). Cengage Learning.
- Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. (2019). *Introduction to Human Nutrition* (3rd ed.). Wiley-Blackwell.
- World Health Organization. (2020). *Healthy diet*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/healthy-diet> (who.int in Bing)

Course Title: Introduction to Nutrition and food production

Course Code: HMT 201

Course Unit: 2 Units

- Foundations and History of Nutrition Science
- Food Constituents: Sources, Digestion, and Roles
- Human Physiology and Dietary Relevance
- Tourists’ Nutrition: Seasonal and Health Variations
- Nutrient Requirements, Deficiencies, and Absorption Process

Series 4: Tourists’ Nutrition: Seasonal And Health Variations

Suggested Outline

- **Part 1: Seasonal Influences on Tourists’ Nutrition**
 - Nutritional needs in hot climates
 - Nutritional needs in cold climates
 - Nutritional adjustments during rainy or humid seasons
- **Part 2: Health-Related Nutritional Considerations for Tourists**
 - Nutrition for disease prevention while travelling
 - Dietary needs for tourists with chronic conditions (e.g., diabetes, hypertension)
 - Food safety and hygiene in tourism settings
- **Part 3: Practical Applications in Hospitality and Tourism**



- Menu planning for seasonal variations
- Catering for diverse health needs of tourists
- Enhancing tourist satisfaction through nutrition-sensitive services
- **Part 4: Case Studies and Best Practices**
 - Examples of seasonal menu adaptations in hotels and resorts
 - Successful approaches to health-conscious tourism catering
 - Lessons from international tourism nutrition practices

Introduction

When people travel, their diets often change in response to new environments, climates, and health needs. A tourist visiting a tropical destination may require more hydration and lighter meals, while another in a cold climate may benefit from energy-dense foods. In addition, health considerations such as food safety, chronic conditions, and disease prevention become especially important when away from home. This Series highlights how seasonal and health variations influence tourists' nutrition and why hospitality providers must adapt to these needs.

The aim of this Series is to equip you with knowledge of how seasonal conditions and health factors affect tourists' nutritional requirements, and to show you how these can be addressed through practical applications in hospitality and tourism.

We shall commence this Series by exploring seasonal influences on tourists' nutrition, including hot, cold, and humid climates. Next, we will examine health-related nutritional considerations such as disease prevention, chronic conditions, and food safety. Following that, we will move on to practical applications in hospitality, focusing on menu planning, catering for diverse health needs, and enhancing tourist satisfaction. Finally, we will wrap up with case studies and best practices, drawing lessons from international tourism nutrition practices to bring the Series to a close.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 4.1** explain how seasonal conditions such as hot, cold, and humid climates influence tourists' nutritional requirements,
- **SLO 4.2** analyse health-related nutritional considerations for tourists, including disease prevention, chronic conditions, and food safety,
- **SLO 4.3** apply nutrition principles to practical hospitality contexts by planning menus and catering for diverse health needs,
- **SLO 4.4** evaluate case studies and best practices in tourism nutrition to identify effective approaches for enhancing tourist satisfaction.

4.1 Seasonal Influences On Tourists' Nutrition

4.1.1 Nutritional needs in hot climates



In hot climates, tourists face challenges such as dehydration and loss of electrolytes through sweat. **Electrolytes** are minerals like sodium, potassium, and magnesium that help regulate fluid balance and muscle function. Meals in hot climates should emphasise hydration, fresh fruits, vegetables, and light foods that are easy to digest. Water intake is critical, and beverages such as fruit juices can provide both fluids and vitamins.

Fill in the blank: Minerals such as sodium, potassium, and magnesium that regulate fluid balance are called _____.

Diagram showing hydration and electrolyte balance in hot climates

Figure 4.1: Nutritional needs in hot climates

Search string: “nutrition hydration electrolytes hot climate OER”

4.1.2 Nutritional needs in cold climates

In cold climates, the body requires more energy to maintain warmth. **Energy-dense foods** are foods that provide high calories per serving, such as whole grains, nuts, and fatty fish. These foods help tourists generate heat and sustain energy. Warm meals, soups, and hot drinks are particularly important to maintain comfort and prevent fatigue.

Fill in the blank: Foods that provide high calories per serving are called _____ foods.

Image showing energy-dense foods such as nuts, grains, and fatty fish

Plate 4.1: Energy-dense foods for cold climates

Search string: “energy dense foods cold climate OER”

4.1.3 Nutritional adjustments during rainy or humid seasons

Rainy or humid seasons often increase the risk of food contamination and waterborne diseases. Tourists should prioritise **food safety**, which refers to practices that prevent foodborne illness, such as proper cooking, safe storage, and clean water use. Meals should include cooked foods rather than raw, and hygiene practices such as handwashing are essential.

Fill in the blank: Practices that prevent foodborne illness, such as proper cooking and safe storage, are called _____.

Box 4.1: Food safety tips for rainy or humid seasons

- Drink only clean or bottled water
- Eat freshly cooked meals
- Avoid raw or undercooked foods



- Wash hands before eating

Search string: “food safety rainy season tourism OER”

Pilot questions 4.1

1. Minerals such as sodium, potassium, and magnesium that regulate fluid balance are called _____.
2. Foods that provide high calories per serving are called _____ foods.
3. What type of meals are especially important in cold climates?
4. Practices that prevent foodborne illness are called _____.
5. Why is hydration critical for tourists in hot climates?

4.2 Health-Related Nutritional Considerations For Tourists

4.2.1 Nutrition for disease prevention while travelling

Travelling exposes tourists to new environments, foods, and water sources, which can increase the risk of illness. **Disease prevention** in nutrition refers to dietary practices that reduce the likelihood of infections or health problems. Tourists should consume safe water, freshly prepared meals, and foods rich in vitamins and minerals that strengthen immunity, such as vitamin C and zinc. Preventive nutrition also includes avoiding contaminated foods and practising good hygiene.

Fill in the blank: Dietary practices that reduce the likelihood of infections or health problems are called _____.

Box 4.2: Nutrition tips for disease prevention while travelling

- Drink bottled or treated water
- Eat freshly cooked meals
- Include fruits rich in vitamin C
- Avoid street foods of uncertain hygiene

Search string: “nutrition disease prevention travel OER”

4.2.2 Dietary needs for tourists with chronic conditions

Tourists with chronic conditions such as **diabetes** or **hypertension** require special dietary attention. Diabetes management involves meals low in refined sugars and high in fibre to regulate blood sugar. Hypertension management requires reduced salt intake and foods rich in potassium, such as bananas and leafy greens. Hospitality providers must ensure that menus include safe options for these groups to prevent health complications during travel.



Fill in the blank: Tourists with hypertension should reduce their intake of _____.

Image showing diabetic-friendly meals (whole grains, vegetables) and low-salt options for hypertension

Plate 4.2: Dietary needs for tourists with chronic conditions

Search string: “diabetic hypertension diet tourism OER”

4.2.3 Food safety and hygiene in tourism settings

Food safety is the practice of handling, preparing, and storing food in ways that prevent foodborne illness. In tourism settings, food safety is critical because tourists may be unfamiliar with local food preparation standards. Proper cooking, refrigeration, and hygiene practices such as handwashing protect tourists from illness. Hospitality providers must train staff and maintain high standards to ensure guest safety.

Fill in the blank: Handling, preparing, and storing food to prevent illness is known as _____.

Diagram showing food safety practices in hospitality (clean water, refrigeration, cooking, hygiene)

Figure 4.2: Food safety and hygiene in tourism settings

Search string: “food safety hospitality tourism OER”

Pilot questions 4.2

1. Dietary practices that reduce the likelihood of infections or health problems are called _____.
2. Tourists with hypertension should reduce their intake of _____.
3. Name one nutrient that helps regulate blood sugar in diabetics.
4. Handling, preparing, and storing food to prevent illness is known as _____.
5. Why is food safety especially important in tourism settings?

4.3 Practical Applications In Hospitality And Tourism

4.3.1 Menu planning for seasonal variations

Menu planning is the process of designing meals that meet nutritional needs while considering seasonal conditions. In hot climates, menus should feature light meals, fresh fruits, and hydrating beverages. In cold climates, energy-dense foods such as soups, grains, and fatty fish are more suitable. During rainy or humid seasons, menus should emphasise food safety, with freshly cooked meals and safe water sources.



Fill in the blank: In hot climates, menus should feature light meals and _____ beverages.

Diagram showing seasonal menu planning with examples for hot, cold, and rainy climates

Figure 4.3: Menu planning for seasonal variations

Search string: “seasonal menu planning hospitality OER”

4.3.2 Catering for diverse health needs of tourists

Hospitality providers must cater to tourists with diverse health needs. This includes offering diabetic-friendly meals, low-salt options for those with hypertension, and allergen-free dishes for guests with food allergies. Providing these options demonstrates sensitivity to health requirements and enhances guest trust.

Fill in the blank: Guests with food allergies should be offered _____-free dishes.

Image showing diabetic-friendly meals, low-salt dishes, and allergen-free options

Plate 4.3: Catering for diverse health needs of tourists

Search string: “hospitality catering health needs tourists OER”

4.3.3 Enhancing tourist satisfaction through nutrition-sensitive services

Nutrition-sensitive services improve tourist satisfaction by aligning meals with health and seasonal needs. Offering balanced, appealing, and safe meals enhances wellbeing and encourages repeat visits. Hotels and restaurants that integrate nutrition into their service delivery often gain a competitive advantage in the tourism industry.

Fill in the blank: Nutrition-sensitive services improve tourist satisfaction by aligning meals with _____ and seasonal needs.

Box 4.3: Benefits of nutrition-sensitive services in tourism

- Improves guest wellbeing
- Encourages repeat visits
- Builds trust and loyalty
- Enhances business reputation

Search string: “nutrition hospitality tourist satisfaction OER”

Pilot questions 4.3



1. In hot climates, menus should feature light meals and _____ beverages.
2. Guests with food allergies should be offered _____-free dishes.
3. Name one type of food suitable for cold climate menus.
4. Nutrition-sensitive services improve tourist satisfaction by aligning meals with _____ and seasonal needs.
5. Why do nutrition-sensitive services give hospitality providers a competitive advantage?

4.4 Case Studies And Best Practices

4.4.1 Examples of seasonal menu adaptations in hotels and resorts

Hotels and resorts often adapt their menus to reflect seasonal conditions and tourist needs. In tropical destinations, menus may highlight fresh fruits, salads, and hydrating beverages, while in alpine resorts, hearty soups and energy-dense meals are more common. These adaptations ensure tourists remain comfortable and healthy while enjoying their travel experience.

Fill in the blank: In tropical destinations, menus often highlight fresh _____ and hydrating beverages.

Image showing seasonal menu adaptations: tropical fruit platters and alpine soups

Plate 4.4: Seasonal menu adaptations in hotels and resorts

Search string: “seasonal menu adaptations hotels resorts OER”

4.4.2 Successful approaches to health-conscious tourism catering

Health-conscious catering involves offering meals that meet diverse health needs while maintaining appeal. Examples include diabetic-friendly desserts, gluten-free options, and low-salt dishes for hypertensive guests. Resorts that provide these options often report higher guest satisfaction and loyalty, as tourists feel their wellbeing is prioritised.

Fill in the blank: Resorts that provide health-conscious catering often report higher guest _____.

Box 4.4: Examples of health-conscious catering approaches

- Diabetic-friendly desserts
- Gluten-free options
- Low-salt dishes for hypertensive guests
- Allergen-free meals for sensitive groups
- Search string: “health-conscious catering tourism OER”



4.4.3 Lessons from international tourism nutrition practices

International tourism provides valuable lessons in nutrition management. For example, Mediterranean resorts often emphasise fresh vegetables, olive oil, and seafood, while Asian destinations highlight rice-based meals and herbal teas. These practices show how cultural traditions can align with health-conscious tourism, offering variety and balance to guests.

Fill in the blank: Mediterranean resorts often emphasise fresh vegetables, olive oil, and _____.

Diagram showing international tourism nutrition practices (Mediterranean, Asian, tropical examples)

Figure 4.4: Lessons from international tourism nutrition practices

Search string: “international tourism nutrition practices OER”

Pilot questions 4.4

1. In tropical destinations, menus often highlight fresh _____ and hydrating beverages.
2. Resorts that provide health-conscious catering often report higher guest _____.
3. Name one example of a health-conscious catering approach.
4. Mediterranean resorts often emphasise fresh vegetables, olive oil, and _____.
5. Why are international tourism nutrition practices valuable for hospitality providers

Series Summary

This Series has examined how seasonal and health variations influence tourists’ nutrition and how hospitality providers can respond effectively. We began by considering seasonal influences, looking at nutritional needs in hot, cold, and humid climates. Then we explored health-related considerations, including disease prevention, dietary needs for tourists with chronic conditions, and the importance of food safety. Following that, we focused on practical applications in hospitality, such as seasonal menu planning, catering for diverse health needs, and nutrition-sensitive services. Finally, we reviewed case studies and best practices from hotels, resorts, and international tourism to consolidate learning.

By completing this Series, you should now be able to explain how seasonal conditions affect tourists’ nutrition (SLO 4.1), analyse health-related nutritional considerations (SLO 4.2), apply nutrition principles to hospitality contexts (SLO 4.3), and evaluate case studies and best practices in tourism nutrition (SLO 4.4). These outcomes ensure you can connect theory with practice, equipping you to enhance tourist wellbeing and satisfaction through nutrition-sensitive hospitality services.

Glossary of Terms

- **Allergen-free dishes:** Meals prepared without common allergens such as nuts, gluten, or dairy, designed to be safe for sensitive guests.



- **Chronic conditions:** Long-term health issues such as diabetes or hypertension that require ongoing dietary management.
- **Disease prevention:** Dietary practices and behaviours that reduce the risk of infections or health problems, especially while travelling.
- **Electrolytes:** Minerals such as sodium, potassium, and magnesium that regulate fluid balance, muscle function, and nerve activity.
- **Energy-dense foods:** Foods that provide a high number of calories per serving, such as nuts, grains, and fatty fish, useful in cold climates.
- **Food safety:** The practice of handling, preparing, and storing food in ways that prevent contamination and foodborne illness.
- **Health-conscious catering:** Hospitality services that provide meals tailored to diverse health needs, including diabetic-friendly, low-salt, and allergen-free options.
- **Menu planning:** The process of designing meals that meet nutritional requirements while considering seasonal and health variations.
- **Nutrition-sensitive services:** Hospitality practices that align meals with health and seasonal needs to improve tourist wellbeing and satisfaction.
- **Seasonal menu adaptations:** Adjustments made to hospitality menus to reflect climate conditions, such as light meals in hot climates or hearty soups in cold climates.

Concept Check Questions

Objective questions

1. Minerals such as sodium, potassium, and magnesium that regulate fluid balance are called _____. (Linked to SLO 4.1).
2. Foods that provide high calories per serving are called _____ foods (Linked to SLO 4.1).
3. Dietary practices that reduce the likelihood of infections or health problems are called _____ (Linked to SLO 4.2).
4. Tourists with hypertension should reduce their intake of _____ (Linked to SLO 4.2).
5. Handling, preparing, and storing food to prevent illness is known as _____ (Linked to SLO 4.2).

Short-answer questions

6. Explain why hydration is critical for tourists in hot climates (Linked to SLO 4.1).
7. Describe one dietary adjustment suitable for tourists in cold climates (Linked to SLO 4.1).



8. State one dietary consideration for tourists with diabetes and explain its importance (Linked to SLO 4.2).
9. Give one example of how hospitality providers can cater for tourists with food allergies (Linked to SLO 4.3).
10. Identify one benefit of nutrition-sensitive services in tourism (Linked to SLO 4.3).

Long-answer questions

11. Analyse how seasonal variations influence tourists' nutritional needs, using examples from hot, cold, and humid climates (Linked to SLO 4.1).
12. Evaluate the importance of health-related nutritional considerations for tourists, including disease prevention, chronic conditions, and food safety (Linked to SLO 4.2).
13. Apply nutrition principles to hospitality by designing a sample menu that addresses seasonal variations and diverse health needs (Linked to SLO 4.3).
14. Assess lessons from international tourism nutrition practices and explain how they can enhance hospitality services (Linked to SLO 4.4).

Answers to Concept Check Questions

Objective questions

1. Electrolytes
2. Energy-dense
3. Disease prevention
4. Salt
5. Food safety

Short-answer questions

6. Hydration is critical in hot climates because tourists lose fluids and electrolytes through sweat, which can lead to dehydration and fatigue.
7. In cold climates, tourists should consume energy-dense foods such as nuts or soups to maintain warmth and energy.
8. Diabetics should eat fibre-rich meals to regulate blood sugar and avoid spikes, which helps prevent complications.
9. Hospitality providers can offer allergen-free dishes, such as gluten-free bread or nut-free desserts, to ensure safety for allergic guests.
10. Nutrition-sensitive services improve guest wellbeing and encourage repeat visits, enhancing business reputation.



Long-answer questions

11. **Basic response:** Seasonal variations affect nutrition by requiring hydration and light meals in hot climates, energy-dense foods in cold climates, and safe, cooked meals in humid seasons. **Value-added response:** Outstanding learners may add that electrolyte replacement is vital in hot climates, high-calorie intake supports thermoregulation in cold climates, and food safety practices reduce risks of waterborne diseases in humid seasons.
12. **Basic response:** Health-related considerations include safe water and meals for disease prevention, low-sugar diets for diabetics, and low-salt diets for hypertensive tourists. Food safety ensures meals are safe to consume. **Value-added response:** Outstanding learners may expand by linking these practices to global health standards, explaining how poor nutrition during travel can worsen chronic conditions, and highlighting the role of staff training in food safety.
13. **Basic response:** A sample menu could include fruit juices and salads for hot climates, soups and grains for cold climates, and freshly cooked meals for humid seasons, with diabetic-friendly and allergen-free options. **Value-added response:** Outstanding learners may design a detailed menu with portion sizes, nutrient balance, and seasonal variety, explaining how these choices enhance tourist satisfaction and align with hospitality standards.
14. **Basic response:** International practices such as Mediterranean diets with olive oil and seafood, or Asian diets with rice and herbal teas, provide healthy and appealing options for tourists. **Value-added response:** Outstanding learners may assess how adopting these practices can diversify menus, promote cultural appreciation, and strengthen the global competitiveness of hospitality providers.

Answers to Pilot Questions

Answers to Pilot Questions 4.1

1. Electrolytes
2. Energy-dense
3. Warm meals, soups, and hot drinks
4. Food safety
5. Hydration prevents dehydration and supports body function in hot climates

Answers to Pilot Questions 4.2

1. Disease prevention
2. Salt
3. Fibre, because it helps regulate blood sugar
4. Food safety
5. Tourists may be unfamiliar with local food standards, making safety essential



Answers to Pilot Questions 4.3

1. Hydrating
2. Allergen
3. Soups or grains
4. Health
5. They improve wellbeing, loyalty, and reputation

Answers to Pilot Questions 4.4

1. Fruits
2. Satisfaction
3. Gluten-free options (or diabetic-friendly desserts, low-salt dishes, allergen-free meals)
4. Seafood
5. They provide models of effective practices and cultural variety for hospitality providers

References and Attributions

All references and attributions below are presented in APA style for clarity and consistency. They include suggested sources for illustrations, open educational resources (OERs), and AI-generated prompts used in the Series.

Figures and Plates

- *Figure 4.1: Nutritional needs in hot climates* AI-generated suggestion: “Create a diagram showing hydration and electrolyte balance in hot climates with water and fruit icons.” Suggested OER search string: “nutrition hydration electrolytes hot climate OER.”
- *Plate 4.1: Energy-dense foods for cold climates* AI-generated suggestion: “Generate an image showing energy-dense foods such as nuts, grains, and fatty fish for cold climates.” Suggested OER search string: “energy dense foods cold climate OER.”
- *Box 4.1: Food safety tips for rainy or humid seasons* AI-generated suggestion: “Generate a text box listing food safety tips for rainy or humid seasons.” Suggested OER search string: “food safety rainy season tourism OER.”
- *Box 4.2: Nutrition tips for disease prevention while travelling* AI-generated suggestion: “Generate a text box listing nutrition tips for disease prevention while travelling.” Suggested OER search string: “nutrition disease prevention travel OER.”
- *Plate 4.2: Dietary needs for tourists with chronic conditions* AI-generated suggestion: “Generate an image showing diabetic-friendly meals and low-salt options for hypertension.” Suggested OER search string: “diabetic hypertension diet tourism OER.”



- *Figure 4.2: Food safety and hygiene in tourism settings* AI-generated suggestion: “Create a diagram showing food safety practices in hospitality such as clean water, refrigeration, cooking, and hygiene.” Suggested OER search string: “food safety hospitality tourism OER.”
- *Figure 4.3: Menu planning for seasonal variations* AI-generated suggestion: “Create a diagram showing seasonal menu planning with examples for hot, cold, and rainy climates.” Suggested OER search string: “seasonal menu planning hospitality OER.”
- *Plate 4.3: Catering for diverse health needs of tourists* AI-generated suggestion: “Generate an image showing diabetic-friendly meals, low-salt dishes, and allergen-free options.” Suggested OER search string: “hospitality catering health needs tourists OER.”
- *Box 4.3: Benefits of nutrition-sensitive services in tourism* AI-generated suggestion: “Generate a text box listing benefits of nutrition-sensitive services in tourism.” Suggested OER search string: “nutrition hospitality tourist satisfaction OER.”
- *Plate 4.4: Seasonal menu adaptations in hotels and resorts* AI-generated suggestion: “Generate an image showing tropical fruit platters and alpine soups as examples of seasonal menu adaptations.” Suggested OER search string: “seasonal menu adaptations hotels resorts OER.”
- *Box 4.4: Examples of health-conscious catering approaches* AI-generated suggestion: “Generate a text box listing examples of health-conscious catering approaches in tourism.” Suggested OER search string: “health-conscious catering tourism OER.”
- *Figure 4.4: Lessons from international tourism nutrition practices* AI-generated suggestion: “Create a diagram showing Mediterranean, Asian, and tropical nutrition practices in tourism.” Suggested OER search string: “international tourism nutrition practices OER.”

General References

- Whitney, E., & Rolfes, S. R. (2019). *Understanding Nutrition* (15th ed.). Cengage Learning.
- Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. (2019). *Introduction to Human Nutrition* (3rd ed.). Wiley-Blackwell.
- World Health Organization. (2020). *Healthy diet*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/healthy-diet> (who.int in Bing)



Course Title: Introduction to Nutrition and food production

Course Code: HMT 201

Course Unit: 2 Units

- Foundations and History of Nutrition Science
- Food Constituents: Sources, Digestion, and Roles
- Human Physiology and Dietary Relevance
- Tourists' Nutrition: Seasonal and Health Variations
- Nutrient Requirements, Deficiencies, and Absorption Process

Series 5: Nutrient Requirements, Deficiencies, And Absorption Process

Suggested Outline

- **Part 1: Nutrient Requirements Across Life Stages**
 - Macronutrient requirements (carbohydrates, proteins, fats)
 - Micronutrient requirements (vitamins and minerals)
 - Nutrient needs in children, adolescents, adults, and elderly
- **Part 2: Nutrient Deficiencies And Their Implications**
 - Common deficiencies (iron, vitamin D, iodine, protein-energy)
 - Symptoms and health consequences of deficiencies
 - Strategies for prevention and management
- **Part 3: Nutrient Absorption And Transport Processes**
 - Digestive mechanisms for macronutrients
 - Absorption pathways for micronutrients
 - Role of circulatory and lymphatic systems in nutrient transport
- **Part 4: Case Studies And Practical Applications**
 - Examples of deficiency-related health challenges
 - Best practices in dietary planning to meet nutrient needs
 - Lessons from global nutrition interventions

Introduction

Nutrients are the building blocks of health, yet many people struggle to meet their daily requirements or suffer from deficiencies that affect wellbeing. Whether it is a child needing protein for growth, an adult requiring iron for energy, or an elderly person needing vitamin D for bone strength, understanding nutrient requirements and how the body absorbs them is essential. This Series highlights the importance of balanced nutrition, the risks of deficiencies, and the processes that enable nutrients to be absorbed and transported in the body.



The aim of this Series is to equip you with knowledge of nutrient requirements across life stages, the implications of deficiencies, and the mechanisms of nutrient absorption and transport. By the end, you will be able to connect dietary needs with physiological processes and practical strategies for maintaining health.

We shall commence this Series by examining nutrient requirements across life stages, focusing on macronutrients and micronutrients. Next, we will explore nutrient deficiencies, their symptoms, and strategies for prevention. Following that, we will move on to the absorption and transport processes, highlighting the role of the digestive, circulatory, and lymphatic systems. Finally, we will wrap up with case studies and practical applications, drawing lessons from real-world nutrition challenges and global interventions to bring the Series to a close.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 5.1** define the macronutrient and micronutrient requirements across different life stages,
- **SLO 5.2** explain the symptoms and health consequences of common nutrient deficiencies,
- **SLO 5.3** analyse strategies for preventing and managing nutrient deficiencies,
- **SLO 5.4** describe the digestive mechanisms involved in the absorption of macronutrients,
- **SLO 5.5** demonstrate how micronutrients are absorbed and transported in the body,
- **SLO 5.6** evaluate the role of the circulatory and lymphatic systems in nutrient transport, and
- **SLO 5.7** assess case studies and practical applications to identify effective approaches for meeting nutrient requirements and addressing deficiencies.

5.1 Nutrient Requirements Across Life Stages

5.1.1 Macronutrient requirements (carbohydrates, proteins, fats)

Macronutrients are nutrients required in large amounts to provide energy and support growth. They include carbohydrates, proteins, and fats. Carbohydrates are the body's main source of energy, proteins are essential for growth and repair, and fats provide energy storage and help absorb fat-soluble vitamins. The balance of these macronutrients varies across life stages, with children needing more protein for growth, adolescents requiring extra energy, and adults focusing on balanced intake for maintenance.

Fill in the blank: Nutrients required in large amounts to provide energy and support growth are called _____.



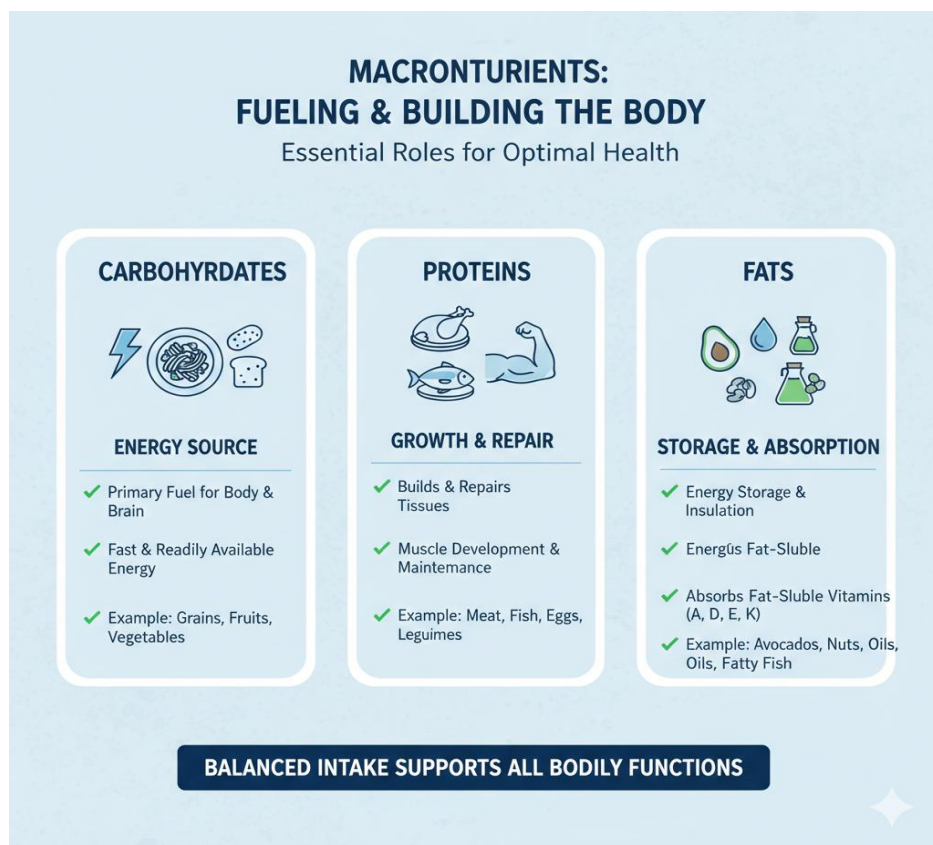


Diagram showing macronutrient functions (carbohydrates for energy, proteins for growth, fats for storage and absorption)

Figure 5.1: Functions of macronutrients

Search string: “macronutrients functions diagram OER”

5.1.2 Micronutrient requirements (vitamins and minerals)

Micronutrients are nutrients required in small amounts but are vital for body functions. They include vitamins and minerals. Vitamins such as vitamin C support immunity, while minerals like calcium strengthen bones. Deficiencies in micronutrients can lead to serious health problems, such as anaemia from lack of iron or rickets from lack of vitamin D.

Fill in the blank: Nutrients required in small amounts but vital for body functions are called

_____.



MICRONUTRIENTS

Essential Vitamins & Minerals

- ✓ **Vitamin C:** Supports Immunity
- ✓ **Vitamin D:** Strengthens Bones
- ✓ **Iron:** Supports Oxygen Transport
- ✓ **Calcium:** Maintains Bone Health

Fueling Health at a Cellular Level

Box 5.1: Examples of micronutrients and their functions

- Vitamin C: supports immunity
- Vitamin D: strengthens bones
- Iron: supports oxygen transport
- Calcium: maintains bone health

Search string: “micronutrients vitamins minerals functions OER”

5.1.3 Nutrient needs in children, adolescents, adults, and elderly

Nutrient requirements change across life stages. Children need protein and calcium for growth and bone development. Adolescents require increased energy and protein to support rapid growth and hormonal changes. Adults need balanced diets to maintain health and prevent disease, while the elderly require more calcium, vitamin D, and fibre to support bone strength and digestion.

Fill in the blank: Adolescents require increased energy and _____ to support rapid growth.



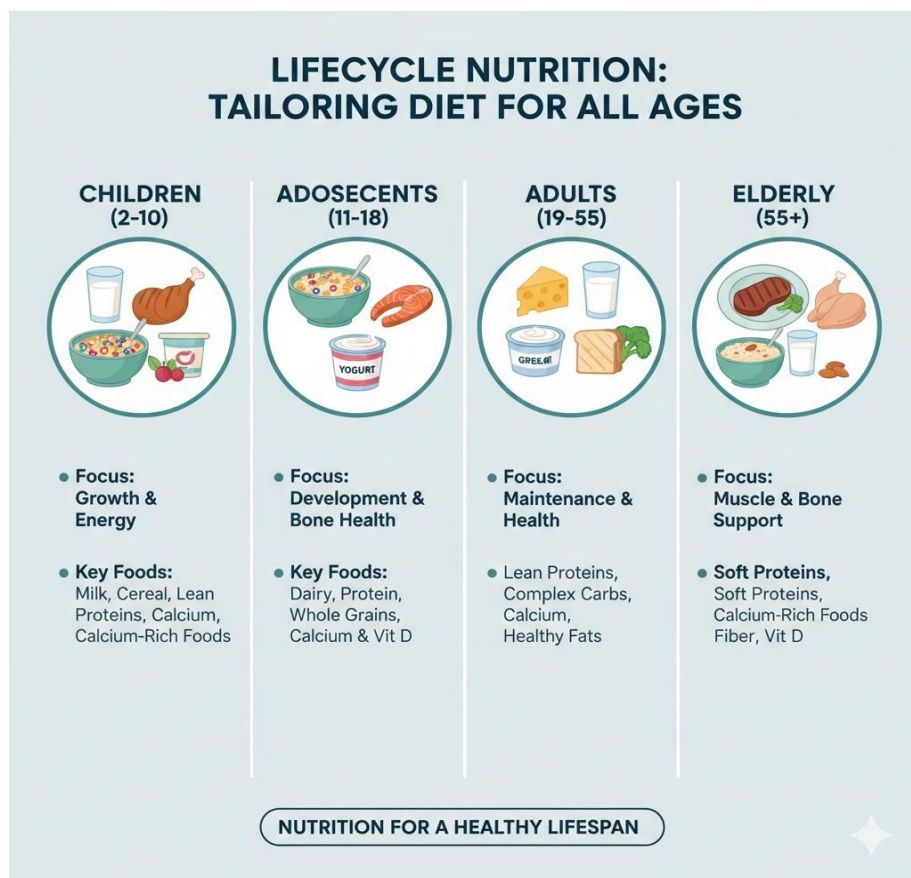


Image showing foods for different life stages: milk and eggs for children, cereals and proteins for adolescents, balanced meals for adults, and calcium-rich foods for elderly

Plate 5.1: Nutrient needs across life stages

Search string: “nutrient needs across life stages OER”

Pilot questions 5.1

1. Nutrients required in large amounts to provide energy and support growth are called _____.
2. Nutrients required in small amounts but vital for body functions are called _____.
3. Name one micronutrient and its function.
4. Adolescents require increased energy and _____ to support rapid growth.
5. Why do elderly people require more calcium and vitamin D?

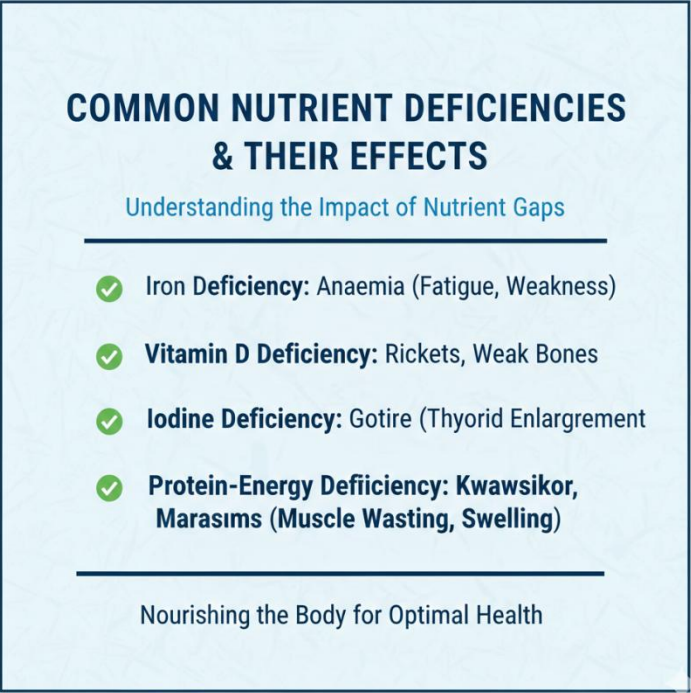
5.2 Nutrient Deficiencies And Their Implications

5.2.1 Common deficiencies (iron, vitamin D, iodine, protein-energy)



Nutrient deficiencies occur when the body does not receive enough of a particular nutrient to function properly. Common examples include iron deficiency, which can lead to anaemia; vitamin D deficiency, which causes rickets and weak bones; iodine deficiency, which results in goitre; and protein-energy deficiency, which leads to conditions such as kwashiorkor and marasmus. These deficiencies are often linked to poor diets, limited food access, or health conditions that affect absorption.

Fill in the blank: A lack of iron in the diet can lead to _____.



**COMMON NUTRIENT DEFICIENCIES
& THEIR EFFECTS**

Understanding the Impact of Nutrient Gaps

- ✓ **Iron Deficiency:** Anaemia (Fatigue, Weakness)
- ✓ **Vitamin D Deficiency:** Rickets, Weak Bones
- ✓ **Iodine Deficiency:** Goitre (Thyroid Enlargement)
- ✓ **Protein-Energy Deficiency:** Kwashiorkor, Marasmus (Muscle Wasting, Swelling)

Nourishing the Body for Optimal Health

Box 5.2: Common nutrient deficiencies and their effects

- Iron deficiency: anaemia
- Vitamin D deficiency: rickets, weak bones
- Iodine deficiency: goitre
- Protein-energy deficiency: kwashiorkor, marasmus

Search string: “common nutrient deficiencies effects OER”

5.2.2 Symptoms and health consequences of deficiencies

Deficiencies often present with noticeable symptoms. For example, anaemia causes fatigue and weakness, rickets leads to bowed legs in children, and goitre results in swelling of the thyroid gland. Protein-energy deficiency can cause stunted growth, swelling, and wasting. Recognising these symptoms is important for early intervention and treatment.



Fill in the blank: Swelling of the thyroid gland due to iodine deficiency is called _____.

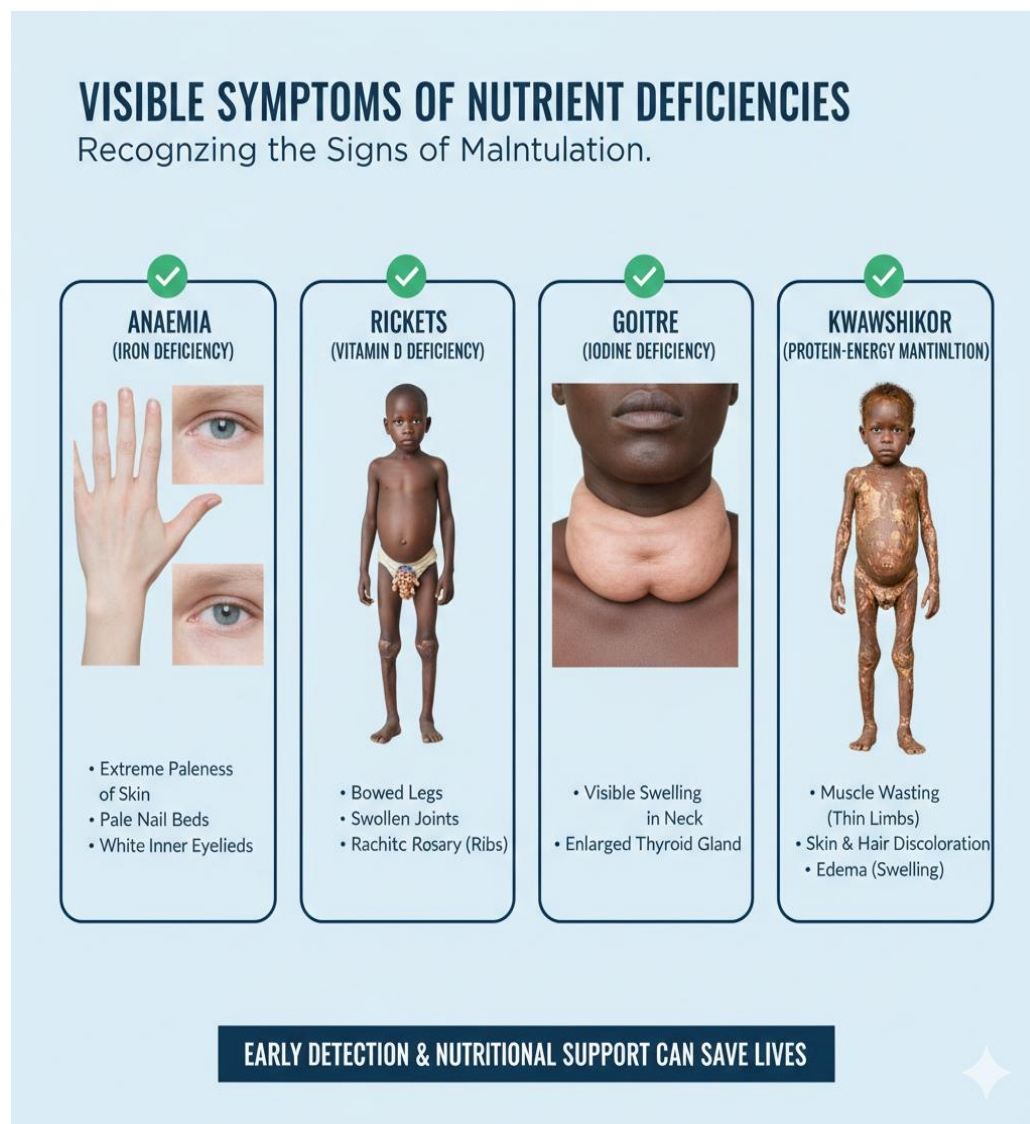


Image showing visible symptoms of deficiencies (anaemia, rickets, goitre, kwashiorkor)

Plate 5.2: Symptoms of nutrient deficiencies

Search string: “nutrient deficiency symptoms OER”

5.2.3 Strategies for prevention and management

Preventing deficiencies requires balanced diets, fortified foods, and supplementation where necessary. For example, iron tablets can prevent anaemia, iodised salt reduces goitre, and vitamin D supplements help strengthen bones. Public health interventions such as food fortification and nutrition education are also effective strategies.

Fill in the blank: Adding iodine to salt is an example of food _____.





Diagram showing strategies for preventing deficiencies (balanced diet, supplementation, fortification, education)

Figure 5.2: Strategies for preventing nutrient deficiencies

Search string: “nutrient deficiency prevention strategies OER”

Pilot questions 5.2

1. A lack of iron in the diet can lead to _____.
2. Swelling of the thyroid gland due to iodine deficiency is called _____.
3. Name one symptom of protein-energy deficiency.
4. Adding iodine to salt is an example of food _____.
5. Why is nutrition education important in preventing deficiencies?

5.3 Nutrient Absorption And Transport Processes

5.3.1 Digestive mechanisms for macronutrients



Digestion is the process by which food is broken down into smaller components that the body can absorb. Carbohydrates are broken down into simple sugars like glucose, proteins into amino acids, and fats into fatty acids and glycerol. These processes occur through mechanical actions such as chewing and chemical actions involving enzymes and stomach acids.

Fill in the blank: Proteins are broken down into smaller units called _____.

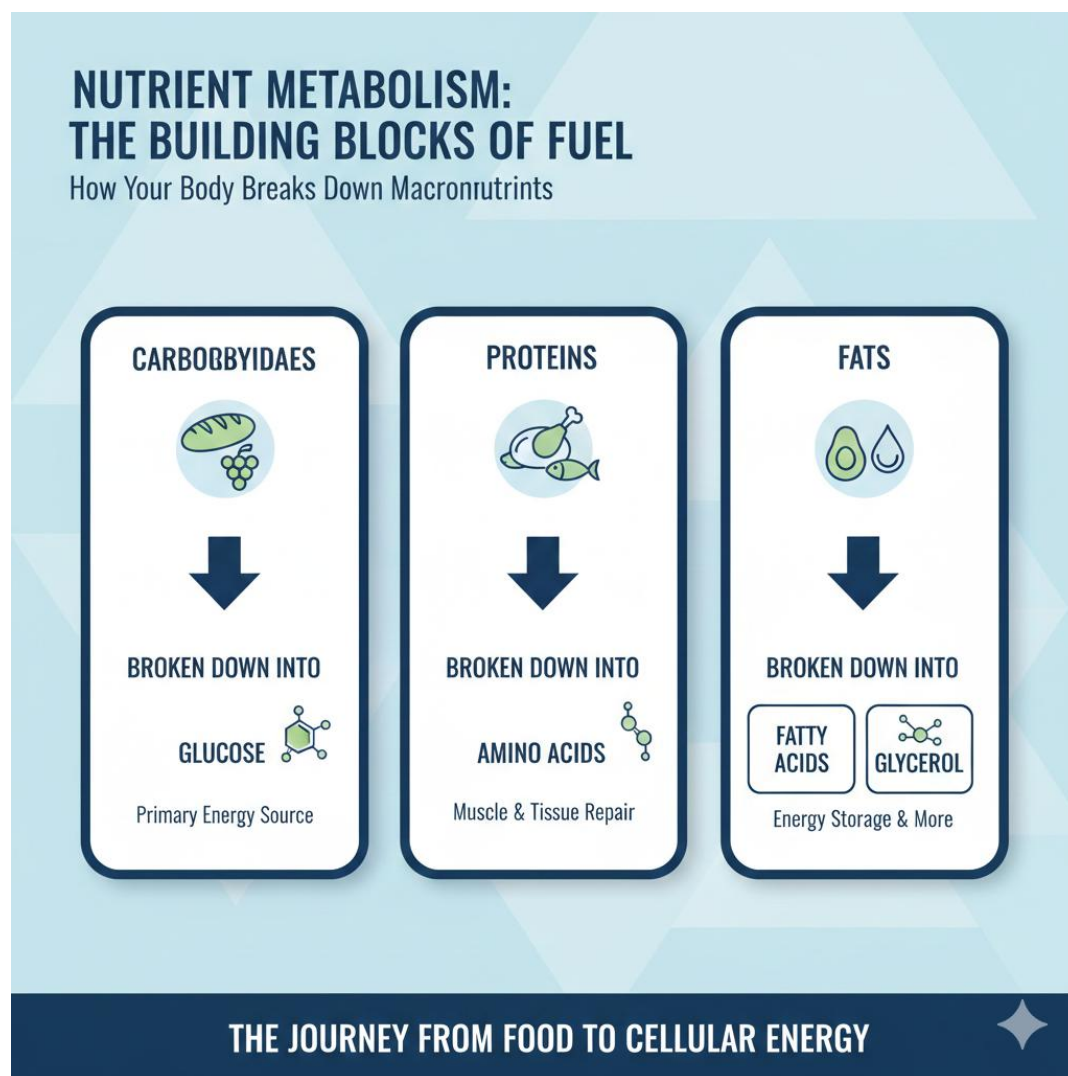


Diagram showing digestive breakdown of carbohydrates, proteins, and fats

Figure 5.3: Digestive mechanisms for macronutrients

Search string: “digestive breakdown macronutrients diagram OER”

5.3.2 Absorption pathways for micronutrients

Absorption is the process by which nutrients pass from the digestive tract into the bloodstream or lymphatic system. Micronutrients such as vitamins and minerals are absorbed in specific parts of the small intestine. For example, iron is absorbed in the duodenum, while vitamin B12



requires intrinsic factor for absorption in the ileum. Calcium absorption depends on vitamin D availability.

Fill in the blank: Vitamin B12 requires _____ factor for absorption in the ileum.

MICRONUTRIENT ABSORPTION PATHWAYS
How Your Body Takes In Essential Nutrients

- ✓ **Iron:** Absorbed in the Duodenum
- ✓ **Vitamin B12:** Requires Intrinsic Factor in the Ileum
- ✓ **Calcium:** Absorption Depends on Vitamin D

A Look at Digestive Specialization

Box 5.3: Examples of micronutrient absorption pathways

- Iron: absorbed in the duodenum
- Vitamin B12: requires intrinsic factor in the ileum
- Calcium: absorption depends on vitamin D

Search string: “micronutrient absorption pathways OER”

5.3.3 Role of circulatory and lymphatic systems in nutrient transport

Once absorbed, nutrients must be transported to cells throughout the body. The **circulatory system** carries water-soluble nutrients such as glucose and amino acids through the blood, while the **lymphatic system** transports fat-soluble nutrients such as fatty acids and fat-soluble vitamins. These systems ensure nutrients reach tissues where they are needed for energy, growth, and repair.

Fill in the blank: Fat-soluble nutrients are transported through the _____ system.



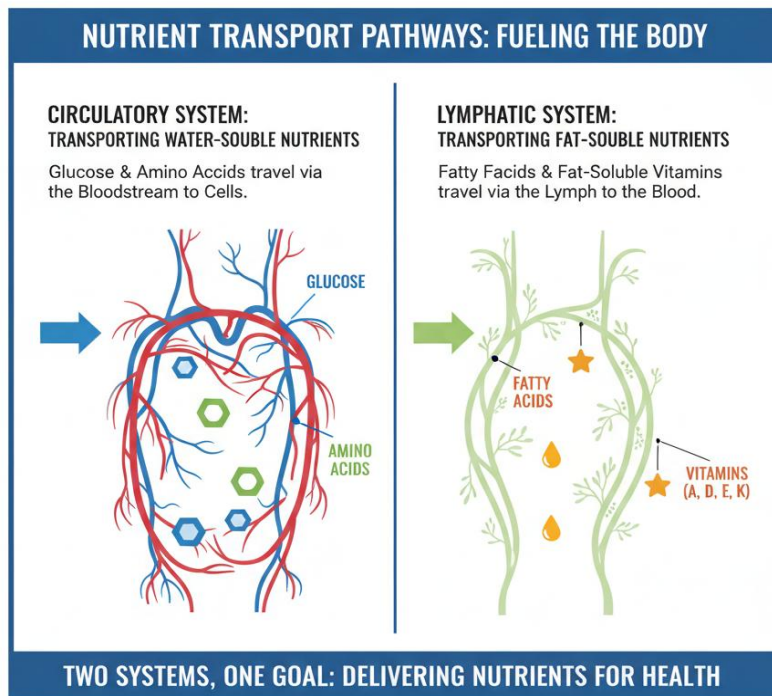


Image showing circulatory system transporting glucose and amino acids, and lymphatic system transporting fatty acids and vitamins

Plate 5.3: Nutrient transport in the body

Search string: “nutrient transport circulatory lymphatic system OER”

Pilot questions 5.3

1. Proteins are broken down into smaller units called _____.
2. Vitamin B12 requires _____ factor for absorption in the ileum.
3. Name one nutrient absorbed in the duodenum.
4. Fat-soluble nutrients are transported through the _____ system.
5. Why is the circulatory system important for nutrient transport?

5.4 Case Studies And Practical Applications

5.4.1 Examples of deficiency-related health challenges



Real-world cases highlight the impact of nutrient deficiencies. For instance, iron deficiency anaemia is common among women of reproductive age, leading to fatigue and reduced productivity. In some regions, vitamin D deficiency has caused widespread rickets in children, while iodine deficiency has resulted in goitre in communities without access to iodised salt. These examples show how deficiencies can affect both individuals and populations.

Fill in the blank: A lack of iodine in the diet can result in _____.



Image showing examples of deficiency-related health challenges (anaemia, rickets, goitre)

Plate 5.4: Deficiency-related health challenges

Search string: “nutrient deficiency case studies OER”

5.4.2 Best practices in dietary planning to meet nutrient needs

Dietary planning refers to organising meals to ensure they meet nutrient requirements. Best practices include balancing macronutrients, incorporating diverse food groups, and considering age-specific needs. For example, including iron-rich foods such as beans and leafy greens can prevent anaemia, while calcium-rich foods like milk and yoghurt support bone health. Effective dietary planning also involves cultural sensitivity and affordability.



Fill in the blank: Including iron-rich foods such as beans and leafy greens can prevent _____.

BEST PRACTICES IN DIETARY PLANNING
Meeting Nutrient Needs for Optimal Health

- ✓ Balance Macronutrients (Carbohydrates, Proteins, Fats)
- ✓ Include Diverse Food Groups (Fruits, Vegetables, Grains, Lean Proteins)
- ✓ Consider Age-Specific Needs (Children, Adolescents, Adults, Elderly)
- ✓ Ensure Cultural Sensitivity and Affordability

Tailoring Nutrition for Individual & Community Well-being

Box 5.4: Best practices in dietary planning

- Balance macronutrients (carbohydrates, proteins, fats)
- Include diverse food groups
- Consider age-specific needs
- Ensure cultural sensitivity and affordability

Search string: “dietary planning best practices nutrition OER”

5.4.3 Lessons from global nutrition interventions

Global nutrition interventions provide valuable lessons for addressing deficiencies. Programmes such as food fortification, school feeding schemes, and supplementation campaigns have reduced deficiencies worldwide. For example, fortifying flour with iron has lowered anaemia rates, while vitamin A supplementation has reduced blindness in children. These interventions demonstrate how coordinated efforts can improve public health outcomes.

Fill in the blank: Fortifying flour with _____ has helped reduce anaemia rates globally.





Diagram showing global nutrition interventions (fortification, supplementation, school feeding programmes)

Figure 5.4: Global nutrition interventions

Search string: “global nutrition interventions OER”

Pilot questions 5.4

1. A lack of iodine in the diet can result in _____.
2. Including iron-rich foods such as beans and leafy greens can prevent _____.
3. Name one best practice in dietary planning.
4. Fortifying flour with _____ has helped reduce anaemia rates globally.
5. Why are global nutrition interventions important for public health?

Series Summary



This Series has explored the essential aspects of nutrient requirements, deficiencies, and absorption processes, highlighting their importance for health across different life stages. We began by examining macronutrient and micronutrient needs, then moved on to common deficiencies and their implications. Following that, we studied how nutrients are digested, absorbed, and transported through the circulatory and lymphatic systems. Finally, we reviewed case studies and practical applications, drawing lessons from dietary planning and global nutrition interventions.

By completing this Series, you should now be able to define nutrient requirements across life stages (SLO 5.1), explain the symptoms and consequences of deficiencies (SLO 5.2), analyse strategies for prevention and management (SLO 5.3), describe digestive and absorption processes (SLOs 5.4 and 5.5), evaluate the role of transport systems (SLO 5.6), and assess practical applications and case studies (SLO 5.7). These outcomes ensure you can connect nutritional theory with real-world practices, equipping you to address health needs effectively in both individual and public health contexts.

Glossary of Terms

- **Absorption:** The process by which nutrients pass from the digestive tract into the bloodstream or lymphatic system for use by the body.
- **Amino acids:** The smaller units into which proteins are broken down during digestion, used for growth and repair of tissues.
- **Circulatory system:** The body system that transports water-soluble nutrients such as glucose and amino acids through the blood to cells.
- **Deficiency:** A condition that occurs when the body does not receive enough of a particular nutrient, leading to health problems.
- **Digestion:** The process of breaking down food into smaller components that can be absorbed and used by the body.
- **Dietary planning:** The organisation of meals to ensure they meet nutrient requirements, considering balance, diversity, age-specific needs, and cultural factors.
- **Electrolytes:** Minerals such as sodium, potassium, and magnesium that regulate fluid balance, muscle function, and nerve activity.
- **Fortification:** The addition of nutrients to foods, such as iodine in salt or iron in flour, to prevent deficiencies in populations.
- **Kwashiorkor:** A severe form of protein-energy deficiency characterised by swelling, stunted growth, and weakness.
- **Lymphatic system:** The body system that transports fat-soluble nutrients such as fatty acids and vitamins to cells.
- **Macronutrients:** Nutrients required in large amounts, including carbohydrates, proteins, and fats, which provide energy and support growth.



- **Micronutrients:** Nutrients required in small amounts, such as vitamins and minerals, which are vital for body functions.
- **Protein-energy deficiency:** A condition caused by insufficient protein and calorie intake, leading to health issues such as kwashiorkor and marasmus.
- **Rickets:** A disease caused by vitamin D deficiency, leading to weak bones and bowed legs in children.
- **Vitamin B12:** A micronutrient essential for blood formation and nerve function, requiring intrinsic factor for absorption in the ileum.

Concept Check Questions

Objective questions

1. Nutrients required in large amounts to provide energy and support growth are called _____ (Linked to SLO 5.1).
2. Nutrients required in small amounts but vital for body functions are called _____ (Linked to SLO 5.1).
3. A lack of iron in the diet can lead to _____ (Linked to SLO 5.2).
4. Swelling of the thyroid gland due to iodine deficiency is called _____ (Linked to SLO 5.2).
5. Fat-soluble nutrients are transported through the _____ system (Linked to SLO 5.6).

Short-answer questions

6. Explain why adolescents require increased energy and protein (Linked to SLO 5.1).
7. Describe one symptom of protein-energy deficiency (Linked to SLO 5.2).
8. State one strategy for preventing nutrient deficiencies and explain how it works (Linked to SLO 5.3).
9. Identify one nutrient absorbed in the duodenum and explain its importance (Linked to SLO 5.5).
10. Give one example of a global nutrition intervention and its impact (Linked to SLO 5.7).

Long-answer questions

11. Analyse how nutrient requirements differ across life stages, giving examples for children, adolescents, adults, and the elderly (Linked to SLO 5.1).
12. Evaluate the health consequences of common nutrient deficiencies, including iron, vitamin D, iodine, and protein-energy deficiencies (Linked to SLO 5.2).
13. Apply nutrition principles by designing a sample dietary plan that prevents deficiencies and meets nutrient needs for a specific age group (Linked to SLO 5.3).



14. Assess the role of the circulatory and lymphatic systems in nutrient transport and explain why both are essential (Linked to SLO 5.6).

15. Examine lessons from global nutrition interventions and discuss how they can be adapted to improve dietary planning in local contexts (Linked to SLO 5.7).

Answers to Concept Check Questions

Objective questions

1. Macronutrients
2. Micronutrients
3. Anaemia
4. Goitre
5. Lymphatic

Short-answer questions

6. Adolescents require increased energy and protein to support rapid growth, hormonal changes, and physical activity.
7. Protein-energy deficiency can cause stunted growth, swelling, or wasting.
8. Fortification is one strategy; for example, adding iodine to salt prevents goitre.
9. Iron is absorbed in the duodenum and is essential for oxygen transport in the blood.
10. Vitamin A supplementation has reduced childhood blindness in many countries.

Long-answer questions

11. **Basic response:** Children need protein and calcium for growth, adolescents require extra energy and protein, adults need balanced diets for maintenance, and the elderly require more calcium, vitamin D, and fibre. **Value-added response:** Outstanding learners may add that nutrient needs are influenced by activity levels, hormonal changes, and age-related absorption challenges, and may provide examples of culturally appropriate foods for each stage.

12. **Basic response:** Iron deficiency causes anaemia, vitamin D deficiency leads to rickets, iodine deficiency results in goitre, and protein-energy deficiency causes kwashiorkor and marasmus. **Value-added response:** Outstanding learners may expand by linking deficiencies to public health burdens, explaining socioeconomic factors, and discussing how deficiencies affect productivity and development.

13. **Basic response:** A dietary plan for children could include milk, eggs, cereals, and fruits to meet protein, calcium, and vitamin needs. **Value-added response:** Outstanding learners may design a detailed plan with portion sizes, nutrient balance, and culturally relevant foods, explaining how the plan prevents deficiencies and supports growth.



14. **Basic response:** The circulatory system transports water-soluble nutrients, while the lymphatic system transports fat-soluble nutrients. Both are essential for delivering nutrients to cells. **Value-added response:** Outstanding learners may explain how these systems interact, discuss clinical conditions affecting transport, and highlight their role in overall metabolism.

15. **Basic response:** Global interventions such as fortification, supplementation, and school feeding programmes have reduced deficiencies worldwide. **Value-added response:** Outstanding learners may assess how these interventions can be adapted locally, considering cultural diets, affordability, and infrastructure, and propose innovative solutions for sustainable nutrition.

Answers to Pilot Questions

Answers to Pilot Questions 5.1

1. Macronutrients
2. Micronutrients
3. Vitamin C supports immunity, vitamin D strengthens bones, iron supports oxygen transport, calcium maintains bone health
4. Protein
5. To support bone strength and prevent conditions such as osteoporosis

Answers to Pilot Questions 5.2

1. Anaemia
2. Goitre
3. Stunted growth, swelling, or wasting
4. Fortification
5. It helps people make informed food choices and prevents deficiencies through awareness

Answers to Pilot Questions 5.3

1. Amino acids
2. Intrinsic
3. Iron
4. Lymphatic
5. It delivers water-soluble nutrients such as glucose and amino acids to cells for energy and repair

Answers to Pilot Questions 5.4



1. Goitre
2. Anaemia
3. Balance macronutrients, include diverse food groups, consider age-specific needs, ensure cultural sensitivity and affordability
4. Iron
5. They reduce deficiencies, improve public health outcomes, and provide sustainable solutions for communities

References and Attributions

All references and attributions below are presented in APA style for clarity and consistency. They include suggested sources for illustrations, open educational resources (OERs), and AI-generated prompts used in the Series.

Figures and Plates

- *Figure 5.1: Functions of macronutrients* AI-generated suggestion: “Create a diagram showing carbohydrates for energy, proteins for growth, and fats for storage and vitamin absorption.” Suggested OER search string: “macronutrients functions diagram OER.”
- *Box 5.1: Examples of micronutrients and their functions* AI-generated suggestion: “Generate a text box listing examples of micronutrients and their functions.” Suggested OER search string: “micronutrients vitamins minerals functions OER.”
- *Plate 5.1: Nutrient needs across life stages* AI-generated suggestion: “Generate an image showing foods for children, adolescents, adults, and elderly, such as milk, cereals, proteins, and calcium-rich foods.” Suggested OER search string: “nutrient needs across life stages OER.”
- *Box 5.2: Common nutrient deficiencies and their effects* AI-generated suggestion: “Generate a text box listing common nutrient deficiencies and their effects.” Suggested OER search string: “common nutrient deficiencies effects OER.”
- *Plate 5.2: Symptoms of nutrient deficiencies* AI-generated suggestion: “Generate an image showing visible symptoms of anaemia, rickets, goitre, and kwashiorkor.” Suggested OER search string: “nutrient deficiency symptoms OER.”
- *Figure 5.2: Strategies for preventing nutrient deficiencies* AI-generated suggestion: “Create a diagram showing balanced diet, supplementation, fortification, and education as strategies for preventing deficiencies.” Suggested OER search string: “nutrient deficiency prevention strategies OER.”
- *Figure 5.3: Digestive mechanisms for macronutrients* AI-generated suggestion: “Create a diagram showing carbohydrates broken into glucose, proteins into amino acids, and fats



into fatty acids and glycerol.” Suggested OER search string: “digestive breakdown macronutrients diagram OER.”

- *Box 5.3: Examples of micronutrient absorption pathways* AI-generated suggestion: “Generate a text box listing examples of micronutrient absorption pathways.” Suggested OER search string: “micronutrient absorption pathways OER.”
- *Plate 5.3: Nutrient transport in the body* AI-generated suggestion: “Generate an image showing circulatory system transporting glucose and amino acids, and lymphatic system transporting fatty acids and vitamins.” Suggested OER search string: “nutrient transport circulatory lymphatic system OER.”
- *Plate 5.4: Deficiency-related health challenges* AI-generated suggestion: “Generate an image showing anaemia, rickets, and goitre as examples of deficiency-related health challenges.” Suggested OER search string: “nutrient deficiency case studies OER.”
- *Box 5.4: Best practices in dietary planning* AI-generated suggestion: “Generate a text box listing best practices in dietary planning to meet nutrient needs.” Suggested OER search string: “dietary planning best practices nutrition OER.”
- *Figure 5.4: Global nutrition interventions* AI-generated suggestion: “Create a diagram showing fortification, supplementation, and school feeding programmes as global nutrition interventions.” Suggested OER search string: “global nutrition interventions OER.”

General References

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- Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. (2019). *Introduction to Human Nutrition* (3rd ed.). Wiley-Blackwell.
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