



Textbook of

Nutrition

for GNM Nursing Students

(As per the INC Syllabus for GNM)



Special Features

- Thoroughly Revised and Updated Edition
- Perfect Blend of Theory and Clinical Practice
- 100+ Figures, Tables, and Flowcharts
- 200+ Multiple Choice Questions
- Exclusively covered Dietary Allowances Tables
- Special Section on Cookery Practical

3rd
Edition



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Varinder Kaur

Textbook of

Nutrition

for GNM Nursing Students

(As per the INC Syllabus for GNM)



Third Edition

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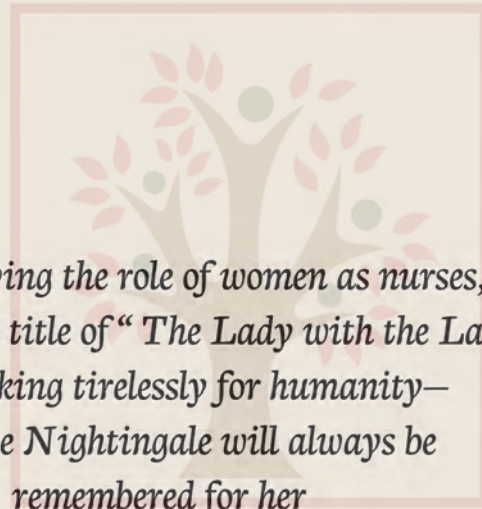
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CBS Nursing Knowledge Tree Extends its Tribute to

Florence Nightingale

*For glorifying the role of women as nurses,
For holding the title of “The Lady with the Lamp,”
For working tirelessly for humanity—
Florence Nightingale will always be
remembered for her
selfless and memorable services to the
human race.*



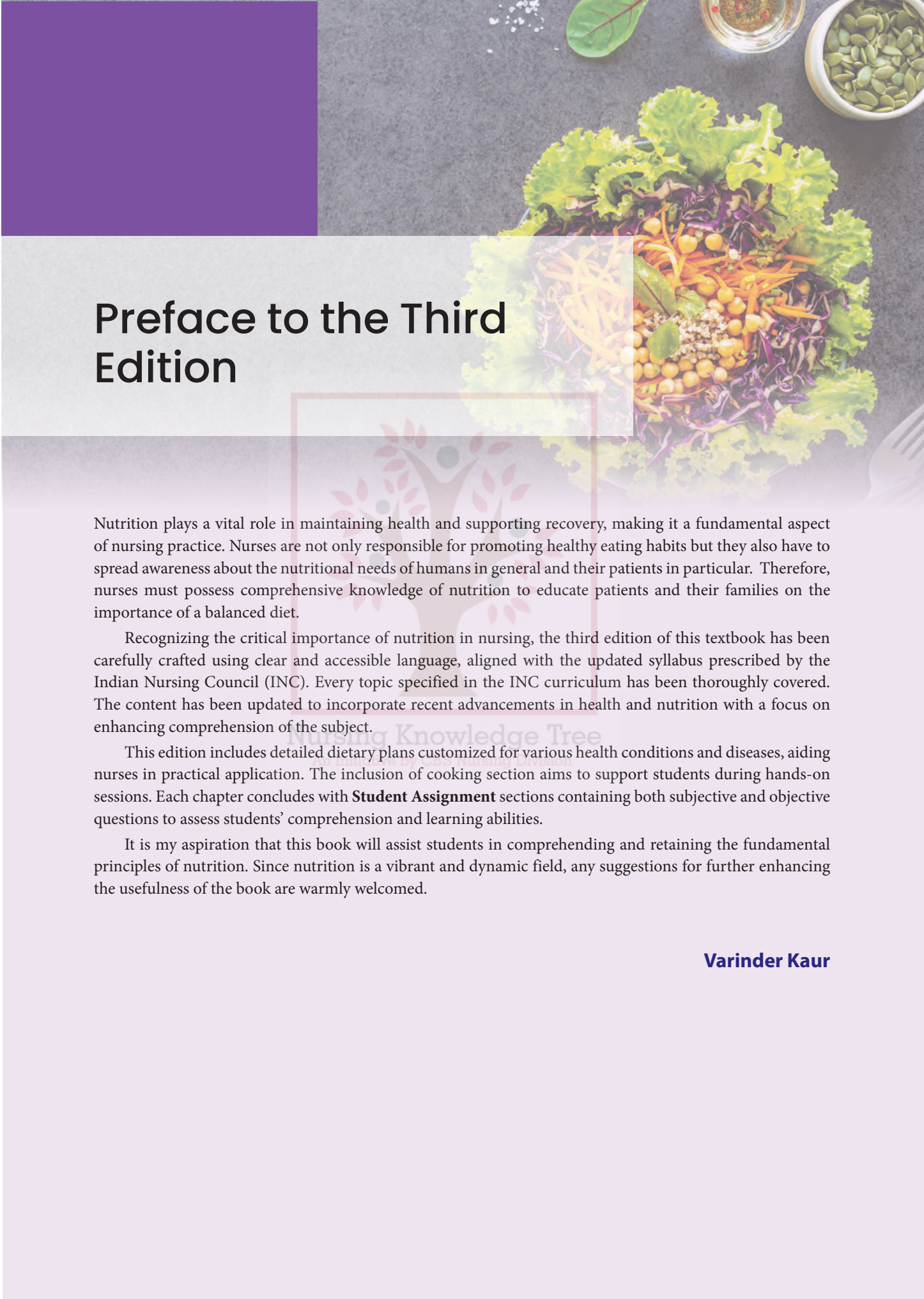
Florence Nightingale
(May 1820 – August 1910)



Dedicated to
The Almighty God,
My Family and
Dear Son

Sehaj Preet Singh

Nursing Knowledge Tree
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Preface to the Third Edition


Nutrition plays a vital role in maintaining health and supporting recovery, making it a fundamental aspect of nursing practice. Nurses are not only responsible for promoting healthy eating habits but they also have to spread awareness about the nutritional needs of humans in general and their patients in particular. Therefore, nurses must possess comprehensive knowledge of nutrition to educate patients and their families on the importance of a balanced diet.

Recognizing the critical importance of nutrition in nursing, the third edition of this textbook has been carefully crafted using clear and accessible language, aligned with the updated syllabus prescribed by the Indian Nursing Council (INC). Every topic specified in the INC curriculum has been thoroughly covered. The content has been updated to incorporate recent advancements in health and nutrition with a focus on enhancing comprehension of the subject.

This edition includes detailed dietary plans customized for various health conditions and diseases, aiding nurses in practical application. The inclusion of cooking section aims to support students during hands-on sessions. Each chapter concludes with **Student Assignment** sections containing both subjective and objective questions to assess students' comprehension and learning abilities.

It is my aspiration that this book will assist students in comprehending and retaining the fundamental principles of nutrition. Since nutrition is a vibrant and dynamic field, any suggestions for further enhancing the usefulness of the book are warmly welcomed.

Varinder Kaur



Preface to the Second Edition

Nutrition is a vital component for a healthy life. Nurses play a crucial role in maintaining and restoring nutrition in the individuals. The role of a nurse in nutrition is not only confined to promote healthy dietary habits but also to take care of the nutritional requirements of the people sick or healthy. Therefore, the nurses must be well-versed with all the aspects of nutrition to educate the patients as well as their family members about the importance of a healthy and nutritious diet.

Keeping in view the importance of nutrition in Nursing, this *Textbook of Nutrition for GNM Nursing Students*, 2nd edition has been designed in a very simple and lucid language and as per modified syllabus prescribed by the Indian Nursing Council (INC). Special care has been taken to include each and every topic prescribed in INC curriculum. The whole content of the book is updated keeping in mind the recent advancements in the field of health and nutrition as well as the necessity of immunity-boosting methods. Detailed diet plans related to various conditions and diseases have been included to help the nurses to apply them as and when needed in their profession. The cookery section added in this edition will surely help the students in practicals. Subjective and objective questions under the heading “Assess Yourself” have been included at the end of every chapter to assess students’ learning skills.

I hope this book will help the students in memorizing and understanding the basic concepts of nutrition. As nutrition is a vast subject to explore, any suggestions for further improvement of the book will be highly appreciated.

Varinder Kaur



Acknowledgments

Every task demands effort but it cannot reach to its completion without cooperation from all the quarters. I pay my profound gratitude to the **Almighty** to glorify my way that led to the completion of this book. I am extremely grateful to my family, especially my husband, **Rupinderjit Singh** and my son **Sehaj Preet Singh** for their continued patience, support and encouragement. I express my gratitude and heartfelt thanks to my colleagues **Ms Kiran** and **Ms Jyoti Saini** for their sincere efforts toward completion of this book.

I extend my special thanks to **Mr Satish Kumar Jain** (Chairman) and **Mr Varun Jain** (Managing Director), M/s CBS Publishers and Distributors Pvt Ltd for their wholehearted support in publication of this book. I have no words to describe the role, efforts, inputs and initiatives undertaken by **Mr Bhupesh Aarora** [Sr. Vice President – Publishing & Marketing (Health Sciences Division)] for helping and motivating me.

I sincerely thank the entire CBS team for bringing out the book with utmost care and attractive presentation. I would like to thank Ms Nitasha Arora (Assistant General Manager Publishing – Medical and Nursing), Ms Daljeet Kaur (Assistant Publishing Manager) and Dr Anju Dhir (Product Manager and Medical Development Editor) for their publishing support. I would also extend my thanks to Mr Shivendu Bhushan Pandey (Sr. Manager and Team Lead), Mr Ashutosh Pathak (Sr. Proofreader cum Team Coordinator) and all the production team members for devoting laborious hours in designing and typesetting the book.

From Publisher's Desk

Dear Reader,

Nursing Education has a rich history, often characterized by traditional teaching techniques that have evolved over time. Primarily, teaching took place within classroom settings. Lectures, textbooks, and clinical rotations were the core teaching tools; and students majorly relied on textbooks by local or foreign publishers for quality education. However, today, technology has completely transformed the field of nursing education, making it an integral part of the curriculum. It has evolved to include a range of technological tools that enhance the learning experience and better prepare students for clinical practice.



As publishers, we've been contributing to the field of Medical Science, Nursing and Allied Sciences and earned the trust of many. By supporting **Indian authors**, coupled with **nursing webinars and conferences**, we have paved an easier path for aspiring nurses, empowering them to excel in national and state level exams. With this, we're not only enhancing the quality of patient care but also enabling future nurses to adapt to new challenges and innovations in the rapidly evolving world of healthcare. Following the ideology of **Bringing learning to people instead of people going for learning**, so far, we've been doing our part by:

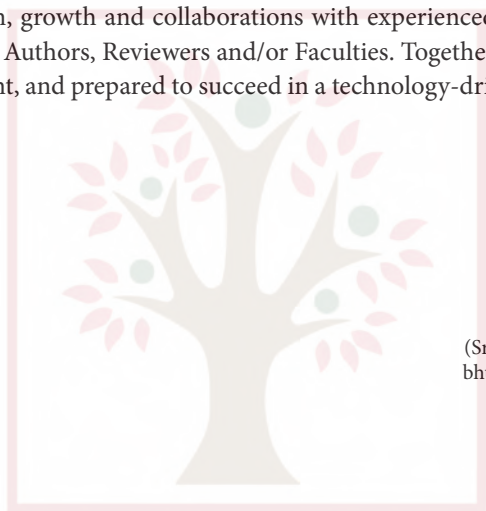
- Developing quality content by qualified and well-versed authors
- Building a strong community of faculty and students
- Introducing a smart approach with Digital/Hybrid Books, and
- Offering simulation Nursing Procedures, etc.

Innovative teaching methodologies, such as modern-age Phygital Books, have sparked the interest of the Next-Gen students in pursuing advanced education. The enhancement of educational standards through **Omnipresent Knowledge Sharing Platforms** has further facilitated learning, bridging a gap between doctors and nurses.

At Nursing Next Live, a sister concern of CBS Publishers & Distributors, we have long recognized the immense potential within the nursing field. Our journey in innovating nursing education has allowed us to make

substantial and meaningful contributions. With the vision of strengthening learning at every stage, we have introduced several plans that cater to the specific needs of the students, including but not limited to **Plan UG** for undergraduates, **Plan MSc** for postgraduate aspirants, **Plan FDP** for upskilling faculties, **SDL** for integrated learning and **Plan NP** for bridging the gap between theoretical & practical learning. Additionally, we have successfully completed seven series of our **Target High** Book in a very short period, setting a milestone in the education industry. We have been able to achieve all this just with the sole vision of laying the foundation of diversified knowledge for all. With the rise of a new generation of educated, tech-savvy individuals, we anticipate even more remarkable advancements in the coming years.

We take immense pride in our achievements and eagerly look forward to the future, brimming with new opportunities for innovation, growth and collaborations with experienced minds such as yourself who can contribute to our mission as Authors, Reviewers and/or Faculties. Together, let's foster a generation of nurses who are confident, competent, and prepared to succeed in a technology-driven healthcare system.



Mr Bhupesh Aarora

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Nursing Knowledge Tree
An Initiative by CBS Nursing Division

Special Features of the Book

Learning Objectives in the beginning of every Chapter help readers understand the purpose of the chapter.

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Define health, nutrition, nutrients and various other terms.
- Describe factors affecting nutrition.
- Discuss changing concepts of food and nutrition.
- Describe relationship between health and nutrition.

CHAPTER OUTLINE

- Introduction
- History and Changing Concepts of Nutrition
- Nutrition
- Nutrients

Chapter Outline gives a glimpse of the content covered in the chapter.

Key Terms are added in each chapter to help understand difficult scientific terms in easy language.

KEY TERMS

Antioxidants: These are natural or synthetic substances found in food that help in boosting the immunity of body.

Health: According to WHO "health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."

Imbalance: It is a pathological state resulting from disproportion of the nutrients.

Nutrition: Nutrition is defined as the scientific study of food and its relation to health.

The book is well illustrated with relevant colorful **Figures** to add value to the content.

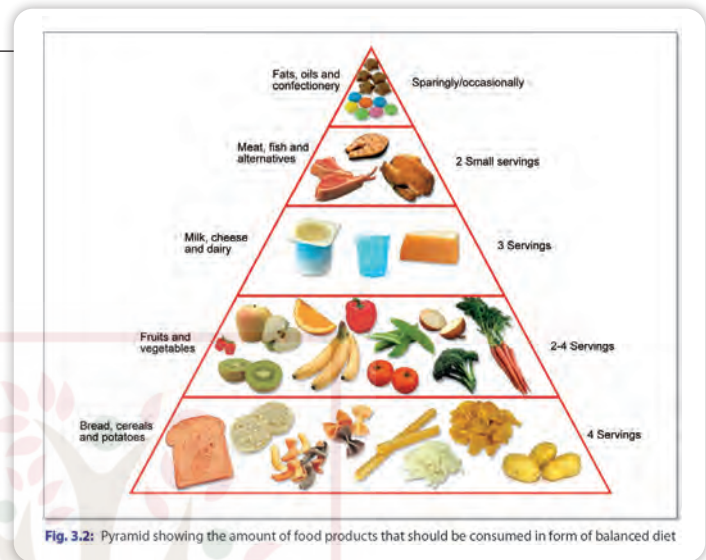


Table 3.3: Body mass index according to body types

Classification	Body mass index
Underweight	<18.5
Normal range	18.5–24.9
Overweight	≥25.0
Preobese	25.0–29.9

Numerous **Tables** have been used in the chapters to facilitate learning in a quick way.

At the end of chapters, **Student Assignment** section is given which contains frequently asked questions in exams and multiple choice questions to help students attain mastery over the subject.

STUDENT ASSIGNMENT

LONG ANSWER QUESTIONS

1. What are the precautions to be taken while preserving the food?
2. How the food can be stored at commercial level?

SHORT ANSWER QUESTIONS

1. Discuss the principles of cooking.
2. Explain the household method of preservation of food.

MULTIPLE CHOICE QUESTIONS

1. The full form of PFA is:

a. Prevention of Food Act	b. Protection of Food Act
c. Prevention of Food Adulteration Act	d. None of these

Studded with a special section on **Cookery Practical** from applied perspective.

Cookery Practical

HOUSEHOLD MEASUREMENT

- 1 liter = 1000 milliliter (mL)
- 1 liter = 1 kilograms (kg) = 1000 grams = 1,000,000 milligrams
- 1 gallon = 4 quarts
- 1 quart = 1 liter
- 1 pint = 500 milliliters (mL)
- 1 cup = 240 milliliters (mL)
- 1 fluid ounce (oz) = 30–32 milliliters (mL)
- 1 ounce = 28 grams
- 1 tbs (tbs) = 15 milliliters (mL)
- 1 tsp (tsp) = 5 milliliters (mL)
- 3 tsp (tsp) = 1 tbs (tbs)
- 2.2 pound (lbs) = 1 kilograms (kg)
- 1 quart = 2 pints = 4 cups = 64 tbs (tbs) = 192 tsp
- 1 quart = 16 ounces = 1 pound
- 1 cubic centimeter (cc) = 1 milliliter (mL)

Note: A cubic centimeter (cc) is equal to the volume of a cube with side length of 1 cm.

Annexure

COMMONLY ASKED QUESTIONS IN EXAMINATION

- Explain common nutritional problems in India.
- Discuss dietary sources of proteins.
- Discuss protein deficiency diseases.
- Plan one day diet for toddler.
- Enlist fat soluble vitamins.
- What are the principles of cooking?
- Describe the different factors that help a patient in acceptance of diet.
- Explain different methods of preparation, preservation and cooking of food.
- Write a short note on balanced diet.
- Explain normal dietary requirements.
- Describe factors affecting selection and planning of meal.
- Write about food hygiene and laws related to food.
- Write a short note on classification of food.
- Write down the classification of proteins.
- What are the factors to be kept in mind by the nurse while selection and planning of meal?
- Explain functions of carbohydrates.
- Enlist main vitamin deficiencies.

Annexure provides additional but valuable information related to topics discussed in the book.

Syllabus for GNM Nursing

NUTRITION

Course Description

This course is designed to help students understand that nutrition is an integral component of health as nutrients play a vital role in the growth, development and maintenance of the body.

General Objectives

Upon completion of this course, the students will be able to:

- Describe the principles of nutrition and dietetics and its relationship to the human body in health and disease.
- Describe the balanced diet in promotion of health.
- Apply this knowledge in providing therapeutic diet and take care of the sick.
- Demonstrate skills in selection, preparation and preservation of food.

Total Hours: 30

Unit	Learning objectives	Content	Hours	Teaching learning activities	Methods of assessment
I	Describe the relationship between nutrition and health	Introduction <ul style="list-style-type: none">• Meaning of food, nutrition, nutrients, etc.• Food habits and customs• Factors affecting nutrition• Changing concepts in food and nutrition• Relationship of nutrition and health	2	<ul style="list-style-type: none">• Lecture cum discussions• Explain using charts	<ul style="list-style-type: none">• Short answer types• Objective type

Contd...

Unit	Learning objectives	Content	Hours	Teaching learning activities	Methods of assessment
II	Describe the classification of food	<p>Classification of Food</p> <ul style="list-style-type: none"> • Classification by origin: <ul style="list-style-type: none"> ▪ Food of animal origin ▪ Food of plant origin • Classification by chemical composition and sources: <ul style="list-style-type: none"> ▪ Carbohydrates ▪ Proteins ▪ Fats ▪ Minerals ▪ Vitamins ▪ Water • Classification by predominant: functions <ul style="list-style-type: none"> ▪ Body building food ▪ Energy giving food ▪ Protective food • Classification by nutritive value: <ul style="list-style-type: none"> ▪ Cereals and millets ▪ Pulses and legumes ▪ Vegetables ▪ Nuts and oilseeds ▪ Fruits ▪ Animal food ▪ Fats and oils ▪ Sugar and jaggery ▪ Condiments and spices ▪ Miscellaneous food 	2	<ul style="list-style-type: none"> • Lecture cum discussions • Real food items • Exhibits charts 	<ul style="list-style-type: none"> • Short answer types • Objective type • Essay type
III	<ul style="list-style-type: none"> • Explain normal dietary requirements • Demonstrate skill in calculating normal food requirements 	<p>Normal Dietary Requirements</p> <ul style="list-style-type: none"> • Energy: Calorie, measurement, body mass index, basal metabolic rate—determination and factors affecting • Balanced diet: Nutritive value of foods, calculation for different categories of people, normal food requirement calculation. Menu plan. Combination of food affecting and enhancing the nutritive value of the diet. • Budgeting for food, low cost meals, food substitutes. • Diseases and disorders caused by the imbalance of nutrients. • Food allergy—causes, types, diet modifications in gluten, lactose and protein intolerance, etc. • Food intolerance—inborn errors of metabolism. 	4	<ul style="list-style-type: none"> • Lecture cum discussions • Charts exhibits • Real food • Practical exercise 	<ul style="list-style-type: none"> • Short answer types • Objective type • Essay type

Unit	Learning objectives	Content	Hours	Teaching learning activities	Methods of assessment
IV	Describe the principles and various methods of preparation, preservation and storage of food	<p>Food Preparation, Preservation and Storage</p> <ul style="list-style-type: none"> Principles of cooking, methods of cooking and the effect of cooking on food and various nutrients. Safe food handling, health of food handlers. Methods of food preservation—household and commercial, precautions. Food storage—cooked and raw, household and commercial, ill effects of poorly stored food. Food adulteration and acts related to it. 	2	<ul style="list-style-type: none"> Lecture cum discussions Field visit to food processing unit Demonstration exhibits 	<ul style="list-style-type: none"> Short answer types Objective type Evaluation of exhibit preparation
V	Describe about therapeutic diet	<p>Therapeutic Diet</p> <ul style="list-style-type: none"> Diet modification in relation to medical and surgical condition of the individual such as Protein Energy Malnutrition (PEM), diabetes, cardiovascular disease, hepatitis, renal, gout, Irritable Bowel syndrome (IBS), obesity, cholecystectomy, partial gastrectomy, gastrostomy, bariatric surgery and colostomy, etc. Special diets—low sodium diet, fat free diet, diabetic diet, bland diet, high protein diet, low protein diet, low calorie diet, geriatric diet, iron rich diet, liquid diet, semisolid diet, soft diet and high fiber diet, etc. Factors affecting diet acceptance, feeding the helpless patient. Health education on nutrition needs and methods in diet modification. 	8	<ul style="list-style-type: none"> Lecture cum discussions Practical of planning therapeutic diet Demonstration charts Exhibits 	<ul style="list-style-type: none"> Short answer types Objective type Essay type

Contd...

Unit	Learning objectives	Content	Hours	Teaching learning activities	Methods of assessment
VI	Describe the concept of community nutrition	<p>Community Nutrition</p> <ul style="list-style-type: none"> • Nutritional problems and programs in India • Community food supply, food hygiene and commercially prepared and grown food available locally. • National and international food agencies—Central Food Training Research Institute (CFTRI), Food and Agriculture Organization (FAO), National Institute of Nutrition (NIN), Food Safety and Standards Authority of India (FSSAI), Cooperative for Assistance and Relief Everywhere (CARE), National Institute of Public Cooperation and Child Development (NIPCCD), etc. 	4	<ul style="list-style-type: none"> • Lecture cum discussions • Videos • Government of India nutrition manuals • Visit to the local food preparation/processing agency. 	<ul style="list-style-type: none"> • Short answer types • Objective type

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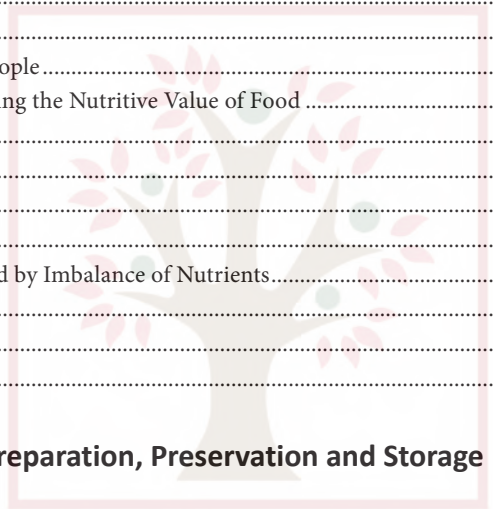
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4

Food Preparation, Preservation and Storage

LEARNING OBJECTIVES

After the completion of the chapter, the readers will be able to:

- Discuss principles and methods of cooking.
- Explain methods of food preservation.
- Describe food storage and ill effects of poorly-stored food.
- Explain food adulteration and the related acts.

CHAPTER OUTLINE

- Cooking
- Safe Food Handling
- Preservation of Food
- Storage of Food
- Food Adulteration and Related Acts

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KEY TERMS

Cookery: It is the group of methods and techniques, the art and science applied for the process of cooking.

Cooking: It is the process of preparing food particularly by the application of heat.

Cross-contamination: Cross-contamination can occur when microorganisms get spread from one person to another either while preparing the food, distributing or during the time of storage.

Cuisine: It is the type and style for cooking the food particularly for a location or culture.

Foodborne diseases: A foodborne disease refers to the infection or irritation of the gastrointestinal tract caused by the food or beverages that contain harmful bacterias, viruses, parasites or chemicals.

Food preservation: It refers to any one or number of techniques used to prevent food from spoilage

Food safety: The action of monitoring the food to ensure that it will not cause any foodborne illness is known as food safety.

Pasteurization: It is a method to preserve the milk in which milk is heated at temperature of 63–66°C (Holder method) for at least 30 minutes and then quickly cooled to 5°C to destroy the pathogens. It is considered better than boiling as it helps to preserve composition, flavor and nutritive value of milk.

COOKING

Cooking is the art, technology and craft of preparing the food for consumption with the use of heat. Earlier cooking was just considered an art but nowadays it is considered combination of both art and science. Cooking is considered a science because selecting the essential nutrients in right amount can only bring the desired effect on health and on the other hand cooking is also an art because it is symphony of taste, aroma and colors that tickle the senses.

Benefits

Cooking is not preparing the food just to provide energy to the body as it has many other benefits also. These are as follows:

- Cooking increases the variety of food available for consumption as different types of dishes can be prepared by using same ingredients.
- Eating cooked food makes the process of digestion easier and more nutrients can be absorbed by the body as compared to raw food. Certain nutrients are difficult to digest and absorb from raw food and should be properly cooked, for example, it is very hard to consume rice in its uncooked form.
- Cooking adds taste and aroma to the food.
- Cooking makes the mastication easier and saves the amount of energy required for chewing and digesting the food.
- Heating the food during the process of cooking kills the pathogens (*Salmonella*, *Staphylococcus*, etc.) and makes the food safer for consumption.
- Cooking also makes the preservation of food easier as storage of cooked food is convenient and also prevents spoilage of food.
- Cooking makes the food more presentable by improving its appearance and palatability.

Principles

It is a well-known fact that some nutrients are lost during the process of cooking. Some principles must be followed to minimize the loss of nutrients while cooking. These are as follows:

- While cooking the food, it is always good to cover the container with the lid as it helps to preserve the nutrients dissolved in water. Otherwise in case of open container all the nutrients would get evaporated with water.
- Food should be cooked by steaming method instead of boiling the food as steaming is very effective in retaining the nutrients. If the food needs to be boiled, sufficient water must be taken instead of using excessive water. In any case if the food is cooked in large amount of water, the excess of water may be used for preparing soups, sambar or for other such gravy items. In this way, the nutrients lost in one item can be used in preparing another item.
- Temperature, while cooking is another factor that must be kept in mind as cooking on high temperature results in the loss of nutrients. So try to keep the flame as low as possible to retain the nutrients in the food.
- Avoid deep frying of the food items. Though deep fried items are more crispy and tasty but are deprived of nutrients. Instead of deep frying, choose broiling or baking method that helps in retaining the nutrients.

- Always wash vegetables and fruits before peeling or cutting them as afterwards water soluble vitamins get dissolved into water. Use only sufficient water for washing instead of using excessive water.
- While picking up the food items from refrigerator, allow it to come to room temperature before cooking or consuming such items.
- It is also advised to prepare the food in iron pot as it provides elemental iron.
- Try to consume any vegetable or fruit within two days to avoid getting stale and deficient of nutrients.
- In case of dairy products like milk, sudden changes in temperature must be avoided as it destroys all the nutrients.
- Always pick whole grains over the refined grains. For example, brown rice have their bran intact and thus have more fibers, vitamins and other micronutrients (zinc and calcium).
- Cut fruits and vegetables for salads just before they are to be served and store in a cool place.
- Do not use excessive condiments like salt or red pepper, etc. as it may lead to common problems like hypertension or piles.
- Try to use organic food items to get maximum amount of nutrients.
- Cooking should always be done in hygienic place. The place for handling and storing the food should be hygienic.

Increasing the Nutritive Value of Food

There are various methods for increasing the nutritive value of food:

- Fermentation of the cereals and pulses increases the content of vitamins as done in South India for the preparation of idli and dosa.
- Pulses can be sprouted to increase the content of vitamin B and C. Sprouting not only increases the nutrient contents but also increases the digestibility of pulses. These can be consumed raw or by cooking lightly.
- Mixing the pulses with cereals adds in the nutritive value especially in the protein contents, for example, khichdi. The protein value can also be increased by adding dal, groundnuts to rice, roti or chapati.
- Addition of milk in place of water also increases the content of proteins and calories, for example, milk porridge for the children.
- Using millets such as ragi, jowar or bajra together with staple food as cereals add extra nutrients to the diet.
- The green leafy vegetables can be pounded either fresh or dried. It can be added to the dough for making chapatis. It increases the protein as well as iron content of the food item, for example, palak and dhania.

Methods

The commonly used basic cooking methods are divided into dry heat and moist heat cooking method based upon the type of heat used and way of cooking the food.

Dry Heat Method

In this method, the food being cooked does not use water to cook the food. The food is left dry and heat is applied to cook the food. The juices or water present in the food gets evaporated during heating process, which helps in cooking the food.

The following are the methods of dry heat cooking:

- **Baking (Fig. 4.1):** Food is cooked using convection heating. The food is put into an enclosed area where heat is applied within the confined space that helps the food to cook. Temperature required for baking is 250–255°F. Food prepared by this method is bread, pastry and cake.
- **Steaming (Fig. 4.2):** To steam food, water is added to a pot and then a stand is placed inside the pot. Food is placed on the stand and heat is applied. The hot steam rising from the boiling water acts on the food and helps it get cooked (there is not any contact between the food and water inside the pot). This method is very effective for cooking vegetables as the food does not lose its flavor and much of nutrients are retained during the cooking process.
- **Grilling and broiling (Fig. 4.3):** It is a dry heat cooking method. In the grilling method, food is cooked either directly or in the grill. The flavor and nutrients of the food is not much affected. In this method, heat is applied below the food and the heat seals the outside part of the food and juices inside the food cook it. Food is frequently turned over to prevent it from burning and to ensure that equal heating and cooking time is applied to both sides of the food. Foods like brinjal, tomato, cheese and kebab are cooked by this method. In broiling, heat source for cooking the food is above the food instead of below the food as in case of grilling method and it is also useful for preparing different types of meat.
- **Roasting (Fig. 4.4):** While roasting the food, direct heat is applied to the food. The action of direct heating makes the food tender. Again there is very little nutrient loss and flavor is not spoiled. This is mainly used for the flesh food like fish, meat or chicken.
- **Barbecue (Fig. 4.5):** It is also a dry method of cooking like grilling. The duration of cooking and type of heat used is the main difference between barbecue and grilling method. Grilling is generally done quickly over moderate to high direct heat that produces little smoke while barbecue is done slowly over low, indirect heat and food is flavored by the smoking process. This is mainly used for preparing meat or chicken.



Fig. 4.1: Baking



Fig. 4.2: Steaming



Fig. 4.3: Grilling and broiling



Fig. 4.4: Baking



Fig. 4.5: Barbecue

Moist Method

In this method, liquids, such as water, oil or coconut creams are used as a medium to cook the food. These liquids are added before the food is added to the cooking utensils.

- **Boiling (Fig. 4.6):** It is a very common and simple method of cooking. Enough water is added to the food and then cooked over the fire over 100°C. The action of the heated water makes the food cooked, for example, cooking the rice, beans, grams and pulses. Specific time must be kept for boiling these commodities otherwise excessive boiling results in the loss of essential vitamins and minerals.
- **Simmering (Fig. 4.7):** This method includes cooking below 80°C approximately. It helps in preserving the essential vitamins and minerals. It is used for cooking fish and meat where hardening of fibers occurs at high temperature.
- **Stewing (Fig. 4.8):** In this method, food is cooked by using a lot of liquid. Different kinds of vegetables are chopped or diced and mixed with water then put into the container with well-fitted lid to prevent evaporation. The only disadvantage is that some of the vegetables may be overcooked and nutrient may be lost. It is, therefore, important that the vegetables that took the longest time to cook must be put into the pan first and the ones that need least cooking should be put in the last and in this way nutrients can be preserved.



Fig. 4.6: Boiling



Fig. 4.7: Simmering



Fig. 4.8: Stewing

- **Frying (Fig. 4.9):** Food is fried using oil and solid fat. It is of further two types:
 - i. **Shallow frying:** Food is cooked with a little amount of oil or fat, for example, to make parantha, egg (omelette), dosa or chilla.
 - ii. **Deep frying:** Lots of oil or fat is used to cook the food. Food is cooked by putting into hot boiling oil. For example, potato chips and meat balls are cooked by this method.



Fig. 4.9: Frying

Effects of Cooking on Food Constituents

- **Carbohydrates:** Starch, sugar, gum and cellulose are important carbohydrates found in food. On cooking, the starch granules in food swell as they absorb water, this process is called gelatinization. Gelatinization also increases the volume of the food as may be seen in case of rice, when it is cooked there is bulk increase in the volume. When the sugar in the carbohydrates gets browned, this process is called caramelization, for example, when bread is heated its color changes to golden brown.

- **Proteins:** On heating, the proteins get hardened and solidified. The liquid inside the protein changes into solid with the effect of heat and this process is known as coagulation. It is very important to cook proteins on right temperature as excessive temperature makes them hard, dry and indigestible.
- **Fats:** Ordinary cooking has no effect on fats but prolonged heating as in case of frying for long periods thickens and darkens the fats. A part of essential fatty acids present in fats are destroyed, toxic polymerized products are formed and a change in flavor also occurs with prolonged heating.
- **Vitamins:** Thiamine and vitamin C are two vitamins which are much affected by the process of cooking. Loss of water soluble vitamins is mainly due to excessive heating or dissolving in excessive water.
- **Minerals:** There is no loss of mineral in normal cooking process but if food is overcooked or water used in cooking is discarded a small fraction of minerals may be lost.

Effects of Cooking on Different Types of Food

- **Cereals:** Cereals are the main staple food consumed for obtaining desired calories in India. Cereals are cooked mostly before consumption for easy digestion. Cereals are mainly rich in starch with a little protein within the cell wall. There are many methods of cooking the cereals. All cereals absorb water during cooking and starch granules swell up and burst, this process is called gelatinization. After gelatinization the protein content on the cell wall of cereals coagulates that improves the process of digestibility. Excessive use of water during cooking leads to loss of water soluble vitamins and minerals, therefore, cooking must be done with sufficient water that gets absorbed in the end of cooking process.
- **Pulses:** Pulses are a rich source of proteins and also contain little amount of carbohydrates, starch fats and fibers. Pulses also contain an antitrypsin substance that hinders the absorption of proteins, vitamins and minerals that get destroyed by proper cooking. Therefore, pulses must be properly cooked before consumption but excessive washing of pulses must be avoided to preserve essential nutrients.
- **Vegetables:** Vegetables are great sources of vitamins and minerals. The application of heat has a definite impact upon vegetables, the cellulose of vegetables gets softened by the heat process and is easier to digest as compared to raw vegetables. Cooking the vegetables in a closed vessel helps to retain flavor as well as essential nutrients. It is also very important to cook the vegetables in sufficient amount of water with sufficient time to avoid destruction of the micronutrients.
- **Meat:** Food of animal origin like meat is rich source of both macro and micro nutrients. Cooking has a major effect on the connective tissue of meat. Cooking results into contraction and gelatinization of collagen fibers, which convert the meat into jelly (very soft)-like structure. The fat of the meat is also melted by heat, which makes it chewable and easy to digest. Cooking also kills the pathogens and makes the meat safer to consume.
- **Milk:** Milk is a rich source of many nutrients like proteins, fats, calcium and phosphate but lacks in Vitamin C and iron. When milk is heated a layer full of fats gets accumulated on the surface, which can be removed easily that reduces the fat and protein content of the milk. Boiled milk is easier to consume as compared to raw milk. Boiling destroys enzymes, thiamine and useful lactic acid bacteria present in the milk. Pasteurization is another alternative method to preserve the milk in which milk is heated at temperature of 63–66°C for at least 30 minutes and then quickly cooled to 5°C to destroy the pathogens. It is considered better than boiling as it helps to preserve composition, flavor and nutritive value of milk.
- **Fish:** It is a rich source of proteins, vitamins and minerals. On heating, the proteins of the fish get coagulated. Cooking makes it chewable and easy to digest.

- **Eggs:** Eggs are the rich source of proteins. The albumin (white portion) of egg begins to coagulate and solidify and gets tough upon heating but much of the nutrients within the egg are not affected by the process of cooking. Raw eggs are very difficult to digest and there are many methods to consume the eggs in various forms that make the digestion of the eggs easier.

SAFE FOOD HANDLING

Safe steps in cooking, distributing and storage are essential to prevent foodborne diseases. Harmful bacteria cannot be seen with naked eyes so it is always better to have precautions.

To handle the food safely, special attention must be given upon 4 Cs. These are cleanliness, cross- contamination, cold or chill (maintenance of temperature) and cooking at safe temperature. These are as follows (Fig. 4.10):

- **Cleanliness:** Cleanliness of eating places is very important to prevent foodborne diseases. To maintain proper cleanliness of eating places, following facilities must be there:

- Eating places should not be near the open drains, manure pits or other sources of infection.
- Rooms where meals are served must be well ventilated and with adequate lighting facility. Walls of the eating room must be smooth and easily washable. Floors should be higher than the adjoining land and made up of such material that would be easy to clean.
- Kitchen where the food is prepared must have adequate facilities like ventilation, self-closing doors, proper water facility for drinking and washing the utensils along with adequate facilities for disposal of waste.
- There must be separate rooms for storage of cooked and uncooked food with adequate facility for maintaining the temperature.
- The whole area where the food is being prepared, served or stored must be free from rats, flies, cockroaches and other vectors.

- **Cross-contamination:** Cross-contamination can occur when microorganisms get spread from one person to another either while preparing the food, distributing or during the time of storage. Cross-contamination can lead to infection and serious diseases. To prevent cross-contamination, following measures must be adopted.

- Always wash hands before and after handling the food. Hands must be washed after using the toilets, changing the diapers, handling the pets, after coughing, sneezing and smoking. Use personal towels to rub the hands.
- Avoid contact with hair, saliva, mucus, sweat, blood, nails, clothes, jewelry or bandages while handling the food items.
- Food should not be handled by the person suffering from vomiting, diarrhea, sore throat, foodborne diseases, flu, cold, and discharge from ear, eye or any infection on the hands or skin. If in any case such person is handling the food then cover the skin and use mask to prevent cross-contamination.

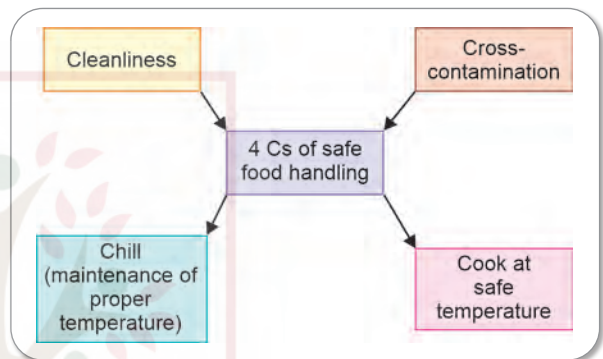


Fig. 4.10: 4 Cs to handle the food safely

- Wash cutting boards, dishes, utensils with hot and soapy water before and after preparing the food items.
- Use paper towels for cleaning the kitchen surface. If cloth towels are used then it must be washed properly.
- Always separate raw meat from other food items as their juices may contaminate the other food items. Use separate knives and cutting boards for preparing meat to avoid contamination.
- Always rinse fresh fruits and vegetables under running tap water and lid of the canned food items must be cleaned before opening.
- **Chill (maintenance of proper temperature):** Refrigerate the food items quickly because cold temperature slows the growth of harmful bacteria. There are different temperatures for storing various food items as some are essential to be stored in freezer at a very low temperature.
 - Do not over stuff the refrigerator as cold air must circulate to keep the food items safe.
 - Separate raw meat and other food items even while keeping them in the refrigerator.
 - After removing the food from refrigerator if it looks or smells bad never taste it just discard the food.
 - Do not consume the food items immediately after removing from refrigerator, allow it to come to room temperature.
 - Cooked food that has been frozen and removed from freezer must be reheated and eaten immediately once fully defrosted.
 - Clean the fridge regularly to ensure that it remains hygienic and in good working condition.
- **Cook at safe temperature:** Cooking must be done at adequate temperature as overcooked food may result in loss of nutrients whereas undercooked food may lead to indigestion and many food-borne diseases might occur due to contamination by the microorganisms.

Health of Food Handlers

Food handler is the person who either prepares, cooks, serves, packs, displays, stores, delivers or preserves the food items. The chances of food contamination depend greatly upon the health status of the food handlers, their hygiene behavior and practices. The diseases that are likely to spread by the food handlers are diarrhea, dysentery, common flu, typhoid, paratyphoid, viral hepatitis, intestinal worms, tuberculosis, staphylococcal and streptococcus infections. To prevent such diseases following measures must be taken:

- Food handlers must undergo medical examination at the time of employment. Any person suffering from typhoid, paratyphoid, tuberculosis, chronic diarrhea or dysentery should not be employed.
- Person suffering from wounds, skin or ear, eye infections should not be permitted to handle the food or utensils.
- Day to day health appraisal of the food handlers must be done and if they are found sick they must be excluded from handling the food. Any illness that is occurring in the family of food handler must be notified at once.
- Education of the food handlers is a very important aspect to prevent foodborne diseases. They must be educated regarding personal hygiene, food handling, utensils, dish washing, insects and rodents control. Special emphasis must be given on the following aspects.
 - **Hands:** Always wash hands before and after handling the food. Hands must be washed after using the toilets, coughing, sneezing and smoking. Use personal towels to rub the hands. Finger nails must be trimmed and should be free from dust.

- **Hair:** Head should be covered to prevent loose hair entering to the foodstuffs.
- **Overall:** Clean white overalls must be worn by all food handlers to avoid cross-contamination by the clothes.

PRESERVATION OF FOOD

Preservation of food is done to keep the food safe for a long time. Preservation prevents the food from deterioration and also makes the food safe for consumption. There are many methods to preserve food that can be used single or in combination.

Household Methods (Fig. 4.11)

- **Refrigeration (at low temperature):** It is widely used household method for preserving the perishable items. At low temperature microorganisms are less active and prevent food from spoiling. Foods can be stored either at low temperature between 1°C and 4°C to preserve the food for short time or at freezing point, which is between -18°C and -28°C to preserve the food for long time period.

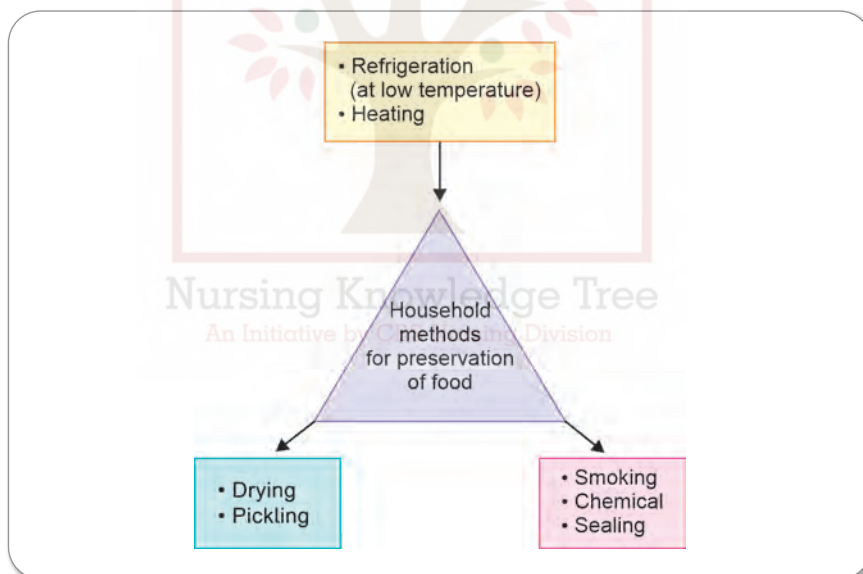


Fig. 4.11: Household methods for preservation of food

- **Heating:** Food is also preserved by the application of heat. The heat is applied at a very high temperature that helps to destroy the pathogenic organisms associated with the food. Another method of applying the heat for preservation of food is known as blanching, which is performed by dipping the food product in boiling water for 2–3 minutes. It also helps to minimize the growth of microorganisms by inactivating their enzymes.
- **Drying and pickling:** This is age-old method of preserving the food by the use of salt and sugar. Salt is considered a valuable preservative, which is used mainly in pickling as it helps to remove moisture and stops the microbial growth. Similarly fruit pulps are preserved in the form of jam by adding sugar.

- **Drying:** It is also an ancient and natural method of preserving the food. In this method, moisture from food content is removed that helps to retard the growth of microorganisms. Moisture can be removed either by sun drying or using by mechanical methods. Fruits, vegetables and fish can be preserved by this method.
- **Smoking:** It is a complementary process that not only preserves the food but also improves flavor and appearance. Temperature control is very important to maintain the texture. Meat is commonly preserved by this method.
- **Chemical:** Various chemicals like vinegar, citric acid, sodium benzoate, acetic acid, etc. can be used to preserve the food as it retards the growth of microorganisms by decreasing the pH of food and prolongs the shelf life of food.
- **Sealing:** It is the process of covering food to keep the air and moisture out of food items. This process delays the microbial activities but does not kill the microorganisms that spoil the food. Nuts and grains can be preserved by this method.

Commercial Methods

- **Canning and bottling:** It involves the process of storing the foodstuffs in sealed containers. It is based upon the process of sterilization; firstly the microorganisms are killed by the application of heat then sealed in sterilized and air tight container to prevent any further attack of microorganisms. Fruits, jams, pickles, cheese, butter, meat and fish are preserved by this method.
- **Machine drying:** Dehydration in sunlight is an ancient method of preserving the food at home. Various machines are used for different foodstuffs that operate at different temperatures. Commercially special type of steam roller is used for drying milk to reduce it into powdered form. Similarly special ovens are used for drying vegetables at a specific temperature. This method is found better than the traditional method.
- **Preservatives:** Adding preservatives to reduce the microbial growth, such as sugar or salt concentrate, oil and sodium benzoate.
- **Freeze drying:** During drying vegetables or fruits by mechanical methods or by direct sunlight, these foodstuffs get too much squeezed and do not take the original position when used again. In order to modify this defect, freeze drying was invented in which the foodstuffs are kept at -20°C temperature for some time to convert the water content of the food into ice particles and then dried with the machines under low pressure. When foodstuffs are to be used again these are kept under hot water for sometime. This method helps to retain the shape and color of foodstuffs, which got damaged by the simple drying process.
- **Cold storage:** This is the most popular method to preserve the food in rural as well as urban areas based on the principle of refrigeration. Vegetables, fruits, eggs, fish, meat are kept under cold storage and according to the demand of market are carried to the places of requirement.
- **Irradiation:** This is new technique of preserving the food, which still is in an experiment phase. World Health Organization (WHO) has advised the use of this process only for few food items like wheat, onions and potatoes. In this method, gamma rays or high speed electrons, which are termed as ionizing radiations, are used to destroy the microorganisms. The best advantage of this technique is that food can be stored without refrigeration.
- **Use of antibiotics:** These are very often sprayed on the crops as well as used in the animal feeds or in treating infections. When animals are fed with antibiotics their residues may be found in milk. Food and drug administration specifies that milk from such animals should not be used for at least three days

following the treatment with antibiotics. Fishes and poultry items are also treated with antibiotics to increase their shelf life. The effective method of cooking destroys the antibiotics residual from fish or poultry items and makes them harmless for human consumption.

- **Pasteurization:** This method is only applicable for milk. In this method, milk is heated at temperature of 63-66°C (Holder method) for at least 30 minutes and then quickly cooled to 5°C to destroy the pathogens. Milk is pasteurized at a very large scale to safeguard any bacterial infections. The pasteurized milk is then filled in sterilized bottles, which are sealed and can be preserved for 5–6 days. It is considered better than boiling as it helps to preserve composition, flavor and nutritive value of milk.

Precautions to be Taken While Preserving the Food

Food safety is the major concern of the day to day life as poorly preserved food may lead to foodborne diseases, which are sometimes very serious and even results in death.

The following precautions must be taken while preserving the food:

- Keep food surfaces clean. Wash the utensils, plates as soon as used.
- Use safe water and raw material.
- Always separate raw food from the cooked one.
- Keep food at safe temperature. Pathogens grow well between the temperatures 4° and 6°C. Therefore, proper temperature must be maintained.
- Wash the vegetables to remove soil and contamination. Drain completely and place in air tight containers.
- Use proper canning jars for storing the food and never use old lids as it becomes inadequate after use.
- Check from time to time that adequate temperature has been maintained.
- Cool the leftover food as soon as possible and refrigerate it.

STORAGE OF FOOD

Household Storage of Raw Food

Storage of the food items in an effective way prevents the spoilage of the food and makes it safer for consumption. Different food items require different storage conditions depending upon the type, texture, temperature and humidity conditions of the food items. The following points must be kept in mind while storing the raw food at home.

Fruits and Vegetables

- Fruits and vegetables stored at room temperature should be removed from any packing and must be kept loose as the packets/bags traps ethylene gas that causes premature ripening of these food items.
- Green leafy vegetables must be rinsed and dried properly. These items must be wrapped in a paper towel before placing them into fridge.
- Do not store fruits and vegetables together as fruits give off high level of ethylene (ripening agent) that can premature ripen and spoil the surrounding vegetables.
- Before storing the vegetables remove any tie or rubber band. Ensure that the bag in which the vegetables are being stored has some holes to allow for good air flow. Keep the vegetables loosely and separately in the fridge as closer they are greater are chances of spoilage.

- Vegetables can be washed with water before storing them in refrigerator but soft herbs and mushroom should not be washed until these are to be used.
- Fruits like grapes, apples, berries, mangoes ripen very fast at hot temperature so they must be either consumed within two days or must be stored in refrigerator immediately.
- Vegetables must be fresh and unbruised at the time of purchase.
- Potatoes, onions should be kept at cool temperature in a well-ventilated space and frozen vegetables like peas should be placed in the freezer of the refrigerator.
- Fruits when purchased should not be over-ripened, if these are under-ripened they can be kept at room temperature for 2–3 days and when get ripened naturally can be consumed.
- Fruit juices should be consumed immediately as delay may alter the taste as well as nutritive value of the fruit juices.

Cereals

Keeping in mind the importance and high demand of cereals for daily consumption, it is important to store these food items in a proper way as they may be attacked by pests, bacteria or fungi. From ancient times many natural resources are being used for the safe storage of grains as they are considered safer than the chemicals available in the market. These are as follows:

- Neem leaves are widely used to repel pests from stored food grains. Pluck the fresh neem leaves and shade them dry and crush them in the powdered form. Make pouches of the muslin cloth and fill it with neem leaves or powder and keep these pouches inside the container where grains have been stored.
- Turmeric, garlic, cloves, red chillies and camphor have strong smell and insecticide properties, which not only keep the insects away but also are equally safe for the consumption.

Rice and Grains

Rice and grains should be put into clean container that is completely dry as moisture provides a very good medium for the microorganisms to grow.

Pulses

Pulses should be dried in the sunlight and must be stored in the airtight container. Pulses can also be roasted in an open vessel by stirring continuously to avoid burning that helps to remove moisture and make it safer for storage. Roasted dal is also better in taste when cooked.

Peanuts

Peanuts can be stored along with the mint leaves to keep them moisture free. If the storage place is too humid it must be stored in freezer.

Suji

Suji (semolina) and dalia (broken wheat) can be roasted on slow fire in a heavy bottomed vessel or in a microwave and can be stored in air-tight container after cooling to prevent these items from insects attack.

Milk and Milk Products

Milk should not be stored for long time. Dry milk if used should be kept free from moisture in an air-tight container and must be consumed before expiry date. Dairy products should be kept in cool and clean places, whereas cheese, butter and ice creams or deserts must be stored in the freezer.

Meat, Fish and Poultry

Uncooked meat fish or poultry products have higher chances of getting contaminated so these products must be kept away from the cooked items and stored at low temperature in refrigerator after covering them properly. Always store eggs in the available boxes in the fridge.

Household Storage of Cooked Food

Storage of cooked food is mainly done in the refrigerator at household level.

The following points must be kept in mind while storing the food in fridge:

- Cool down the left over food as quickly. It must be ensured that food has been cooled before putting it into the fridge otherwise it can promote bacterial growth.
- Always keep cooked food away from raw food even in the refrigerator.
- Cooked meat must be stored in a sealed container to avoid contamination.
- Never put the open cans in the fridge as the metal may get transferred to the food content, if necessary, place the contents of the can in a storage container or in a covered bowl.
- When food has been prepared try to consume within two hours, if not possible, then it must be kept out of fridge for the minimum possible time.
- Cooked food that has been frozen and removed from the freezer must be reheated and eaten immediately once fully defrosted.
- Defrosted food must be reheated only once because frequent cooling and reheating increase the chances of contamination of food. The bacteria can grow and multiply very fast when food is cooled too slowly or reheated at inappropriate temperature.
- Food stored in freezer such as ice cream and dessert if removed should not be returned in the freezer, so only required amount of items should be removed.
- Food can look or smell fine even after expiry date (packed food) but it is not safe to consume them as there are still chances that the food may be contaminated.
- Keep the temperature of the fridge at 5°C or below.
- Refrigerator must be cleaned regularly and it must be ensured that it remains hygienic and in good working condition to safely store the food items.

Commercial Storage of Food

Food at large level is stored in the cold storage that includes temperature, humidity control, air circulation and maintenance of proper space between the containers for adequate ventilation. A cold store is any building used for storage at controlled temperature. The following facilities must be available in the cold storage:

- The storehouse must be protected from rodents and insects by keeping it clean and free from trash.
- It must be equipped with rat guards, concrete floors, adequate number of doors and windows for proper ventilation and drainage. Building of the store house must be properly insulated.
- Onions, garlic and other food items can be stored safely at low humidity in the stores, if these items are stored in the containers then adequate supply of air must be provided at the bottom of the container and it must be well ventilated, whereas fresh fruits need very low temperature for storage to slow down their metabolic process responsible for ripening the fruits.
- Reusable containers should be disinfected in the chlorinated or boiling water before every use.

Harmful Effects of Poorly Stored Food

Food is a potential source of infection as it can be contaminated at any point during its journey from producer to the consumer. Poorly stored food is one of the common means by which the foodborne infections such as dysentery, cholera, typhoid, etc. may occur. Foodborne diseases or food poisoning is the infection or irritation of the gastrointestinal tract caused by the food or beverages that contain harmful bacteria, viruses, parasites or chemicals. Common signs and symptoms of these diseases include vomiting, diarrhea, abdominal pain, fever or chill. Raw foods such as milk, fish, meat or dairy products if stored poorly may get contaminated very easily and cause foodborne diseases. If the food is not stored at appropriate temperature that may also be a common factor responsible for foodborne infections as under such conditions microorganisms multiply very quickly. Cross-contamination of the food is another major reason for foodborne diseases. Good hygiene practices before, during and after preparation of food can reduce the chances of getting an illness. The action of monitoring the food to ensure that it will not cause any foodborne illness is known as food safety. It includes hygiene in the production, handling, distribution and serving the food.

FOOD ADULTERATION AND RELATED ACTS

Food Adulteration

Food adulteration is a legal term that means the food products get failed to meet the mandatory standards set by the state or any legalized agency. Food adulteration consists of a large number of practices that include mixing, substitution, concealing the quality, putting up decomposed food for sale, misbranding or giving the false labels and addition of toxicants. When the consumer gets adulterated food he is not only paying the extra money for the substandard products but also it can be injurious to his health and even may lead to death, for example, adulteration of mustard oil with argemone oil causes epidemic dropsy.

Food adulteration is a very old problem and its practice varies from time to time and from one place to another place across the world. Food adulterant is any substance that is used unnecessarily to spoil the nature and quality of food items. The common adulterants used to adulterate the food is listed in Table 4.1.

Table 4.1: Common adulterants used in food materials

Food materials	Common adulterants
Cereals such as wheat and rice	Mud, grits, soapstone bits
Dals	Coal tar dyes, kesari dals
Haldi (turmeric powder)	Lead chromate powder
Dhania powder	Starch, cow dung or horse dung powder
Black pepper	Dried seeds of papaya
Chilli powder	Saw dust, brick powder
Tea dust/leaves	Black gram husk, tamarind seeds powder, saw dust, used tea dust
Coffee powder	Date husk, tamarind husk, chicory
Asafetida (Hing)	Sand, grit, resins, gums, soap stones
Mustard seeds	Seeds of prickly poppy, argemone
Edible oils	Mineral oil, argemone oil

Contd...

Food materials	Common adulterants
Butter	Starch, animal fat
Ice creams	Cellulose, starch, non-permitted colors
Fresh green packed peas	Green dye
Milk	Extraction of fat, addition of starch and water
Ghee	Vanaspati, mashed potatoes, sweet potatoes
Sweet wines	Diethylene glycol
Honey	High fructose syrup, cane sugar, jaggery
Alcoholic liquors	Methanol
Wheat flour	Excessive sand, dirt, bran and chalk powder
Cumin seeds	Grass seeds colored with charcoal dust

Types of Food Adulteration

- **Physical adulteration:** Mixing substances like stones, sand, or non-edible colors.
- **Chemical adulteration:** Adding harmful chemicals like artificial colors, pesticides, or preservatives.
- **Biological adulteration:** Contamination with pathogens or microorganisms.

Tests to Detect Common Adulteration

- **Ghee:** Boil 5 mL of the sample in a test tube. Cool and add a drop of iodine solution. Blue color indicates presence of starch. Color disappears on boiling and reappears on cooling.
- **Honey:** Take 5 mL of honey in a dish. Add aniline chloride solution and stir well. Orange red color indicates presence of sugar.
- **Pulses:** Add 50 mL of diluted HCl to a small quantity of dal and keep on simmering water for about 15 minutes. Development of pink color indicates the presence of kesari dal.
- **Black pepper:** Pour the seeds in a beaker containing carbon tetra chloride. Black papaya seeds float on the top while the pure black pepper settles down.
- **Coriander powder:** Soak in water. Dung will float and can be easily detected by its foul smell.
- **Chillies:** Pour the sample in a beaker containing a mixture of chloroform and carbon tetrachloride. Brick powder and grit will settle at the bottom.
- **Wheat flour:** Sprinkle on water surface, bran will float on the surface. Shake sample with dilute hydrochloride effervescence indicates chalk.
- **Turmeric powder:** Dissolve the sample in 1:7 sulfuric acid and filter it. Add 1–2 drops of 0.1% diphenylcarbazine. A pink color indicates presence of lead chromate.
- **Cumin seeds (Jeera):** Rub the cumin seeds on palms. If palms turn black, adulteration is indicated.
- **Asafetida (Heeng):** Shake a little quantity of powdered sample with water. Soap stone or other earthy matter will settle at the bottom.

Food Adulteration Act (1954)

This Act was passed by the Indian Parliament in 1954 and later on amended in 1964, 1976 and lately in 1986 to make it more stringent. Rules are framed, which are revised from time to time by an expert body called **Center Committee for Food Standards** constituted by the Indian government. Although it is a central Act,

its implementation is largely carried out by the state governments and local bodies in their respective areas. Center plays a vital role in coordination, monitoring and surveillance of the Act throughout the country with the help of food laboratories and four regional central laboratories (Kolkata, Mysore, Ghaziabad and Pune).

Food Adulteration Act has the following objectives:

- To protect the public from poisonous and harmful foods.
- To prevent the sale of substandard food.
- To protect the interests of the consumers by eliminating fraudulent practices.

Concept of Adulteration

According to PFA (Prevention of Food Adulteration Act), an article of food shall be deemed to adulterated in the following case:

- If the article sold by vendor is not of the nature, substance or quality demanded by the purchaser.
- If the article contains any other substance, which affects the quality of food item.
- If any constituent of the food has been fully or partly extracted to affect the quality of the product.
- If the article has been prepared, packed under unsanitary conditions whereby it has become contaminated or injurious to health.
- If the article is obtained from diseased animal.
- If the article contains any poisonous or other ingredient which is injurious to health.
- If color is used that was not prescribed or color which is present in the article is not within prescribed limits.
- If the article contains any prohibited preservatives in excess of the prescribed limit.
- If the quality or purity of the article falls below the prescribed standards or its constituents are present in the quantities not within the prescribed limits and injurious to health.

Penalties

Guilty will be punished with minimum imprisonment of six months with fine up to ₹1000. Whereas for the cases of adulteration, which may render the food injurious to cause death or such harm may amount to grievous punishment going up to life imprisonment and a fine not less than ₹5000. With the amendment of the Act in year 1986, the consumer and voluntary organization have been empowered to take samples of food.

Food Safety and Standards Regulation Act 2011

Prevention of Food Adulteration Act (PFA) was replaced in 2006 by the Food Safety and Standard Act 2006 and again in 2011 certain amendments were done for laboratories and sample analysis. According to this Act, the sample of any imported article will be sent by the authorized officer for analysis in the central laboratories like Central Food Laboratory at Kolkata, Ghaziabad, Mysore and Pune.

- **Food Safety and Standards Alcoholic Beverages Regulations 2018:** This regulation specifies the requirements for labeling of alcoholic beverages that includes declaration of alcoholic content, not to write any nutritional information, no health claim and restriction of the word nonintoxicating on alcoholic beverages.
- **Food standards:** Food adulteration is a social problem. Certain food standards have been made to combat with this problem. These are as follows:

- **PFA Standards:** Under the Act of Prevention of Food Adulteration (1954), standards have been established, which are revised from time to time by the central committee of food standards.
- **Food Safety and Standards Authority of India (FSSAI):** It has been established under the Food Safety and Standard Act 2006 as a statutory body for laying down science-based standards articles of food regulating, manufacturing, processing, distribution, sale and import so as to ensure safe and wholesome food for human consumption. It was formed in 2011 and its headquarter is in New Delhi. It is an agency of Ministry of Health and Family Welfare of Government of India. It is responsible for protecting and promoting public health through regulations and supervision of food safety.
- **Food Safety and Standards (Foods for Infant Nutrition) Regulations, 2019:** The Food Safety and Standards (Foods for Infant Nutrition) Regulations, 2019 are specific regulations aimed at ensuring the safety and nutritional quality of foods meant for infants and young children. The regulations apply to foods specifically meant for infants and young children, including infant formula, follow-up formula, foods for special medical purposes, and processed cereal-based complementary foods. The regulations set out specific standards and specifications for these categories of foods, including requirements for ingredients, composition, nutritional content, labelling, and packaging. Clear and informative labelling is mandated to provide consumers (parents and caregivers) with essential information about the product, including ingredients, nutritional information, usage instructions, storage conditions, and any warnings or precautions.

- **The AGMARK Standards (Fig. 4.12):** It is a certification mark employed on agricultural products of India and these standards are set by the directorate of marketing and inspection of the government of India. The AGMARK is legally enforced in India by the Agricultural Produce (Grading and Marking) Act in 1937 and amended in 1986. The term AGMARK was coined by joining the words 'AG' that means agriculture and 'MARK' for certification mark. The AGMARK assures the quality of the various food products being delivered to the consumer.

The commodities certified under AGMARK are whole spices, vegetable oils, pulses, ghee, wheat, honey, etc. Importance of AGMARK is that it not only ensures the quality of the product but also assures that the product has been produced in hygienic condition and is safe for human consumption.

Benefits of AGMARK:

- ◆ Farmers benefit from increased subsidies for products carrying the mark.
- ◆ Products receive a marketing boost.
- ◆ Product quality is ensured through legal compliance measures.

Differences between FSSAI and AGMARK:

- ◆ The FSSAI mark is mandatory, while AGMARK certification is voluntary.
- ◆ FSSAI licensing applies to all food processing and packaging, encompassing all types of food items. AGMARK, however, is specifically designed for agricultural products.
- ◆ FSSAI licensing operates under the Food Safety and Standards Act, 2006, while AGMARK operates under the Agriculture Produce (Grading and Marketing) Act of India, 1937.



Fig. 4.12: Logo of AGMARK

- **Bureau of Indian Standards (BIS):** It is the national standard body of India working under ministry of consumer affairs, food and public distribution and government of India. It was established by the Bureau of Indian Standards Act in 1986. Its headquarter is at Manak Bhawan, Old Delhi. **Indian Standard Institutions (ISI) (Fig. 4.13)** mark on any article of food assures about the quality of the food product prescribed by the Bureau of Indian standards. BIS certification is mandatory for certain products taking into consideration of public health whereas ISI mark is mandatory on all the industrial and electronic appliances of India.



Fig. 4.13: Logo of Indian Standard Institutions

BIS Act, 2016: The BIS Act, 2016 is a pivotal legislation that reconstituted and empowered the Bureau of Indian Standards (BIS), India's national standards body. The Act was notified on March 22, 2016, and came into effect on October 12, 2017. It replaced the previous legislation governing BIS, namely the Bureau of Indian Standards Act, 1986. The BIS Act establishes BIS as the main authority responsible for creating and enforcing standards across different industries in India. Its goal is to align Indian Standards (IS) with global benchmarks to improve the quality, safety, and effectiveness of products, processes, and services.

Powers and functions: BIS, according to the Act, has the legal power to:

- ◆ Develop Indian Standards (IS) based on science and industry requirements.
 - ◆ Issue certification marks like the ISI mark, Hallmark, etc., to indicate compliance with Indian Standards.
 - ◆ Set up systems to check if products meet specified standards.
 - ◆ Monitor, test, and inspect certified products to ensure they maintain quality and are safe for consumers.
- **Codex Alimentarius (Fig. 4.14):** It is a collection of internationally recognized standards, guidelines and recommendations related to food production. It was established in 1961 by Food and Agriculture Organization (FAO) of UN and later on was joined by World Health Organization (WHO) in 1962. The main objective of this organization is to protect the health of consumer and ensure fair practices in the food trade at international level. It is a world trade organization that helps in the resolution of disputes related to food safety and consumer protection at international level. As per 2020, there are 189 members in the Codex Alimentarius commission.



Fig. 4.14: Codex Alimentarius



STUDENT ASSIGNMENT

LONG ANSWER QUESTIONS

1. What are the precautions to be taken while preserving the food?
2. How the food can be stored at commercial level?
3. Explain the effects of cooking on different types of food.
4. Explain various food standards to ensure the quality of food.
5. What is food adulteration and what are the main laws to prevent adulteration of food?

SHORT ANSWER QUESTIONS

1. Discuss the principles of cooking.
2. Explain the household method of preservation of food.
3. Enlist the methods of cooking food.
4. What is safe food handling and what are the ill effects of poorly stored food?

MULTIPLE CHOICE QUESTIONS

1. **The full form of PFA is:**
 - a. Prevention of Food Act
 - b. Protection of Food Act
 - c. Prevention of Food Adulteration Act
 - d. None of these
2. **Which of the following is an adulterant?**
 - a. Pesticides
 - b. Urea
 - c. Iron fillings in the tea
 - d. All of these
3. **Pasteurization is the process of heating milk:**
 - a. Above 100°C
 - b. Above 500°C
 - c. Above boiling point
 - d. Below boiling point
4. **Which of the following is a food preservative?**
 - a. Sodium benzoate
 - b. Alenine
 - c. Ergot
 - d. All of these
5. **Which of the following is a food adulterant?**
 - a. Saffron
 - b. Argemone oil
 - c. Vanilla
 - d. All of these
6. **While planning a balanced diet which of the following is essential?**
 - a. Knowledge about the food group
 - b. Knowledge about food exchange system
 - c. Knowledge of RDA
 - d. All of these

7. **Which of the following is used to check the quality of meat?**
- a. Bright pink color
 - b. Firm and elastic in touch
 - c. Agreeable odor
 - d. All of these
8. **Which of the following is not a household method of preservation of food?**
- a. Refrigerator (cold storage)
 - b. Smoking
 - c. Irradiation
 - d. Salting and pickling
9. **Food Adulteration Act was passed by the Indian Parliament in the year:**
- a. 1954
 - b. 1965
 - c. 1970
 - d. 1960
10. **Adulteration of mustard oil with Argemone oil causes:**
- a. Diarrhea
 - b. Epidemic dropsy
 - c. Anemia
 - d. Peptic ulcer
11. **The following are the food standards to ensure quality of food:**
- a. PFA standards
 - b. AGMARK standards
 - c. Bureau of Indian Standards (BIS)
 - d. All of the above
12. **Which cooking method involves cooking food in an oven using dry heat?**
- a. Grilling
 - b. Roasting
 - c. Boiling
 - d. Steaming
13. **In which cooking method is food submerged completely in hot oil or fat?**
- a. Baking
 - b. Poaching
 - c. Frying
 - d. Braising
14. **What cooking method involves cooking food by exposing it directly to a flame or hot coals?**
- a. Boiling
 - b. Grilling
 - c. Sautéing
 - d. Steaming
15. **Which method of cooking uses a combination of dry and moist heat?**
- a. Roasting
 - b. Poaching
 - c. Sautéing
 - d. Broiling
16. **What method of cooking involves cooking food by placing it directly under a heat source?**
- a. Baking
 - b. Grilling
 - c. Steaming
 - d. Stewing
17. **Which cooking method is used to cook food slowly and gently in water or broth that is just below boiling point?**
- a. Boiling
 - b. Poaching
 - c. Frying
 - d. Roasting
18. **In which method of cooking is food cooked quickly in a small amount of oil or fat over high heat?**
- a. Sautéing
 - b. Braising
 - c. Baking
 - d. Broiling

19. **What is the recommended temperature for storing refrigerated foods?**
- Below 0°C (32°F)
 - Between 4°C to 60°C (39°F to 140°F)
 - Below 4°C (40°F)
 - Room temperature
20. **When should you wash your hands while handling food?**
- Only before touching raw meat
 - Only after handling raw meat
 - Before and after handling any food, especially raw meat
 - Only after cooking is complete
21. **How should you store leftover food in the refrigerator?**
- Cover loosely with aluminum foil
 - Leave it uncovered to cool faster
 - Store it in shallow containers with lids
 - Stack containers on top of each other
22. **Which surfaces should be sanitized regularly in a kitchen to prevent cross-contamination?**
- Only cutting boards used for raw meat
 - Only the sink where raw meat is washed
 - Any surface that comes into contact with food, including countertops and utensils
 - None of the above
23. **How often should you change dishcloths and kitchen towels to prevent bacterial growth?**
- Once a week
 - Once a month
 - Daily
 - Only when visibly dirty
24. **Which of the following is NOT a safe practice for storing leftovers?**
- Leaving food uncovered in the refrigerator
 - Storing leftovers in airtight containers
 - Labeling containers with the date of preparation
 - Placing leftovers in the refrigerator within 2 hours after cooking
25. **Which of the following is an example of food adulteration?**
- Adding salt to enhance flavor
 - Mixing pure honey with sugar syrup
 - Adding vitamins to fortified cereals
 - Using organic ingredients in cooking
26. **What is the purpose of food adulteration?**
- To improve nutritional content
 - To increase shelf life
 - To deceive consumers and increase profits
 - To enhance flavor
27. **Which agency is primarily responsible for monitoring and preventing food adulteration in India?**
- World Health Organization (WHO)
 - Food Safety and Standards Authority of India (FSSAI)
 - Centers for Disease Control and Prevention (CDC)
 - United Nations Educational, Scientific and Cultural Organization (UNESCO)

28. **What is the term used to describe the addition of non-permitted substances to food?**
 a. Fortification
 b. Dilution
 c. Adulteration
 d. Preservation
29. **Which of the following is a common form of food adulteration in milk?**
 a. Adding sugar
 b. Adding water
 c. Adding vitamins
 d. Adding preservatives
30. **How can consumers detect the presence of chalk powder in spices such as turmeric?**
 a. By visual inspection for an unnatural brightness
 b. By tasting for a bitter aftertaste
 c. By smelling for a strong odor
 d. By checking the expiry date
31. **Which of the following is an example of physical adulteration?**
 a. Adding artificial colors to fruit juices
 b. Adding water to milk
 c. Adding synthetic preservatives to pickles
 d. Adding stones to rice
32. **What health risks are associated with consuming adulterated food?**
 a. Allergic reactions
 b. Food poisoning
 c. Long-term health problems
 d. All of these
33. **Which test can be used to detect the presence of starch in milk to check for adulteration?**
 a. Iodine test
 b. pH test
 c. Benedict's test
 d. Biuret test
34. **Who is responsible for penalizing offenders involved in food adulteration?**
 a. Local grocery stores
 b. Food inspectors and regulatory authorities
 c. Manufacturers' associations
 d. Consumer advocacy groups

ANSWER KEY

1. c	2. d	3. d	4. a	5. b	6. d	7. d	8. c	9. a
10. b	11. d	12. b	13. c	14. b	15. a	16. b	17. b	18. a
19. c	20. c	21. c	22. c	23. c	24. a	25. b	26. c	27. b
28. c	29. b	30. a	31. d	32. d	33. a	34. b		

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