A Programme implemented for

FOOD SAFETY AND STANDARDS AUTHORITY OF INDIA
Inspiring Trust, Assuring Safe & Nutritious Food

Training of Master Trainers in Food Safety and Nutrition Awareness Raising

AWP3 - Activity 123

Prepared by:

Ms Sunetra Roday, Senior Food Safety Specialist

Dr Eram Rao, Senior Nutrition Specialist

Ms Surbhi Datta, Junior Food Safety Specialist

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Foreword

The EU-India Capacity building Initiative for Trade Development – abbreviated CITD project - is a technical assistance programme financed by the EU and implemented in close coordination with the Indian government. The objective is to support India in strengthening its capacity to achieve economic growth and sustainable development, and ultimately poverty reduction, through further integration into the global trading system, by increasing the safety and quality of products, and by reducing costs and impediments to trade. It addresses a wide range of issues (standardisation, accreditation, testing, inspection, education) aiming at enhancing the safety of different products such as medical devices, electrical equipment, chemicals products, food and beverages.

The CITD project is contributing to FSSAI's food safety and nutrition awareness campaign through financing the *Training of Master Trainers in Food Safety and Nutrition Awareness*. This initiative is part of a nationwide campaign entitled **Safe and Nutritious Food… a way of life**. It is proposing a 360 degree approach to food safety and healthy nutrition to prevent food borne infections and diseases and for complete nutrition for citizen everywhere at all time in India. It comprises actions directed at all segments of the society and awareness messages to be used at ***home***, at ***school***, at the ***work place*** and when ***eating Out***. Besides the Training of Master Trainers in Food Safety and Nutrition Awareness, other initiatives being launched by FSSAI consist of "Project Clean Street Food", "Kitchen Hygiene", "STEM Olympiad: nurturing Young Food Scientists", "Catch them Young : A Nutrition, Food Safety Hygiene Intervention Through NCERT", "Framework for a Better and Healthier School", and the "E-Learning portal".

This training programme financed by the EU, through the CITD project is therefore part of a comprehensive scheme addressing food safety and nutrition information raising on the street, in households and at school. Its objective is to train up to three hundred Master Trainers, in six sessions being organised throughout the year 2017, in different location in India. Three food safety and nutrition specialists have been mobilised to elaborate the content of all the material used in this campaign, namely: Ms. Sunetra Roday, Ms. Eram Rao and Ms. Surbhi Datta.

This training material is available upon request at CITD project office or FSSAI.

Abbreviations

CVD	Cardio-Vascular Disease
EAA	Essential Amino Acid
EFA	Essential Fatty Acid
FIFO	First-In, First-Out
FSSAI	Food Safety and Standards Authority of India
GHP	Good Hygiene Practices
pH	Hydrogen ion concentration
MSG	Mono Sodium Glutamate
NCD	Non-Communicable Diseases
PPM	Parts Per Million
PCM	Protein Calorie Malnutrition
RTE	Ready-To-Eat
RDA	Recommended Dietary Allowances
TVP	Textured Vegetable Protein
TFA	Trans Fatty Acids
UV	Ultra Violet
WHO	World Health Organization

Introduction

This manual comprising of 7 modules has been designed to provide guidelines to trainers who have undergone formal training/Degree in Home Science, Food Science, Food Technology and Nutrition. The basic objective of this manual is to revise the core concepts and principles underlying nutrition, hygiene, and food safety. The trainer in turn will teach students the significance of safe wholesome food and its relation to health in their day to day life by inculcating the principles underlying health, hygiene and nutrition.

This manual is proposing **seven distinct modules** which are all interlinked, but can be used separately to undertake thematic punctual awareness activities with children. It is completed by a set of presentation tools which available at upon request at FSSAI.

NEED FOR FOOD SAFETY - THE INVISIBLE WORLD OF MICROBES

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Seven Modules on Food Safety and Nutrition Awareness

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- Key terms

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- The food pyramid
- The healthy eating plate
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- Planning Balanced diets using the 5 Basic Food Groups
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- Key terms

Module 1 Need for food safety - The invisible world of microbes

INTRODUCTION TO NEED FOR FOOD SAFETY

Food is a perishable commodity. It spoils easily and permits disease causing microorganisms to grow if it is handled unhygienically. Infections are caused by different microorganisms which cannot be seen by us, they are visible only under a microscope.

MALNUTRITION AND INFECTION

Frequent infections can lead to malnutrition and a lowered resistance to infection. Once malnutrition sets in, children are more prone to catching infections. If hygiene standards are poor, children are constantly exposed to common infections like colds, coughs, influenza and diarrhoea as described in fig 1.1. Infections affect the intake and utilization of nutrients by the body. Sick children have a poor appetite and reduced food intake. Also nutrient absorption is affected, and there is loss of nutrients from the body, particularly proteins, during fevers and infections. This affects the overall growth and development of the child.

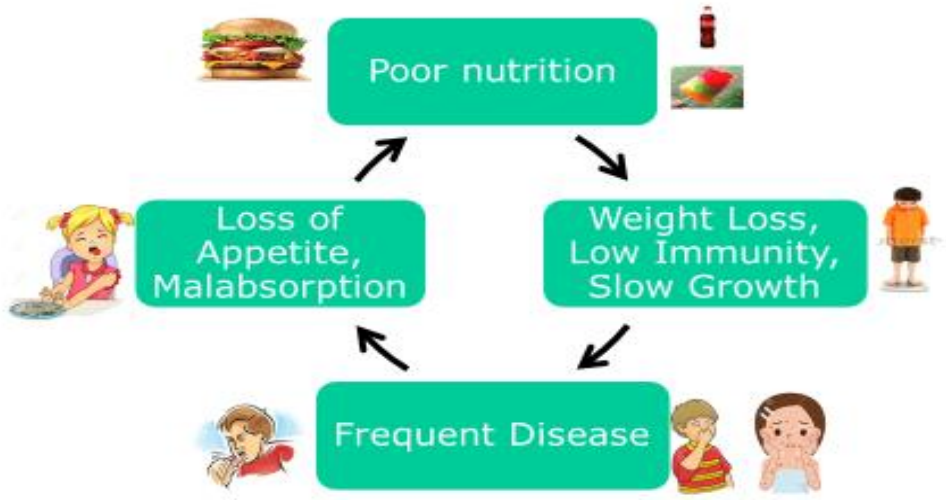


Fig 1.1 Vicious cycle of Malnutrition and Infection

Food handlers should understand the relationship between malnutrition and infection and try to break the vicious cycle of malnutrition and infection. Food not only causes infection but it may also spoil if it is not stored and handled properly. Spoilage makes food unfit for consumption and leads to wastage.

If a good Nutritional Status is to be achieved, it is necessary that children are served safe and wholesome food in a clean environment. The trainer should highlight the message given in the box above and explain the vicious cycle between malnutrition and infection

Message: *Malnutrition increases the risk of infections and infections can, in turn, lead to malnutrition. Hygiene and Nutrition go hand in hand.*

ROLE OF SCHOOLS

Schools play an important role in the overall growth and development of the child. The teacher is their role model and children have a lot of faith in what is taught in school and what their teachers have to say.

Schools should take measures to ensure that food hygiene, personal hygiene and environmental hygiene i.e. hygiene of the classrooms and surroundings is maintained. Teachers should encourage children to bring wholesome meals in their lunch boxes and healthy snacks for the short break. Food served in schools should not only be healthy but palatable as well. Physical activity plays an important role in the overall growth and development of the child and this should not be neglected. Children will speak about the cleanliness, care and good food habits taught in school to their parents and this message in turn will percolate to the community.

Before we study hygiene and nutrition, let us take a look at how infection/disease is transmitted.

MODE OF SPREAD OF FOOD BORNE DISEASES

Pathogens or disease causing agents are spread to food through

- **FOOD** (contaminated food and drink infected by food handler or from the farm, diseased animals and their products)
- **FINGERS** (unwashed hands and dirty, grown fingernails)
- **FAECES** (sewage contaminated food, water and unwashed hands after using the toilet)
- **FOMITES** (unclean utensils, equipment, door knobs, taps, towels)
- **FLIES** (pests like houseflies, cockroaches, rats, mice)

These are the 5F's.

Care should be taken to ensure that these sources of contamination are kept in check. The 5 F's' namely food, fingers, faeces, fomites and flies need to be controlled to keep both food spoilage and food borne diseases away.

We will deal with each of these sources under the relevant sections. The causative agent in each case is a microorganism. Let us understand more about microorganisms and their relationship with our food and health.

Food borne Diseases

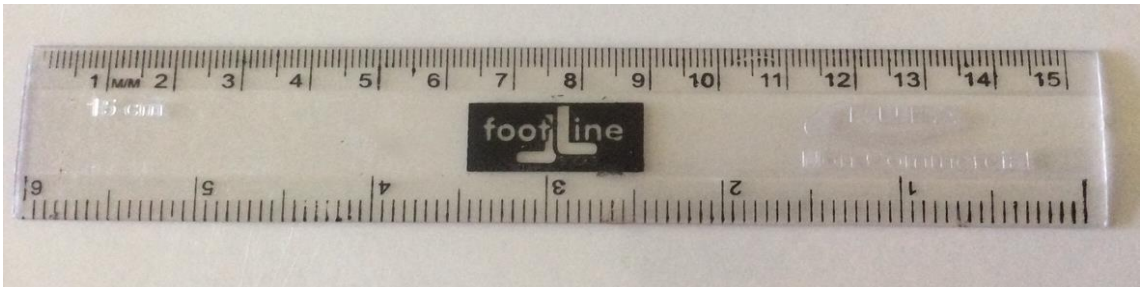
Sometimes the food you eat makes you sick. This is because the food has something in it that makes you sick. When you fall ill after consuming food, the illness is called a food borne disease. The food has been contaminated, usually with bacteria. Where do you think these bacteria have come from and how do they enter our food. Let us study how these bacteria enter our food.

WHAT ARE MICROORGANISMS AND WHERE ARE THEY FOUND

Microorganisms are tiny microscopic creatures which we cannot see with the unaided eye. They cause infections or disease. There are many different microorganisms which are found everywhere – air, water, sewage, soil, plants, animals, humans and their food. Since they are very small, we cannot see them unless we use a microscope. This is the reason why many of us do not understand them.

Microorganisms may be unicellular or multi-cellular and are of different shapes and sizes. Average size of bacteria is one micron or 1/1000th of a millimetre (mm). A mm. is the smallest marking on your scale/foot ruler (10 mm. make 1cm.). They are so small that it would take 1000 bacteria to cover the point of a pencil.

Picture of foot ruler to show one millimetre marking



However we must understand that all microorganisms are not harmful to us, infact some are useful.

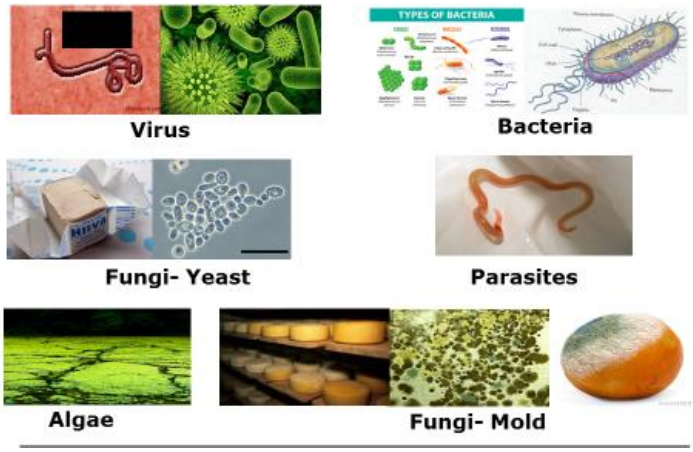
Some microorganisms are useful to us like the bacteria which set our curd or other bacteria which make idlis fluffy. Some microorganisms are harmful, causing diseases, like viruses which cause measles and bacteria which cause food poisoning. Others spoil and rot our food like mold growth on bread and yeasts fermenting fruit juice.

Let us learn more about these invisible creatures and see which microorganisms are of importance to our food, environment and health.

USEFUL AND HARMFUL MICROBES

Five groups of microorganisms are of significance to us. They are listed in an ascending order with the smallest listed first:

1. Viruses
2. Bacteria
3. Fungi. This group includes:
    - a. Yeasts
    - b. Molds
4. Algae
5. Parasites. This group includes:
    - a. protozoa
    - b. eggs and cysts of worms



Viruses

Viruses are the smallest of all microorganisms. They are strict parasites and grow only in living cells. They are found in sewage contaminated food and water and can cause diseases such as poliomyelitis and infectious hepatitis (jaundice). Air borne viruses can cause common cold, influenza, mumps, measles and chicken pox.

Bacteria

Bacteria are found everywhere. They are unicellular and are of different shapes and sizes, generally rod shaped or spherical. Average size of bacteria is one micron or 1/1000th of a millimetre (mm).A mm. is the smallest marking on your scale (10 mm. make 1cm). They cannot be seen by the unaided eye.

When they multiply on a suitable medium, visible colonies appear on the plate within 24 hours. Each colony contains lakhs and crores of bacteria which appear as dots on the plate. Each dot on the plate is a bacterial/microbial colony. Each colony seen, may have formed from a single microorganism.

Some bacteria are capable of forming spores. A spore is a resistant structure formed in some rod-shaped bacteria when conditions for growth are unfavourable. Spores remain dormant till conditions become favourable and form a vegetative cell that can once again grow and multiply. Since a single spore is formed in a cell, spore formation is not a means of reproduction in bacteria.

Bacteria are both useful and harmful. Useful bacteria such as species of Lactobacilli and Streptococci ferment lactose in milk to lactic acid and are used to prepare curds, yoghurt, and cheese. Other bacteria leaven idli, dosa and dhokla batters, while some oxidize ethyl alcohol to acetic acid for making vinegar. Many bacteria cause diseases like cholera and typhoid fever. Most food infections and food poisonings are caused by bacteria. They can also spoil the colour and flavour of our food.

Fungi

This group includes two types of microbes namely the yeasts and molds.

Yeasts

Yeasts are unicellular microorganisms which are larger in size than bacteria. They can ferment sugar and starch to ethyl alcohol and CO2. This property is made use of in bread making and for alcoholic beverages. Food yeast is rich in B-complex vitamins. They can grow on the surface of preserves such as jams and pickles and spoil them i.e. they are osmophilic.

Molds

Molds are multi-cellular microorganisms and are several mm. in length. They are saprophytes i.e. they grow on the surface of dead organic matter and on food with low moisture content. Mold growth may be cottony, dry, powdery velvety or slimy, with colours ranging from white, yellow, blue, green or black.

Molds reproduce by forming multiple spores which germinate when they settle on organic matter.

They spoil bread, jam, cheese and pickles and are also responsible for spoilage or rotting of fresh fruits and vegetables. They grow on damp groundnuts and grains, producing toxins in them. The skin infection ringworm is caused by a type of mold.

Molds are useful to us. They are used to ripen cheese, make soya sauce and produce life saving antibiotics like penicillin. Edible mushrooms are also a mold and are very nutritious. They are a good source of proteins, vitamins and minerals.

Algae

Algae are found in water and are both unicellular and multi-cellular. They are useful in water purification and sewage treatment plants. They are used to manufacture food additives which are used in ice-creams to prevent ice crystal formation.

Parasites

Parasites include both protozoa and the cysts of parasitic worms commonly found in the intestine. Amoebic dysentery or amoebiasis is a common illness in our country caused by sewage contamination of food or water.

Trichinosis and tape worm infestation is caused through consumption of diseased pork. Eggs of round worm, thread worm and giardia are transmitted through sewage contaminated soil, water and food and through the faecal-oral route (improperly washed hands after visiting the toilet).

BASIC GROWTH REQUIREMENTS OF MICROORGANISMS

Like humans, microorganisms also need certain conditions for growth and multiplication. The terms growth and multiplication are synonymous for microbes. Growth means an increase in number of microbes.

Basic growth requirements are:

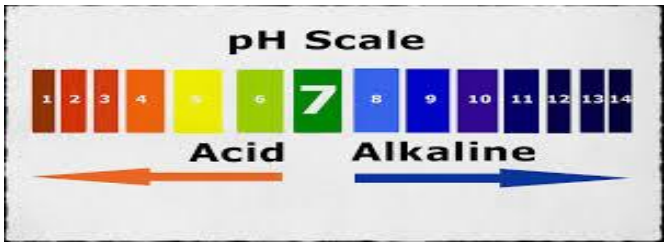
FOOD - Microorganisms use our food as a source of nutrients for their growth. They grow rapidly in protein rich food such as milk, meat, poultry, and leftover moist cooked food if other conditions for growth are favourable.

MOISTURE – Microorganisms need moisture for their growth. If moisture is removed from food by drying or dehydration, the food will not spoil like papads and dried beans. Growth of microorganisms does not depend only on total moisture but on available moisture in food i.e. water which is not bound to sugar or salt and which microbes can use for growth.

TEMPERATURE - Microorganisms grow best in the temperature range of 5^0C and 63^0C. This temperature range is called the 'Danger Zone' because it is dangerous to us. Multiplication is maximum between 15^0 C to 49^0 C and slows down towards both ends of the danger zone. They die if exposed to temperatures above 63^0 C for several minutes and their growth is retarded at temperatures below 5^0 C. They are not killed when food is refrigerated or frozen but merely become dormant. Cooking does not destroy all microorganisms and chances of re-contamination of food are high. Very often some pathogenic microorganisms or their spores remain in food and they multiply rapidly to numbers large enough to cause food borne illnesses.

TIME- Microorganisms need time to grow to numbers large enough to spoil our food. When conditions are favourable in terms of temperature, food and moisture, bacteria multiply by a process called Binary Fission by dividing into two every 20 minutes.

pH- Most microorganisms grow best at a neutral pH of 7. Molds and yeast grow in food with an acidic pH of 4, while bacteria do not grow in acidic foods. This is the reason why acids such as acetic acid and citric acid are added to food to preserve it as they can control microbial growth.



OSMOTIC PRESSURE- Bacteria cannot grow in high concentrations of sugar and salt like jam and pickle. Molds and yeasts can grow at high osmotic pressures or high concentrations of sugar and salt and they spoil such foods.

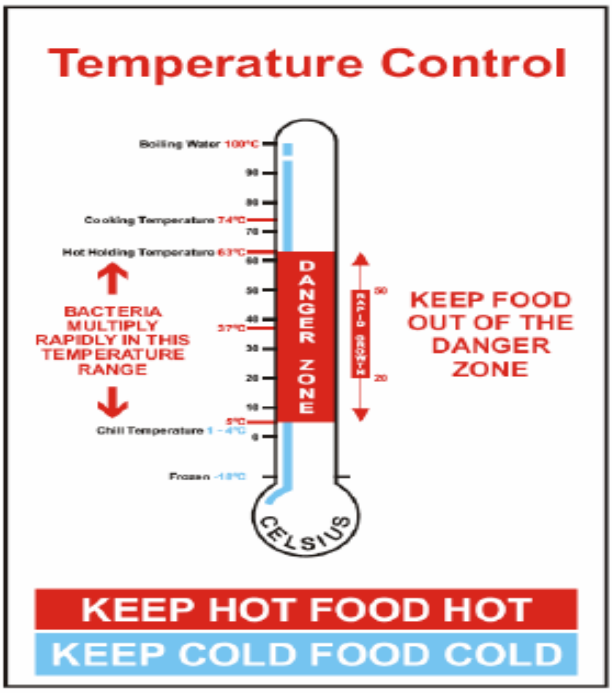
OXYGEN- Just like humans, animals and green plants, most microorganisms need oxygen for growth. However, some types of microorganisms do not need oxygen for growth and they may die in the presence of oxygen as oxygen may be toxic to them. Microbes which need oxygen are called aerobes, while those who do not need oxygen are called anaerobes.

WHAT IS THE DANGER ZONE?

We have just read that microbes need certain conditions to grow (multiply), and suitable temperature is one of the basic prerequisites for growth. Microbes multiply over a wide range of temperature.

The range of **5^0C to 63^0C** (41^0F to 145^0F) is called the **DANGER ZONE** because microbes grow very fast within this range.

The temperature in our classroom, in the kitchen and in our body is also within this range. Since microbes are present everywhere, and food can get easily contaminated, the time and temperature for which food remains in this zone should be controlled.



Now that we know the basic conditions for microbial let us see how microbial growth can be controlled. Once we are familiar with these we can apply the same in our daily life and keep microbes away.

HOW CAN WE CONTROL MICROBIAL GROWTH?

When conditions necessary for growth are not available, bacterial growth slows down. They can be controlled by:

- **Controlling Temperature –** Bacteria grow (Multiply) best in the Danger Zone i.e. temperatures between 5 ^{0}C and 63 ^{0}C.

    1. **Low temperatures:** At refrigerator and freezer temperatures bacterial growth slows down and bacteria become dormant. They do not die.

    2. **High Temperatures**: When food is heated to high temperatures, bacteria are destroyed. However spores may survive normal cooking temperatures.

- **Removing Oxygen** – Aerobic bacteria die when oxygen is removed when food is vacuum packed and canned. Anaerobic bacteria if present, can grow in tinned foods.
- **Adding Chemical Preservatives** – Preservatives are added in permitted amounts to tomato sauce and fruit based squashes to extend their shelf life.
- **Reducing the Moisture Content** – The moisture content of foods like milk is reduced by evaporation and dehydration to improve keeping quality. Sugar and salt bind water and make it unavailable to microbes. They are added to jams and pickles to preserve them.
- **Exposure to Ultraviolet Rays** – Sunlight has ultraviolet rays which are lethal to bacteria. Ultraviolet Rays are useful in sterilizing the surface of food and equipment. Ultraviolet lamps can be used as well.

THE TIME TEMPERATURE PRINCIPLE

The Danger Zone in Food Preparation

When conditions necessary for growth are not available, bacteria cannot grow fast. They can be controlled by controlling time and temperature

Let us see how this happens by setting curds. Curd is made from liquid milk by action of bacteria. One teaspoonful of curds contains millions of useful bacteria which are capable of converting a litre of milk into curds. Milk is a nutritious food containing adequate moisture. If given favourable temperature and time one teaspoonful of curds can become 1 kg curds.

The trainer should highlight the message given in the box.

Message: *Microbes are present everywhere and need to be kept in check.*

- *Microbial growth in food can be controlled by controlling time and temperature.*
- *Bacteria die at high temperature. They stop growing and remain dormant at low temperatures.*
- *However spores may survive boiling temperatures unless food/water is boiled for some time.*

Now that we know what microbes are, how they grow and how they can be controlled we are in a better position to stop their growth and curb spoilage and infection. We are aware that some microbes can make us sick and spoil our food and we can understand the need for hygiene better.

In the following modules we will study how microbes are spread and what we need to do to prevent their spread to stay healthy under 3 different headings namely:

1. Personal hygiene
2. Hygienic Handling of Food and
3. Hygiene of our surroundings

KEY TERMS (Module 1)

Bacteria: Unicellular microorganisms which cannot be seen by the unaided eye and are both useful and harmful.

Clean: removing matter from a surface on which it is not acceptable with the help of cleaning tools and cleaning agents.

Danger Zone: The temperature range of 5^0C to 63^0C in which microbes grow best. Thermometer with range marked in red.

Detergent: Cleaning agents, which when used with water, loosen and remove dirt and hold it in suspension so that dirt is not re-deposited on the cleaned surface. They include both soapy detergents and synthetic detergents.

Disinfectant: Chemical substances that kill majority of bacteria present on a surface but do not kill spores. Used on inanimate objects like floors and toilets.

Fomites: Inanimate articles or substances other than food and water which get infected by microorganisms from discharges of patients like glasses, plates, towels, railings, etc.

Food Handler: Any person who cooks or serves food.

Health: A state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity.

High-Risk Foods: Foods which are rich in protein and moisture and usually eaten without reheating. They support bacterial growth and are most likely to cause food poisoning and food infections.

Hygiene: The art and branch of science that deals with preserving good health by maintaining high standards of cleanliness. It includes all conditions or practices conducive to maintaining health and preventing disease, especially through cleanliness.

Malnutrition: Faulty nutrition or impairment of health resulting from a deficiency, excess or imbalance of nutrients in the diet.

Microorganisms: Microscopic plants and animals which are too minute to be seen with the unaided eye. They include viruses, bacteria, yeast, molds, algae, and parasites.

Nutritional status: Is the condition of health of an individual as influenced by the utilization of nutrients by the body.

Osmophilic: Organisms that can grow at high osmotic pressure i.e. high concentrations of sugar and salt, and cause spoilage.

Parasite: Microorganisms that require living host cells to grow.

Pathogens: Disease causing microorganisms.

Perishable: Food which has a short shelf life of few hours to a few days and is an ideal medium for microbial growth. Examples are meat, fish, milk, cream, cooked food, bananas etc.

Personal Hygiene: Personal cleanliness, maintenance of health and good habits to prevent spread of disease through disease causing organisms present in and on the body of food handlers through food.

Pests: Insects and rodents such as cockroaches, houseflies, rats and mice and stored grain insects which contaminate and waste our food and are a nuisance in the home. Classified under the 5 F's as FLIES.

Refrigerated store: A temperature controlled unit or walk-in, in which temperatures should range from 1^0C to 4^0C. Used for short time storage of perishable food.

Sanitizer: An agent used for reducing the bacterial count to a safe level.

Saprophyte: Microorganisms that grow on dead organic matter.

Sewage: Waste matter from the toilets, bathrooms and kitchen drains which is carried by sewers and is a source of many pathogens. Also called gray water.

Spore: A resistant structure formed in some rod-shaped bacteria to withstand unfavourable conditions. Spores remain dormant till conditions become favourable and form a vegetative cell that can once again grow and multiply. Molds reproduce by forming multiple spores which germinate when they settle on organic matter.

Yeast: A unicellular fungi which reproduces by budding and is used in bread making.

Module 2 Personal Hygiene

In Module 1 on **'The invisible world of microbes'** we learnt about microorganisms and their basic growth requirements. Let us now learn how they are transmitted to our food through various routes. In this module we will be studying how we can prevent infections from spreading by practicing personal cleanliness. We should practice personal hygiene, be healthy and have good habits, to prevent direct transmission of pathogens or disease causing microorganisms onto food.

Let us begin by understanding the meaning of the terms hygiene, health and personal hygiene.

DEFINITIONS

Hygiene - Hygiene includes all conditions or practices conducive to maintaining health and preventing disease, especially through cleanliness

Food Hygiene: Food Hygiene is defined as "All condition and measures necessary to ensure the safety and suitability of foods at all stages of food chain." which involves preventing objectionable matter getting into the food.

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

Personal hygiene: It is defined as the action, habit, or practice of keeping oneself clean, especially as a means of maintaining good health. It includes personal cleanliness, maintenance of health and good habits to prevent spread of disease through disease causing organisms present in and on our body through food.

WHY PERSONAL HYGIENE?

Humans harbour microorganisms in and on their body, and those microorganisms that cause food borne illnesses are present on the skin and in the nose, throat, mouth and gastrointestinal tract of the person handling food. These microorganisms are transmitted to food mainly through the hands and nails of the person or by accidently coughing or sneezing on food.

Personal hygiene should become a habit. It is a part of good grooming. We should be well groomed when we go to school every day and practice good habits all day long.

A well-groomed person has a pleasing personality and is more attentive and confident.

WHAT DOES PERSONAL HYGIENE INCLUDES ?

Personal hygiene includes all personal practices which need to be followed to keep our body clean and healthy. The following personal practices should be followed every day.

- Visit the toilet regularly and keep your bowels clean. Wash hands well after every visit to the toilet.
- Bathe daily to wash away sweat, dirt and secretions of the skin which are food for bacteria.
- Wear clean clothes and clean/polished shoes.
- Wash and comb hair and neatly tie it to prevent hair from falling on to food.
- Eyes and ears should be washed and kept clean while bathing. Rubbing of eyes should be avoided.
- Teeth should be brushed twice a day to remove food particles which get lodged between teeth, and cause tooth decay and bad breath.
- The tongue should be cleaned with a tongue cleaner and mouth should be rinsed well.
- Keep hands clean and keep nails trimmed and unvarnished.
- Clean and apply antiseptic on all cuts, sores and wounds and cover with a waterproof dressing.

LET US STUDY EACH OF THESE PERSONAL PRACTICES IN DETAIL

1. TOILET HABITS

Visit the toilet regularly to remove indigestible toxic waste from the body. Make it a habit to evacuate your bowels every morning. Flush the toilet after use and wash hands well in the wash basin using liquid soap and preferably warm water.

2. HAND WASHING

Why should we wash our hands?

We have already learnt in Module 1 that microbes are present everywhere. We constantly touch different surfaces and collect all types of microorganisms. They flourish well on the skin because of the following factors:

- Human body temperature is within the ‘Danger zone’ and is the ideal temperature for growth
- Skin secretions are food for microbes
- Being microscopic they get lodged in pores and cracks and
- Large numbers can get accumulated in our hands and nails

Hand washing should therefore become a habit. Hand washing helps in reduction of and transfer of pathogenic bacteria leading to Food Borne Diseases (FBD) particularly in children such as Salmonella, Escherichia coli 0157, Staphylococcus aureus, Vibrio cholera and Viral infections. Moreover, there is a danger of remaining a ‘Carrier’ of these pathogens after an infection. Therefore, hand washing is the only solution to prevent cross contamination directly or indirectly.

Why should we wash our hands?

Hand washing is one of the most important components of personal hygiene. Our fingers are the main vehicle by which transfer of pathogens takes place. We often pick up germs from hand towels, doorknobs, stair railings or any surface that has been touched by others who are not good hand washers. Unwashed hands transfer pathogens to food. We should wash our hands well as hand washing helps to reduce / prevent contamination of food and food borne diseases can be controlled by proper hand washing.

When should we wash hands?

Hands should be washed well before carrying out any one or more of the following activities:

- You prepare or eat food.
- You dress any cut or wound.
- Any activity where you put fingers near your mouth, eyes, etc.

Hands should be washed after:

- Using the wash room
- Touching raw foods
- Scratching the body
- Combing or touching hair
- Handling waste or used tissues
- Coughing, sneezing , blowing the nose
- Touching cuts or sores, or biting nails
- Meeting someone who is sick
- Playing
- Handling pets
- Any other activity which may contaminate the food.

How should we wash hands

How we wash and dry our hands is very important. If we wash our hands well but dry them with a soiled hand towel, the very purpose of washing hands is lost. Follow the steps listed below to wash and dry your hands.

1. Wet hands with warm running water.
2. Apply liquid soap on palm.
3. Rub hands between fingers and nails for20 seconds.
4. Rinse hands under warm running water
5. Dry hands well with a hand towel. In public places, an air dryer or disposable paper towel is preferred. Follow the 20/20 principle i.e. wash hands for 20 seconds and dry hands for 20 seconds.
6. Turn off the tap using a paper towel and discard it.

How to wash hands: in case of non-availability of water

In case of non-availability of water we can sanitize our hands by using a hand sanitizer.

How to clean hands: In areas with limited water resource

By use of Tippy Tap facility

TIPPY-TAP FACILITY

Germs spread when we inadvertently cough or sneeze without covering our nose and mouth. The proper technique to be followed to prevent spread of germs while coughing or sneezing is listed below:

- Cover your mouth and nose with a tissue or handkerchief when you cough or sneeze.
- Discard the used tissue in the waste basket.
- Remember to change your handkerchief often and wash your handkerchief every day.

OR

- In case of unavailability of tissue paper or handkerchief, sneeze into your upper sleeve not your hands.
- Wash and dry hands using liquid soap and water as described above

Hand Hygiene Team: A Hygiene team can be formed comprising of trainer/ teacher and a group of senior students who can monitor the hand washing activity of the class using the check list.

The following checklist should ideally be used at least once a month

1. Are adequate hand washing facilities provided in school? ..... Yes/No
2. Are these facilities well maintained? ..... Yes/No
3. Is liquid soap used for washing hands? ..... Yes/No
4. Are soap dispensers refilled regularly? ..... Yes/No
5. Are hygienic hand drying facilities provided in hand wash areas? ..... Yes/No
6. If towels are used are they changed frequently? ..... Yes/No
7. Do children wash hands well before having meals? ..... Yes/No
8. Are finger nails clean, trimmed and unvarnished? ..... Yes/No
9. Are washbasins provided in wash rooms & outside dining area? ..... Yes/No
10. Are hands washed in sinks used for food preparation? ..... Yes/No
11. Are children observed picking nose, scratching head or face? ..... Yes/No
12. Are children encouraged to wash hands after blowing the nose? ..... Yes/No
13. Is hand sanitizer available in the washroom/class room? ..... Yes/No

3. BRUSHING OUR TEETH

NEED FOR ORAL HYGIENE - Dental caries or tooth decay is the single most prevalent Non-Communicable Diseases (NCD) globally affecting 60-90% of all children. It is the result of metabolism of sugars to acids by oral bacteria. These acids corrode the enamel destroying the hard tooth tissue and cause tooth decay. Lack of oral hygiene, together with a frequent and high sugar intake, can lead to dental caries.

Dental caries needs to be prevented because it causes

- discomfort and pain
- infection and abscess formation
- tooth loss
- lack of concentration at school
- reduced quality of life.

What can be done?

Children should be encouraged to eat a healthy diet and reduce the frequency and consumption of sugar, sweets and sweetened beverages. If sweets are to be consumed, they should be eaten with meals and not in-between meals.

Children should be encouraged to practice oral hygiene by brushing teeth twice a day and rinsing their mouth and gargling after every meal. The tooth brush should have soft bristles and should be changed every three months

When and how should we brush our teeth?

The following points should be kept in mind while brushing teeth

- Brush teeth at least twice a day for two minutes with a pea-sized amount of fluoridated tooth paste.
- Brush preferably after meals
- Do not swallow the toothpaste, spit out the foam and rinse your mouth
- Teach children the right technique for brushing
- Use a soft tooth brush with a small head to be able to reach all teeth
- Keep the tooth brush clean and dry after use
- Use a tongue cleaner to remove bacterial build-up on the tongue
- Visit a Dentist for check-ups or if there is any pain, discomfort or discoloration of teeth.

4. BATHING

Bathe daily to wash away sweat and dirt and remove body odour. A good soap helps in cleaning our body by emulsifying body secretions. Body odour is caused by bacteria breeding on our body and in our unwashed clothes. Change and wash undergarments every day. Preferably use a talc or deodorant after a bath.

5. FEET AND FOOTWEAR

Children lead an active life and their legs and feet are subjected to stress and strain.

Feet should be washed and kept clean specially between the toes, and toe nails should be kept trimmed. Shoes should have a flat heel and should be comfortable to stand for long hours and to run and play. Socks should always be worn with shoes to keep away dirt and absorb perspiration. They should be changed every day. Shoes should be sturdy, comfortable, clean, and well-polished and form part of the uniform. Shoes are important because they protect the feet against injury.

6. HAIR

Hair can be a breeding ground for bacteria if it is not shampooed and kept clean. Unclean hair causes dandruff and lice and makes the scalp itch. Scratching the head is a common habit because of which both hair and Staphylococci present on the skin and scalp may get into food. Boys should have a short haircut up to mid-ear level and girls should tie up/plait their hair. Hair should not be left loose and should be free from dandruff and lice. Covering the hair with a net, scarf or cap discourages people from touching their scalp and contaminating food. It also prevents hair from falling into food.

7. JEWELLERY

No jewellery except small ear studs is permitted in school. Embedded stones or small parts of jewellery can accidentally enter food while working in the Food laboratory. Jewellery that comes in contact with food should not be worn. Finger rings can accumulate food particles, like dough while kneading which could later enter the food. Bangles, bracelets and wristwatches can get heated while cooking and can get in the way of work. Earrings are a distraction while working and may fall into the food.

8. CUTS AND SORES

Cuts and sores on your body also have bacteria in them. They must be washed and kept covered with a water proof dressing or plaster. This is to stop the bacteria from contaminating food or any other surface. If you cut yourself you need to wash the wound, apply an antiseptic and cover the wound with a waterproof dressing. This prevents water or any substance getting into the wound and also hastens wound healing. Always keep a ‘First–aid’ box handy and inform your teacher/parent about the hurt.

9. SICKNESS OR ILLNESS

If you are sick or not feeling well while at school, you should tell your teacher. They will tell you what to do. If you are vomiting or have diarrhoea then you must not come to school. You must stay at home until you are better. If you have a common cold, the symptoms could be a running nose, congestion or a bad cough. These symptoms could prevent you from being alert or attentive and you are also likely to infect other children. If you have fever or a contagious disease like Measles, Mumps, Chicken pox or Typhoid, stay at home till the convalescence period is over. The bacteria or viruses that cause these diseases spread very rapidly to other people.

The teachers will ensure that you cover up all that you have missed during your absence from school.

HABITS

Good habits play an important role in maintaining good health. Habits are formed early in life; they are difficult to change once established and can have lifelong consequences that may benefit or harm our health.

Good Habits like practicing personal hygiene should become a daily habit for all of us to stay healthy and break the chain of spread of infection. Other good habits which should be encouraged are listed below:

Message: *Cover your mouth and nose while sneezing and coughing. Keep food and beverages covered during sweeping and dusting.*

1. Avoid handling food with bare hands as far as possible.
    a. Do not pick up or serve food with bare hands.
    b. Use a spoon, tongs or hand gloves while handling ready food items or serving food.
2. Do not cough or sneeze onto food: When a person sneezes or coughs, particles of moisture containing a large number of microorganisms are expelled into the air up to a radius of 1 metre or more. When the moisture from the small droplets evaporates, microorganisms like bacteria or viruses remain suspended in the air. Large droplets of moisture settle down on the floor and become a part of dust. During dusting or sweeping, these dust particles become air-borne and get inhaled or settle on uncovered food or drink.
3. Use a disposable tissue to blow your nose, discard the tissue in the dust-bin and wash your hands thereafter.
4. Do not touch or pick your nose while handling food. Staphylococci are present in our nose and can cause food poisoning if transferred to food.
5. Do not touch food and mouth contact surfaces of crockery and cutlery.
6. Pick up cups by the handle or bottom, glasses by the base, cutlery by the handle and plates by the bottom or edge.
7. Do not leave food uncovered for long. Microbes from the air can settle down on food and multiply, if other conditions are favourable.
8. Ill people should not be permitted to cook or serve food. Report sickness if any, and do not handle food.
9. Prevent cross contamination. Healthy persons can spread disease by cross contamination i.e. by carrying bacteria from infected or dirty areas to clean areas. Observe good habits in the kitchen.
10. Do not blow on milk to keep cream from being poured, or on plastic bags to open them. Our mouth has many different bacteria which are transferred to food.
11. Wash hands in the wash basin, not in the kitchen sink. Do not rinse your mouth or spit in the kitchen sink.
12. Avoid using the kitchen cloth to wipe perspiration or wipe hands after using the toilet. Use your handkerchief or a hand towel.
13. Wear clean kitchen uniforms while cooking food.
14. While working in the laboratory, students should wear protective clothing which includes a clean apron, a head cover, and covered comfortable footwear.
15. They should carry a separate kitchen cloth and a handkerchief which should be changed every day.
16. Personal hygiene must be strictly followed.

NEED FOR REST, RELAXATION AND EXERCISE

There should be a balance between the amount of time spent on studies and home-work, and the rest, relaxation and sleep that a child gets in order to stay in good health.

Exercise

Regular exercise and physical activity are important for children and adolescents to maintain a healthy weight, develop strong bones and muscles and reduce the risk of developing NCD's in later life. Physical activity for at least 60 minutes every day is recommended. During school hours, sports and exercise as well as free and recreational play, walking, and gardening should be a part of the curriculum. Cycling or walking to school and helping the family in household chores should be promoted.

Exercising in fresh air helps to:

- Improve respiration and blood circulation
- Maintains muscle tone
- Promotes digestion
- Keeps skin clean and
- Maintains an efficient nervous system
- Reduces the risk of developing NCD's in later life.

Sleep

Rest and relaxation revives a person, lessens psychological and physical tiredness and makes them active and alert in class. Children need 8 to 10 hours of undisturbed sleep to feel refreshed on awakening. Fatigue or tiredness reduces the capacity of a child to concentrate in school.

Recreation and relaxation

Some form of recreation is necessary for a healthy mind. It refreshes the mind just like exercise refreshes the body. Children should be encouraged to pursue a hobby, listen to music, dance and be taken for outings to break the monotony.

PERSONAL APPEARANCE

Uniforms and Clothing

School uniforms, undergarments, socks and handkerchiefs should be changed daily. Uniforms should be ironed and shoes polished. Shoes should be comfortable to stand for long hours, to run and play and have a flat heel. Clothes should be durable to withstand washes and made of cotton/blend of cotton to be absorbent. Clothes should be neatly folded or placed on hangers in the cupboard. Protective clothing in the form of a laboratory coat, an apron and head cover should be used while working in the kitchen to prevent contamination of food and protect the person from heat and hot splashes. All clothing should be clean and comfortable.

Protective Clothing

Our clothes are often contaminated with hair and dust from the environment. Laboratory coats and aprons should be worn while handling food. They should be clean, washable and light in colour so that dirt shows up when they are dirty. Hair should be covered with a net or cap to prevent dandruff or loose hair falling into our food.

HEALTH CHECK-UP AND DE-WORMING

All students attending school should be in a good state of health. A sick child is not only a source of infection, but also cannot concentrate in school activities and gets tired easily. Students should be active and alert and for this both body and mind should be healthy. Good health does not only depend on one's height and weight. Children should be physically fit and mentally alert, and have ample reserve energy for recreation and sports.

Nutritious and wholesome meals are essential for good health.

Periodic health check-ups, inoculations and medication to de-worm should be routinely followed by the parents/school.

We will be learning about nutrition, healthy foods and good eating habits in the Modules 5, 6, & 7

HOW SCHOOLS CAN CONTRIBUTE TOWARDS PERSONAL CLEANLINESS

The school should ensure that the following is observed

- Annual medical check-up
- Dental check-up
- Periodic de-worming (six monthly) and necessary inoculations
- Communicable illnesses should be reported and fitness certificate submitted to school
- Parents should be encouraged not to send ill children to school even if it means missing class tests and examinations
- Personal cleanliness and wrong habits should be corrected/necessary action should be taken (parents informed if necessary)
- Adequate well maintained washrooms, separate for girls and boys should be provided.

Facilities in Restrooms

Restrooms should have basic facilities which are well maintained like water closets and urinals with flushing systems in place, connected to septic tanks. Other facilities include:

- Hand washing and drying facility
- Pedal operated, lined sanitary bins
- Mirror
- Changing room with lockers and hangers

KEY TERMS (Module 2)

Antiseptic – Chemical substances used on the skin that retard growth and multiplication of microbes. They do not destroy bacteria. Dettol and Savlon are antiseptics.

Carrier – A carrier is a person who harbours a specific infectious microbe without any signs and symptoms of the disease, but can transfer pathogens to others.

Deodorant – A roll-on or spray that removes or conceals unpleasant smells specially body odours.

Disinfectant – Chemicals that kill most substances on a surface. They are used on inanimate objects.

Food Hygiene - is defined as "All condition and measures necessary to ensure the safety and suitability of foods at all stages of food chain" which involves preventing objectionable matter getting into the food.

Hand sanitizer – Alcohol based liquid chemical sanitizer rubbed on the hands till dry to reduce the number of microbes present and bring them to a safe level.

Health - Health as defined by the WHO is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

Health check-up - A periodic physical examination along with investigations like X-rays and laboratory blood and urine tests, which help detect disease at an early stage, sometimes even before visible symptoms are seen.

Hygiene -Hygiene includes all conditions or practices conducive to maintaining health and preventing disease, especially through cleanliness.

Infection – An infection is the entry and multiplication of an infectious microbe into the body with visible signs and symptoms of the disease.

Protective clothing – Aprons and laboratory coats worn by people working in kitchens to protect food from contamination. People are protected from heat, grease and fumes. It should be comfortable, durable, absorbent and easy to wash.

Recreation - Refreshment of the body or mind after work by any form of indoor or outdoor activity undertaken during leisure time like active or passive hobbies, play, amusement etc.

Module 3 Hygienic Handling of Food

INTRODUCTION

We have learnt in Modules 1 and 2 that Food borne diseases are caused by microbes which enter food that has been improperly handled by careless food handlers.

Food safety is a primary concern for everyone and assurance of safe, wholesome food is the primary responsibility of each and every person who handles food. Maintenance of quality, safety and suitability of the food from farm to plate is this year's theme of the World Health Organisation (WHO). This can be achieved through the application of Good Hygienic Practices (GHP's) throughout the food chain. GHP's are the foundation for food safety and can prevent disease and other food safety issues.

We have learnt that Hygiene includes all conditions or practices conducive to maintaining health and preventing disease, especially through cleanliness. In Module 2 we have defined Food Hygiene as "All conditions and measures necessary to ensure the safety and suitability of foods at all stages of food chain." which involves preventing objectionable matter getting into the food.

In this module we will be focusing on Food Hygiene. Let us begin by understanding the terms 'Quality' and 'Safety' and see its impact on our food.

The term 'Quality' can mean different things to different people. When people are conscious about quality they look for some or all of the following:

- Appearance or presentation
- Odour, flavour and texture of the food when eaten
- Nutritional value or purity
- Price or value and sales service
- Consistency
- Food safety

The order or priority of these things will vary with each consumer.

For most, food safety may be the most important, whereas others may consider the price to be almost as important

The term 'Food Safety' means an assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.

HYGIENIC PRACTICES AFFECT THE QUALITY AND SAFETY OF FOOD

When food is handled hygienically from the farm to the plate, it will retain its quality and nutritive value and would be safe to eat. For example, if farm fresh perishable fruits and vegetables are stored in the dry food store instead of the refrigerator, they will lose both quality and nutritive value; if fish or chicken is left on the kitchen platform or in a bowl of water in the sink to thaw, it would not be safe to eat. In this module we will learn about how we can achieve food safety through good hygiene practices. We will learn about the nutritive value of food and how it can be retained and enhanced in the coming modules.

We can achieve food safety through good handling practices

- Selecting good quality wholesome food from reliable sources and rejecting contaminated or poisonous food or food from suspect sources
- Protecting food from contamination, including harmful microorganisms, poisons, allergens and foreign bodies.
- Preventing multiplication of bacteria to a level which would result in illness of consumers or the early spoilage of foods and reduction in nutritional values
- Destroying microorganisms in the food or food environment
- Discarding /removing unsafe/ unfit or contaminated foods

To ensure food safety we must begin with selection of wholesome food which is at the right stage of maturity and free from contaminants. Food should be protected from contamination through all the stages it undergoes till it is consumed. Spoilage in food begins from as soon as vegetables and fruits are harvested, animals are slaughtered, milk is drawn from cattle etc. and continues till it is consumed. To prevent food from getting spoiled we need to know why foods spoil, why some foods spoil faster, what the factors that bring about spoilage are, and how we can prevent food from getting spoiled.

Let us first understand the term food spoilage and see how it differs from contamination.

FOOD SPOILAGE can be defined as decomposition and damage caused to food by various agents, making it unsuitable for consumption.

The term **CONTAMINATED** is used for those foods which are not fit to be eaten for sanitary reasons. Although they may look, smell and taste good, they may contain harmful chemicals, non-food matter and microbes. Contaminated food is also spoiled.

Spoilt food has an unattractive colour, smell, taste and looks unfit to eat. Both spoilt and contaminated food should be discarded.

In Module 1 on The Invisible World of Microbes we have learnt about the basic growth requirements of microbes. They need food and moisture for growth, along with a favourable temperature, pH and time. Some foods spoil faster because they are rich in nutrients and moisture, and get easily contaminated at the source, for example meat, fish, milk etc.

On the basis of shelf-life, foods are classified as:

- **Non-perishable or stable foods:** These foods do not spoil unless handled carelessly and can be stored in a cool, dry place for up to one year. For example, sugar, oil, whole grains, preserves and canned food.
- **Semi-perishable foods:** Foods in this group remain in a good condition for a few weeks to a few months, if stored properly in correct containers in well ventilated, cool rooms. This group includes foods like semolina, gram flour, onions, apples, frozen foods, etc.
- **Perishable foods:** This is the largest group and includes most food items we consume everyday like milk, eggs, meat, fish, poultry and most fruits and vegetables specially green leafy vegetables. These foods contain high amounts of proteins, moisture and other nutrients and are an ideal medium for bacterial growth. They spoil easily by natural enzymatic changes and have a very short shelf-life of a few hours to a few days after which they will spoil rapidly. This group is responsible for the outbreak of food borne diseases. This group also includes all prepared food, opened canned food and frozen food which has thawed. Foods in this group must be stored at low temperatures to retard growth of microbes and action of enzymes.

Causes of Spoilage in Food

Foods spoil mainly because of anyone or more of the following reasons:

- Microbiological action – souring of milk, moldy bread
- Action of insects – damaging grains and food like weevils, insect fragments
- Presence of contaminants – stones, grit, irradiation
- Natural enzymatic changes – over-ripening of fruits
- Physical damage – bruising, freezer burn
- Chemical reactions – rancidity in fats, hydrogen swell

The following conditions that could lead to spoilage of food are listed below:

- Buying more than required
- Buying poor quality food
- Not checking commodities, packaging and labels
- Not refrigerating/freezing purchased food promptly
- Refrigerators/freezers not working properly
- Using refrigerator space incorrectly

A food is called spoilt or unfit for consumption when undesirable changes take place in it and/or harmful microbes or contaminants are present in it. Spoilt food should be discarded.

Signs of Spoilage in Food

While purchasing food we should select clean wholesome food which is at the right stage of maturity. Food should be purchased from reliable licensed suppliers only. Some of the common signs of spoilage in foods which we consume frequently are listed below:-

1. Fruits and vegetables
   - Discolouration and mushy texture, presence of mold
   - Leaves are wilted and limp
   - Presence of insects/worms
   - Skin or peel is damaged or bruised
   - Potatoes are green and sprouted
   - Overripe fruit and over-mature vegetable
2. Canned food
   - Cans are leaky or rusty
   - Bulging ends and puffy appearance
   - Contents smell putrid
   - Contents discoloured
   - Brine or syrup looks cloudy, bubbly or slimy
   - Contents spurt out when can is opened
3. Frozen foods
   - Do not buy food with lot of ice-crystals in packet
   - Discard if there is any discolouration, off taste or smell
   - Do not refreeze food once it has thawed
   - Thaw only what you need

Signs of Spoilage in Food (Cont'd)

4. Milk
   - Spoiled milk curdles or turns sour
   - Milk may turn slimy or ropy
   - Discolouration
   - Change in smell
5. Cereals and Pulses
   - Presence of weevils, beetles, moths and worms
   - Clumping of whole grains
   - Dirt, mud and stones
   - Musty odour and off flavour
6. Eggs
   - Dirty discoloured shells
   - Cracked shells
   - Egg floats in water
   - Broken egg has blood spot/meat spot/foul odour
7. Fish
   - Dull sunken eyes
   - Gills grey or green
   - Off odour
   - Flesh flabby, separates from bone
   - Few scales left on flesh
   - Depression remains when outer skin is pressed
8. Meat
   - Discolouration
   - Putrid smell
   - Slimy appearance and feel
9. Dry fruit and chocolates
   - Spoiled by yeast
10. Cooked food
    - High risk of getting spoilt
    - Spoilage may or may not be visible
    - Off flavours and off odour

WHAT SHOULD WE DO IF WE FEEL A FOOD HAS SPOILT?

WHEN IN DOUBT THROW IT OUT.

CONTAMINATION AND CROSS CONTAMINATION

What is a contaminant?

Anything naturally introduced into the product or intentionally added to the product during the different stages of the food chain from the farm to the table which may cause harm to the consumer is termed a contaminant. This includes pathogens and/ or their toxins, residues of cleaning chemicals, chemicals from the environment, drug residues, additives if added in excess or use of unapproved colours and chemicals, Physical objects in foods and other foreign matter indicating the insanitary conditions during processing are all termed as contaminants.

Contaminants are classified into three main categories namely

Biological contaminants

They include both visible and invisible contaminants in food such as rat droppings, beetles and weevils, insect body parts , flies and worms which can be seen in food and are repulsive as well as invisible contaminants, most commonly, bacteria and other microorganisms which cause food poisoning or infection. They are called food pathogens or pathogenic microorganisms.

They may occur on the food naturally or through contamination, but due to some lack of control, they grow to high numbers on the food product. It is either the organisms themselves, or toxins produced by them, which make people ill.

Microorganisms other than bacteria, which may be hazardous, include viruses, molds, toxic algae and parasites like cysts of worms and amoebae.

Chemical contaminants

They include any form of chemical compound, which may contaminate food products and which result in illness or harm to consumers.

These may include non-permissible food additives, adulterants, cleaning chemicals, packaging adhesives and inks and refrigerants, etc.

Or Chemicals accumulated in food like heavy metals (lead, mercury, cadmium) pesticide residues, veterinary drugs, etc. And sometimes naturally occurring toxins in food such as solanine in green potatoes, sea food toxins and mycotoxins.

Physical contaminants

Physical hazards can include a wide variety of contaminants such as glass, metal, bone, shell, hair, etc, which may cause harm to the consumer while they are eating the food product.

In many cases, objects that are called physical hazards are in fact the source of biological hazards.

These would include sticking plasters, stones, grit, feathers, cigarette stubs etc, which are themselves contaminated with pathogenic organisms.

Cross Contamination

In Module 1 we were introduced to the term cross contamination. Let us revise this term in the context of food hygiene.

Cross Contamination is the transfer of pathogens from contaminated food (usually raw) to ready- to- eat foods by direct contact ,drip or indirect contact using a vehicle such as hands or a cloth or cutting boards and knives. Cross contamination can happen at any stages of processing, transportation, storage, distribution or even at the stage of consumption.

Cross Contamination may occur from any of the following.

- Raw food is placed on the surface, then cooked food is placed on the same surface.
- Food to food transfer
- Surface to surface transfer
- Food to surface transfer
- Not washing hands after handling each item.

What can we do to prevent Cross Contamination?

- Keep raw and cooked food apart.
- Store cooked food above raw food in the refrigerator to prevent drip.
- Colour code chopping boards and knives
- Practice hand hygiene

FOOD POISONING, FOOD INFECTION AND FOOD ALLERGIES

Consumption of contaminated food can result in food borne illnesses.

A food borne illness/disease is a general term applied to all types of illnesses caused by microbes, substances or any kind of material present in the food we have eaten.

It includes

- Food Poisoning
- Food Infections and
- Food Allergies

Food Poisoning

Food poisoning or food intoxication is an illness caused by toxins present in contaminated food. The toxin may be:

- A poisonous chemical intentionally or accidently added to food
- A naturally occurring poison like solanine in green potatoes or
- A toxic metabolite excreted by bacteria

When food gets contaminated by bacteria, the toxin is produced during growth of bacteria in the food. When such food is consumed, the toxin present irritates the lining of the GI tract causing symptoms such as vomiting, abdominal pain and diarrhoea.

Since the ready poison or toxin is already present in food, symptoms appear in one to six hours of consuming the contaminated food. The offensive food may not contain any living bacteria, which may have been destroyed during reheating.

Trainer should highlight the point that food gets contaminated by unhygienic handling and bacteria multiply if conditions are favourable. Conditions should be created to ensure that bacteria do not survive.

Food Infection

A food infection is an illness caused by microbes. It happens when we consume food which contains living bacteria. The bacteria multiply in our body and cause infection. Symptoms of infection occur when our body reacts to the presence of large number of bacteria or their metabolites. Symptoms of infection include some or all of the following:

- Nausea
- Diarrhoea
- Abdominal pain
- Vomiting
- Fever

Toxins need higher temperatures and more time to be destroyed than the bacteria which produce them.

The incubation period for an infection to occur is longer, approximately 12 to 24 hours.

Did you know?

- For bacterial food poisoning or food infection to occur, approximately one million or more bacteria must be present in food.
- Gastric juice present in our stomach is acidic and destroys some bacteria. We are more likely to contract a food borne illness when we overeat.

What is the difference between a Bacterial Food Poisoning and a Food Infection?

FOOD POISONING	FOOD INFECTION
Generally transmitted through food	Transmitted through other vehicles as well as food
Caused by a toxin. Bacteria multiply in food and release toxin.	Caused by living microbes. Bacteria multiply in the body reaching large numbers
Incubation period: 1 – 6 hours. Relatively short onset period	Incubation period: 12 – 24 hours Usually a longer onset period
Symptoms: nausea and vomiting, diarrhoea, usually no fever	Symptoms: diarrhoea, abdominal pain, vomiting, fever
Duration: one day, sometimes longer	Duration: one to seven days, sometimes longer
Examples: Staph food poisoning, Botulism, Bacillus cereus food poisoning, Perfringens food poisoning	Examples: Salmonellosis, Gastro-enteritis, Shigellosis, Cholera, Hepatitis A, Amoebiasis, Giardiasis

Golden Rules of Handling Food

The three golden rules to be observed while handling food are:-

- Prevent Contamination
- Prevent Multiplication
- Prevent Survival

Food Allergies

In recent times food allergies have become a real food safety issue and control of allergen in any food business is a mandatory requirement as part of food safety system.

What is a food Allergy?

An allergy is defined as a special reaction of an individual to some ingredient in food. Some people show abnormal sensitivity to certain foods which are otherwise harmless to people. Substances which cause allergies are called 'Allergens'.

Substances which cause allergies are called 'Allergens'.

True food allergies are abnormal responses of the immune system of an individual to components of certain foods. Food allergy is different from food intolerance.

Food intolerance, also known as non-IgE mediated food hypersensitivity or non-allergic food hypersensitivity, refers to difficulty in digesting certain foods. It is important to note that food intolerance is different from food allergy.

Food allergies trigger the immune system, while food intolerance does not. Some people suffer digestive problems after eating certain foods, even though their immune system has not reacted - there is no histamine response.

Foods most commonly associated with food intolerance include dairy products, grains that contain gluten, and foods that cause intestinal gas build up, such as beans and cabbage.

It can be difficult to determine whether the patient has a food intolerance or an allergy because the signs and symptoms often overlap.

In an allergy, even small amounts result in symptoms, as may be the case with peanuts. Whereas, with food intolerance, tiny amounts will usually have no effect.

The symptoms of food intolerance generally take longer to emerge, compared to food allergies.

Onset typically occurs several hours after ingesting the offending food or compound and may persist for several hours or days. In some cases, symptoms may take 48 hours to arrive.

Some people are intolerant to several groups of foods, making it harder for doctors to determine whether it might be a chronic illness or food intolerance. Identifying which foods are the culprits can take a long time.

The most common symptoms of food intolerance are:

- Bloating
- Migraines
- Headaches
- Cough
- Runny nose
- Feeling under the weather
- Stomach ache
- Irritable bowel
- Hives

In fact, Food sensitivities – is used as a general term and includes both food intolerance and food allergy.

Why should allergies be taken seriously?

Allergens cause the body's immune system to react often within minutes, but sometimes within hours. In serious cases the person may go into life threatening anaphylactic shock.

Foods which commonly contain Allergens

- Nuts – Peanuts (groundnuts), all types of tree nuts such as walnut, pistachio, Brazil nut, cashew nut, hazel nuts.
- Milk and milk products
- Eggs
- Fish and Shellfish
- Soya and its products like tofu, bean curd, soya milk
- Cereals containing gluten like wheat
- Sesame seed, mustard, celery

Common Food Allergies	
Infants and Young children	**Older children and Adults**
Cow's Milk	Fish
Egg White	Shellfish
Wheat	Peanut
Soy protein	Tree-nuts (Almond, Cashew etc)
Peanut	Celery, Tomato, Onion, garlic
Fish	Fruits : Apple, Strawberry

Symptoms of allergy vary and include

- General flushing of the skin
- Swelling of throat and mouth
- Severe asthma
- Sudden feeling of weakness
- Fall in blood pressure
- Urticaria or rashes on the body
- Difficulty in swallowing and speaking
- Abdominal pain, nausea and vomiting,
- In some cases the person may collapse and lose consciousness

Did you know?
Food allergies are caused by allergens present in foods we eat every day like eggs, wheat, tree nuts, groundnuts, fish, shellfish, and cow's milk.

How can Food Allergies be controlled?

Food allergies need to be controlled. They can be easily controlled if we observe the following points:-

- Clearly label all ingredients used in RTE foods.
- Mention whether the same processing plant is used for processing foods containing likely allergens.
- During production of foods, take extreme care to prevent carryover of allergens from the utensils/equipment.
- Menu description must be clear and Service staff in restaurants should know basic ingredients used in recipes.
- Clearly write all ingredients on the label to facilitate informed choice by consumers.
- In case of severe symptoms immediate medical attention shall be sought.
- Effective communication to all food handlers regarding allergens and its control.

Food allergy is a serious nutritional problem. At present, there is no effective medical treatment. The family physician needs to support families and teaches in avoiding exposure of these children to unwanted foods and in treating the allergic reactions. However, the big hope for such allergenic patients is hypoallergenic foods and a major breakthrough in this field is expected with advances in genetic engineering.

TEN COMMON FAULTS IN FOOD PREPARATION AND SERVICES

1. Preparing food much before serving time.
2. Storing perishable food at room temperature beyond four hours.
3. Slow cooling of surplus food at room temperature before refrigerating it.
4. Inadequate storage facilities and improper reheating of leftover food.
5. Cooking frozen meat/fish/poultry without thawing it.
6. Cross contamination from raw to cooked food and using cooked food contaminated with bacteria.
7. Undercooking meat and poultry.
8. Holding hot food below 63^0C during service.
9. Infected food handlers.
10. Preparing surplus food and not checking quality before consumption.

CONTROL OF FOOD BORNE DISEASES

Food borne diseases can be easily controlled if we observe the three golden rules which we have discussed earlier namely:-

- Prevent Contamination
- Prevent Multiplication
- Prevent Survival

Foods which are commonly responsible for outbreaks of food borne diseases are

- Poultry (under cooked)
- Cooked red meats and meat products
- Desserts
- Shellfish and fish
- Salads, vegetables and fruit
- Egg based products
- Unpasteurized milk and milk products
- Boiled rice
- Milk based sweetmeats like pedha and basundi
- Left-over cooked food

What are high risk foods?

Foods that are ready to eat and can easily support the growth of food poisoning bacteria if they are not handled carefully and will not be cooked any further before being served. The foods listed above are high-risk foods.

Control of Food Borne Diseases

They are generally transmitted through careless food handlers who may be suffering from the disease or may be carriers. Healthy food handlers can transmit disease through cross-contamination. Food Borne Diseases can be prevented by practicing the basic principles of hygiene listed below.

- Prevent cross – contamination
- Ill persons or carriers should not handle food
- Thorough cooking of potentially hazardous foods like mince and burgers
- Washing of salad vegetables, fruit thoroughly
- High standards of personal hygiene, hand washing
- Strict segregation of raw/ high risk foods
- Proper temperature control and checks while storing, cooking, serving, cooling and reheating food
- Avoid untreated milk and milk products
- Improve hygiene of harvesters, slaughter house, retailers
- Training of food handlers including farm workers
- Increase consumer awareness

7C's TO PREVENT CONTAMINATION OF FOOD

1. CHECK
2. CLEAN
3. COVER
4. CROSS CONTAMINATION AVOID
5. COOK
6. COOL/CHILL
7. CONSUME

CHECK

- Check all commodities for quality before purchasing and purchase from reliable outlets.
- Select wholesome food at right stage of maturity.
- No signs of visible contamination.
- If frozen, at right temperature.
- If packaged, check 'Best before date', packaging intact

CLEAN

- Wipe all packages, tins, bottles etc. before storing them in appropriate storage area.
- Pick and clean green leafy vegetables to remove spoilt leaves, inedible stalks and roots.
- Wash whole fruit, vegetables and eggs and drain/dry before storing in refrigerator

COVER

- Keep all food covered in storage area or during preparation and service to keep away pests and dust.
- Store stable foods in clean, dry, covered containers in dry food store.
- If lids are unavailable, use cling film or aluminium foil.
- Even food kept in refrigerator should be covered to prevent contamination drying out and absorbing off odours.

CROSS CONTAMINATION AVOID

- Wash hands well before handling food.
- Keep raw and cooked food apart. Store raw food below cooked food.
- Use separate chopping boards and knives for raw and cooked food.
- Wash hand often to prevent cross contamination

COOK

- Cooking destroys pathogenic organisms.
- Improves digestibility.
- Increases taste, flavour and aroma.
- Improves appearance and prevents enzymatic browning.
- Increases shelf-life.
- Thaw frozen foods before cooking them.
- Cook food thoroughly.
- Check internal temperature of food is at least 700C with probe thermometer.
- Reheat leftovers thoroughly.
- Stir food in Microwave oven for even cooking/heating.

COOL / CHILL

- Cool food within 1 ½ to 2 hours if food is perishable/ potentially hazardous, and is to be served later.
- Cool food in shallow containers or in a water/ice bath.
- Cool in small portion sizes to cool faster.
- Refrigerate/freeze food within 1 ½ to 2 hours.

CONSUME

- Serve food in a clean environment.
- Use clean crockery and cutlery.
- Eat freshly prepared food as far as possible.
- Hot hold above 630C and keep perishables out of 'Danger zone'.
- If single service items are used for service, do not reuse them.
- Do not waste food, serve only what you can eat.
- Segregate plate waste and plastic waste in bins and recycle.
- Rinse/wash dishes/tiffin boxes well after the meal is over.

HYGIENIC SELECTION AND STORAGE OF FOOD

Once we have selected safe wholesome food and purchased it from authorized/reliable outlets, we need to clean it and store it properly. Before storing food for use at a later date we should wipe the packages clean to remove dust and microbes from the godowns or warehouses. Pests such as rats may be present in such places, making it necessary to wipe bottles and cartons clean before placing them in the refrigerator or store.

DID YOU KNOW?
The golden rule to follow while purchasing food is to buy only from reputable suppliers and spot check the food for obvious signs of contamination or spoilage

Sometimes fruits like pineapple and green leafy vegetables contain inedible portions of food and visible soil which need to be removed before storing them. All storage areas should be cleaned regularly.

Hygiene Storage of Food

There are three main storage areas for food on the basis of temperature

- The dry food store or storeroom – room temperature
- The refrigerator – 1^0C to 4^0C – chilled storage
- The deep freezer – Temperature - 18^0C – Frozen storage

The dry store or pantry is used to store stable or non-perishable food for long periods. The storage area should be airy, well-lit, clean, protected from pests and excessive moisture. Food in the dry store should be kept cool, clean and covered. Rotate food supplies using the first-in, first –out (FIFO) principle. No commodities or bins should be stored on the floor. They should be placed on racks or shelves at least 15 cm off the floor to aid in cleaning below the shelf. Bins or containers should have well fitted lids with a scoop to remove contents. Commodities should be inspected once a week for signs of spoilage like weevils, clumping of grains etc.

The refrigerator is used for short term storage of perishable food including surplus cooked food. Food is preserved by circulation of cold air, hence the refrigerator should not be overcrowded and the door should not be opened often. If hot foods are stored or kept to cool in the refrigerator, the internal temperature rises and can spoil all foods stored inside. Milk and milk products absorb smells, hence all food should be kept covered and fruit such as apples and bananas should not be refrigerated. Raw food, especially flesh foods are highly contaminated and should be placed below cooked food to prevent drip or contamination from raw to cooked food.

The deep freezer with an ideal temperature of -18^0C is used for long term storage of perishable food and frozen food items. Unlike the refrigerator, it should be well stacked to maintain low temperatures. All foods should be well wrapped to prevent freezer burn, cross contamination and absorption of odour and flavor. The food package should have the date and contents labelled neatly on the package. Frozen foods should be thawed before use. Once thawed, food should be used immediately and should not be refrozen.

Thawing is the stage when a frozen food reaches an unfrozen state i.e., when the ice crystals that were formed during the freezing process, melt and the food can be cooked. One should make sure frozen food has thawed before it is cooked unless otherwise specified on the label. Food once thawed should never be refrozen but should be cooked immediately to ensure good quality products.

Thaw or defrost, frozen food by any one of the following ways

- In the refrigerator below 4^oC
- Under cold potable running water while it is still in the packet
- In the microwave oven if you are cooking it immediately.

The peel of bananas darkens when refrigerated. Milk absorbs flavor of fruits and spoils the taste of our tea. Fruits such as bananas should not be refrigerated

DID YOU KNOW

Frozen Foods can spoil if Freezer Temperatures are not maintained

- *Some shop keepers switch off the deep freezer to save on power. Foods often thaw and refreeze. Reject food which has a large number of ice crystals in the packet*
- *Food can remain frozen in a deep freezer for up to 24 hours provided the door/lid of the freezer is not opened. This is the reason why ice cream vendors do not open the display cabinet and do not sell ice cream during power cuts.*

POTABLE WATER

Food can remain frozen in a deep freezer for up to 24 hours provided the door/lid of the freezer is not opened. This is the reason why ice cream vendors do not open the display cabinet and do not sell ice cream during power cuts.

What is potable water?

Potable water is drinking water, free from harmful pathogens and toxic chemicals.

CONTAMINATION OF WATER

Our water supply can get contaminated from the soil, environment, sewage, industrial wastes, toxic chemicals, and mishandling of water sources by people.

Invisible contaminants such as microbes mainly bacteria and viruses, inorganic pollutants like heavy metals (lead,) organic pollutants such as pesticide residues, radioactive contaminants etc. and visible contaminants like dirt, dust, and sand are present in polluted water.

Diseases transmitted through contaminated water include diseases like Cholera, Hepatitis A (Jaundice), Gastroenteritis, Polio, Dysentery etc.

We can prevent contamination of water in the kitchen by:-

- Store drinking water in a clean, covered container.
- Clean the water container every day.
- If the container is not fitted with a tap, use a long handled glass for taking out water.
- Do not dip hands or any container in the water.
- If doubtful about water quality, bring water to a boil, simmer for 10 minutes, cool and use.
- Clean overhead tank and sump once in 6 months and keep tanks covered with well fitted lids which will not blow off.
- Make ice from potable water only or purchase from reliable sources.
- Use clean tongs/spoon to pick up ice

Potable water should be supplied from source itself and should comply with the drinking water standards published by BIS.

The methods of purification of water include chlorination, membrane/micro filtration, reverse osmosis (RO), UV filtration, boiling and so on. Filtration units require regular maintenance (every 6 months) and change of filter every year.

Purifying water by chlorination is preferred because chlorine is easily available, low cost and reliable, hence it is the cheapest and most effective method for disinfection of water. The dose of chlorine is 0.2 to 1 ppm as chlorine tablets to be added to water to purify it.

Water needs to be sampled and tested for all the microbiological parameters and chemical contaminants once in six months to ensure potability. A schedule for the routine cleaning of overhead water tank, sump and pipe line should be developed and followed to ensure that the water is not getting contaminated.

The plumbing line should be checked to ensure that there is no leakage. The water tank both ground level and overhead tanks shall be covered and protected from dust and other foreign objects including excreta from birds and insects.

IMPORTANCE OF FOOD LABELS

All pre-packaged foods must be labelled before they are sold. Labelling is necessary because it tells the consumer what they are purchasing in terms of nutritive value. It helps them make a conscious selection. It helps them compare food products by value for money

The label should

- Be clearly visible
- Be legible
- Properly adhere to the container
- Provide all necessary information as notified by the Government.

Information to be displayed on the label includes:

- Name of the food product
- List of ingredients in descending order of weight
- Symbol for vegetarian/non-vegetarian food
- Nutritional facts
- Food additives and their class/numerical identification number of colours
- Name and address of manufacturer and manufacturing unit
- Net weight of contents and drained weight
- Lot/Code/Batch identification no.
- Date of manufacture dd/mm/year
- Best before date
- If irradiated mention particulars
- Country of origin for imported food
- Instructions for use & disposal of packaging
- Licensing authority and license number
- The label may have pictures and graphics on it

Nutritional facts need to be displayed on the label. In India it is mandatory that the label should mention total carbohydrates, sugar, fat, protein and energy. Comparing the nutrients as a % of RDA is not mandatory. If the manufacturers claim that the product has additional health/nutritional benefits, the claim must be supported by mentioning the appropriate nutrients on the label. For example, if a product is said to be heart healthy, it should mention cholesterol content and all fats present in the product.

If the product is to be exported, then Codex Alimentarius guidelines need to be followed.

Nutritional facts are expressed per 100 g of the product.

1	Energy	Kcal 100 g
2	Proteins	g/100 g
3	Carbohydrates	g/100 g
4	Fats	g/100 g
5	Amount and type of fatty acids:	
	Saturated fatty acids	
	Polyunsaturated fatty acids	g/100 g
	Monounsaturated fatty acids	
	Trans fats	
6	Cholesterol	mg/100 g
7	Vitamins and Minerals	Metric units

To help consumers in making wise choices while purchasing packaged food, the traffic light system of labelling has been introduced.

DID YOU KNOW?

It is mandatory to mention additives and likely allergens which may have accidentally entered on the label

KEY TERMS (Module 3)

Diarrhoea – Frequent passage of loose watery stools

Dysentery – Frequent passage of loose stools with mucous and/or blood

First-in, first-out – A rotation method in which food items purchased first are used up first, and newly purchased food items are stored behind the older items.

Freezer burn – Dehydration and discolouration of foods that are frozen for long periods without being packaged.

High risk foods - Ready to eat (RTE) which can easily support the growth of food poisoning bacteria if they are not handled carefully and are not cooked any further before being served.

Holding – Keeping items on the menu either hot or cold after cooking and during service.

Industrial wastes – Liquid waste or effluent released from factories which is toxic and pollutes our water bodies if discharged without treatment. Contain heavy metals, toxic chemicals, etc.

Leftover food – Food prepared in excess and remains after a meal.

Non-perishable foods – Food which has a long shelf life and resists spoilage unless improperly handled and stored like grains, spices, sugar, pulses etc.

Non-potable water – Also termed polluted or contaminated and contains any one or more of the following like pathogens, harmful chemicals, suspended impurities, colour, odour, and unpleasant taste and is unfit for consumption.

Perishable foods – Foods which spoil easily unless they are specially processed or preserved like milk, meat, most fruit and vegetables etc.

Potable water – Safe, clear and wholesome water which is free from pathogens, harmful chemicals, colour, odour, unpleasant taste and suspended particles, and is fit for consumption.

Potentially hazardous food – A food that is capable of supporting rapid growth of harmful microbes and includes both natural and processed foods like milk and milk products, protein rich moist foods like meat, fish, poultry, cooked rice and pulses etc.

ppm – This is an abbreviation for parts per million which is a measure for concentration. 5 ppm means 5 mg of chlorine is mixed in 1 million parts (1,000,000 mg or 1 kg) of water.

Semi-perishable food – Foods like processed cereals, flours, potatoes, onions, apples etc. which can be stored for a week to a few months at room temperature.

Sewage – Human faecal waste matter diluted with water and other waste waters from kitchens, bathrooms, garden-drains etc. which contains a large number of microbes from the human intestinal tract and soil and needs to be treated before it is dispersed.

Shelf-life – Shelf-life is the amount of time you can keep a product before it must be eaten.

Single service items – They are use and throw onetime use disposable crockery and cutlery made of food grade plastic, paper, thermocole, or foil. They cannot be sanitized so should not be reused.

Thawing – A process for defrosting of frozen foods and the point at which ice crystals are converted to water. Ideally done in the refrigerator**.**

Module 4: Hygiene of our Surrounding

STREET FOODS

Food and Agriculture Organization (FAO) defines street foods as foods and beverages prepared and/or sold by vendors in streets and other public places for immediate consumption without further processing. Most youngsters, especially young workers and students, cannot afford the prices charged in restaurants or hotels and look for easily available cheaper substitutes. The nutritive value and hygiene of these foods is usually neglected or compromised. However, these meals form a significant part of the daily diet and have a major influence on health and well-being.

Challenges for selling of Street Foods:

- Lack of basic infrastructure and services, such as potable water supplies.
- Difficulty in controlling the large numbers of street food vending operations because of their diversity, mobility and temporary nature.
- Insufficient resources for inspection and laboratory analysis.
- General lack of factual knowledge about the microbiological status or the precise epidemiological significance of many street-vended foods.
- Poor knowledge of street vendors in basic food safety measures.
- Inadequate public awareness of hazards posed by certain street foods.
- Use of potable drinking water, (boiled/ filtered water through water purifier etc.) shall be in protected containers of at least 20 litres.
- Health risks of street juice arise mostly because ice is substituted by industrial ice.

PUBLIC HEALTH CONCERN

- *The Consumers International Survey finds that most street food vendors get their water from municipal systems.*
- *The problem arises when stored water is used instead of running water.*
- *In India, 99% of street food vendors re-used stored water multiple times for washing hands and dishes.*

Source: An initiative of the World Bank and the Ministry of Health and Family Welfare, GoI

Street foods and street food operators are constantly exposed to pollutants in the air. Air pollutants are recognized as a major threat to human health. This is a major cause of occupational health and food safety concerns

- **Vehicular pollution** –Indian gasoline have a high volatility, high ambient temperatures increases the potential for evaporating emissions rich in reactive hydrocarbons with the potential to generate ground-level ozone.
- **Traffic congestion** leads to high vehicular emissions.
- It increases carbon monoxide and hydrocarbon emissions per vehicle-km by 200% or more.
- Burning of coal, kerosene- increases the Sulphur dioxide, Benzene levels

The vending stall should be located in a sanitary place away from unhygienic conditions and should be far from any source of contamination like garbage, waste water, open drains, toilet facilities and animals.

A large volume of solid waste arises from roadside vendors who indiscriminately discard the waste next to the stall. Lack of safe method for disposal of waste is one of the main reasons for solid waste pollution in cities. Apart from the quality of water and the cleanliness of the stall, the vicinity/surroundings, the quality of raw food ingredients may be sub-standard. Additives that are banned and cheap non-nutritive substitutes are often used for greater profits. Food is handled unhygienically in a large majority of roadside eateries.

About 0.2-0.5 kg of solid waste is generated per capita per day in Indian cities, which means 35 million tons of municipal solid waste – every year. A large percentage of this waste is non-biodegradable.

Major Concerns regarding Food Hygiene are

- Unhygienic cooking and serving utensils.
- Raw ingredients are not washed well, especially coriander leaves and salad vegetables.
- Food displayed is open to contamination from dust, dirt, flies, customers etc.
- Food is prepared in bulk, many hours in advance and remains in the Danger Zone for long hours.
- Cold storage facilities are inadequate and food is often left open on the ground
- Personal hygiene is poor and vendors are mainly illiterate and therefore do not understand the value of hygiene. Hand washing before handling food, serving food with bare hands, unclean hair and nails are common phenomenon. They have never undergone any health/medical check-up. Because of all these reasons, their safety is doubtful.

Street food vendors should be trained to

- Keep surroundings clean- use dustbins etc.
- Maintain personal hygiene (nails, hair, clean clothes, and not to spit)
- Keep food covered, serve freshly cooked food to prevent growth of bacteria and select wholesome vegetables and fruit.
- Follow best practices on the use of good quality raw materials, authorized colors and cooking medium (fat/oil)
- Use clean water not only for cooking but also to wash their utensils.*(chlorination)
- Personal health- during illness keep away from handling foods and raw materials.
- Adopt safety measures for self and general public.

HYGIENE OF FOOD ESTABLISHMENT: DESIGN AND FACILITIES

Harmful organisms can invade the food service establishment through food, people, unsanitary facilities, unsanitary equipment's, disease spreading pests etc

Food Preparation areas: design and facilities- Premises, equipment and facilities should be located, designed and constructed to ensure that the contamination is minimized. Also, takes care that the Design and Layout permits appropriate maintenance, cleaning and disinfections and minimize airborne contamination.

Food Establishment: design and facilities- Depending on the nature of the operations, and the risks associated with them, premises, equipment and facilities should be located, designed and constructed to ensure that the contamination is minimized; and design and layout permit appropriate maintenance, cleaning and disinfections and minimize airborne contamination

Kitchen: design and facilities- Surfaces and materials, in particular those in contact with food, to be non-toxic, clean, durable and easy to maintain. Where appropriate, suitable facilities to be available for temperature, humidity and other controls like protection against pest access and harbourage.

Summary

Attention to good hygienic design and construction, appropriate location, and the provision of adequate facilities is necessary to enable hazards to be effectively controlled.

ESSENTIAL HYGIENE REQUIREMENTS

1. Location of Food Establishments- Our kitchen or food establishments should have a design and layout that should permit good food hygiene practices including protection against cross-contamination while preparing food. They should normally be located away from:

- Environmentally polluted areas and industrial activities that pose a serious threat of contaminating food;
- Areas subject to flooding unless sufficient safeguards are provided;
- Areas prone to infestations of pests;
- Areas where wastes, either solid or liquid, cannot be removed effectively.

2. Equipment- should be used that functions in accordance with its intended use and facilitates good hygiene practices, including monitoring

Material recommended to be used as equipment's-

- **Stainless steel -** Durable and recommended for use in the kitchen both for equipment and utensils. Does not react with constituents of food. Easy to clean and maintain.
- **Brass –** Should be tin-plated before use
- **Copper –** Good conductor of heat and saves on fuel. If used for cooking, it should be tin-plated before use to prevent copper poisoning. Store drinking water in copper urns. Small amounts of copper are useful to health.
- **Tinning of brass and copper utensils** is necessary to prevent copper poisoning. This results when acidic foods are cooked or stored in brass or copper containers which are not plated
- **Copper bottom utensils –** Excellent conductor of heat and is used as a base on steel utensils
- **Aluminium –** Light weight, strong and good conductor of heat. Food containers should be ISI grade or made of Hindalium (an alloy of aluminium with chromium or nickel). If aluminium has to be used, transfer cooked food to another container immediately.

- **Iron –** Iron utensils and spatulas contribute significantly to the iron content of food cooked in them. Ideal metal for tawas, kadhai, tempering spoon and spatulas. Dry well after use to prevent rusting. Dip tempering spoon in curry for maximum iron benefit.
- **Non-stick cookware -** It is coated with Teflon, which helps us cook food in very little oil and prevents food from sticking to the pan. Once coating wears out, pan should be discarded.
- **Plastic –** Convenient to use for storing commodities and packing food, once food has cooled; and is light in weight. Gets easily discoloured and absorbs odours of food stored in it. Food should not be heated in plastic containers in a microwave oven. Recycled plastics should not be used for food. The chemical Bisphenol-A (BPA) used in plastics can be carcinogenic.
- **Plastic bags -** The government has imposed restrictions on use of plastics to preserve our health and to conserve the environment. Plastic bags should be at least 8 by 12 inches (20 by 30 cms) in size and 20 microns in thickness. Do not accept smaller bags from shopkeepers or hot foods packed in such bags.
- **PET bottles and jars -** Store dry commodities like spices, and grains in them as they are see through and convenient to use.
- **Packaged water bottles -** Are not meant to be reused. Crush bottle after use and recycle. Repeated use of such bottles should be discouraged as they can be carcinogenic.
- **Wood -** Used for meat chopping blocks, chopping boards etc can absorb stains, odours and moisture if not cleaned and dried properly. Wood is being replaced by polypropylene which is available in different colours to prevent cross contamination.
- **Glass -** Cleanest and safest as it is non-reactive and can be washed sparkling clean. Can be safely used in the microwave oven to cook or reheat food. Handle with care
- **Ceramic jars -** Used for pickles and collecting cream. Keeps the food cool.

3. Internal structures and fittings

- The surfaces of walls, partitions and floors should be made of impervious materials with no toxic effect in intended use;
- Walls and partitions should have a smooth surface up to a height appropriate to the operation;
- Floors should be constructed to allow adequate drainage and cleaning;
- Working surfaces that come into direct contact with food should be in sound condition, durable and easy to clean, maintain and sanitize. They should have no cracks or crevices for dirt to build-up or pests to hide. They should be made of smooth, non-absorbent materials, and inert to the food, to detergents and sanitizers. Stainless steel table tops or naturally occurring stone such as kadappa, granite or marble platforms built into the wall with sealed edges is recommended.
- Ceilings and overhead fixtures should be constructed and finished to minimize the build-up of dirt and condensation, and the shedding of particles;

- Windows should be easy to clean, constructed to minimize the buildup of dirt and, where necessary, be fitted with removable and cleanable insect-proof screens. Also doors fixed should be smooth and non-absorbent.

4. Air quality and ventilation

Adequate means of natural or mechanical ventilation is necessary in all areas. In overcrowded poorly ventilated rooms, air gets polluted because of increase in carbon dioxide, increased humidity, and rise in ambient temperatures, air-borne pathogens and pollutants like smoke. It give rise to following symptoms in our body like headache, irritability, poor concentration, loss of appetite and lowered resistance to respiratory tract infections.

An ill-ventilated room not only affects our health and performance, but also promotes multiplication of harmful microbes leading to food spoilage and food poisoning.

Ventilation systems should be designed and constructed so that air does not flow from contaminated areas to clean areas and they should be adequately maintained and cleaned.

The air in Kitchens can be kept free from grease, food odours, cooking fumes and smoke by fitting exhaust fans, chimneys and ventilation hoods over gas ranges and cooking units.

5. Lighting

Adequate natural or artificial lighting should be maintained enabling us to work in a hygienic manner as it makes dirt visible and facilitates cleaning. It increases food safety and prevents accidents. The light intensity should be adequate with no glare or flicker and minimum shadow to prevent eye strain. Also all the lighting fixtures in the kitchen should be protected to ensure that food is not contaminated by breakages.

CLEANING PROCEDURES

Proper cleaning at a desired frequency to be maintained. There should be no accumulation of garbage except in garbage containers, recyclable matter except in containers, food waste, dirt, grease or other visible matter. The food establishment should have adequate facilities, for cleaning food, utensils and equipment. Such facilities should have an adequate supply of hot and cold potable water where appropriate.

Reasons of unsafe food and Importance of cleaning and sanitizing-

- Equipment and utensils are not washed, rinsed, and sanitized between uses.
- Food contact surfaces are wiped clean instead of being washed, rinsed, and sanitized.
- Wiping cloths are not stored in a sanitizer solution between uses.
- Sanitizer solution was not prepared correctly.

Types of cleaning methods

A surface is clean when it is free from dust, dirt, grease, stains, cobwebs or any unacceptable matter. To remove soil, it is necessary to choose the appropriate cleaning method.

Soil can be removed by sweeping, dusting or damp dusting, washing with water and a cleaning agent, friction using an abrasive agent, suction or vacuum cleaning, pressure using a scrubber or a polisher, force by using water or air, solvents for grease and stubborn stains.

Cleaning Procedures

Cleaning procedures will involve, where appropriate

- removing gross debris from surfaces;
- applying a detergent solution to loosen soil and bacterial film and hold them in solution or suspension;
- pressure using a scrubber or a polisher
- rinsing with water to remove loosened soil and residues of detergent;
- dry cleaning or other appropriate methods for removing and collecting residues and debris; and where necessary, disinfection with subsequent rinsing.

Cleaning Procedures for dishes and equipment

There are three methods to clean all food contact surfaces.

1. THE SINK METHOD – To clean dishes and utensils
2. THE THREE BUCKET METHOD – To clean large equipment
3. THE DISH WASHING MACHINE – To clean crockery, cutlery, glassware and utensils

All methods follow three basic steps:

- Wash with detergent & scourer
- Rinse in clean water
- Sanitize with hot water or chemicals

Cleaning Procedures for dishes

- Scrape and pre-rinse dishes before washing them to remove loose soil.
- Wash and scrub in hot detergent water at 520C to melt fat.
- Rinse in clean water at 400C till clean to touch.
- Sanitize in hot water at 770C for 1 minute or with chemical sanitizer.
- Cleaned dishes should be air dried and stored well to avoid contamination.
- Pans and glasses should be stored inverted.
- Food and mouth contact surfaces should not be touched while handling.

Equipment Cleaning

- Equipment and containers coming in contact with food should be made of materials which can be cleaned and sanitized with no toxic effect on food.
- Only food and mouth contact surfaces need to be sanitized.
- Large equipment should be durable and movable or capable of being disassembled to allow for cleaning, disinfection, and maintenance with no place for pests to breed.
- Refrigerators should be defrosted if necessary and cleaned once a fortnight.

Cleaning Programmes

- Cleaning programmes should ensure that all areas are appropriately clean and disinfected.
- Cleaning and sanitizing/disinfection schedules include daily, weekly and spring cleaning.
- Cleaning should begin from the uppermost areas. Clean ceilings and fans, light fixtures and walls once a week to remove dust, cobwebs, grime and mildew.
- Cupboards and shelves should be cleaned once a fortnight.
- Rooms should be swept and mopped with a disinfectant and furniture dusted every day.

DISH CLOTH AND SINGLE SERVICE ITEMS

Dishcloths are typically square, and are usually made of cotton or other absorbent fabric. A dishcloth is used in the kitchen to clean dishes and other surfaces.

Steps to Clean the Dish cloths

- Fill a pot with water.
- Bring it to a boil.
- Add the dirty rags to the boiling water.
- Boil for 15 minutes. The boiling water will sanitize the cloth by killing any mold, mildew, bacteria and germs that may remain after washing.
- After boiling, wash and dry as normal.
- The cloths should look clean and smell fresh.

Single service Items

- Single service items are made of plastic, paper, thermocole, aluminium foil, and leaves.
- They are designed to be used only once and then crushed and discarded.
- They include glasses, plates, cups, bowls, straws, containers and utensils.
- They are convenient to use when cleaning and sanitizing facilities are not available.
- They must be stored in much the same manner as food items.
- They must be covered and protected against the potential for cross contamination at all times.
- They must never be stored on the floor or left open.

WASTE DISPOSAL AND MANAGEMENT

Waste can be almost anything, including food, leaves, newspapers, bottles, construction debris, and chemicals from a factory, wrappers, disposable diapers, or radioactive materials.

Waste management is the collection, transportation, disposal or recycling and monitoring of waste. Recycling and composting, which transform waste into useful products, are forms of waste management. A primary objective of waste management is to protect the public and the environment from potentially harmful effects of waste. Education and awareness on waste management is very important, for the perseverance of global health and security of humankind.

Significance of waste disposal

- Suitable provision must be made for the removal and storage of waste.
- Waste must not be allowed to accumulate in food handling, food storage and other working areas and the adjoining environment.
- It should be disposed off regularly and efficiently to prevent contamination of food products.
- The waste should be segregated before being disposed, into biodegradable and non- biodegradable.

Containers for waste disposal

Containers for waste, by-products and inedible substances should be specifically identifiable, suitably constructed and, where appropriate, made of impervious material.

Containers used to hold dangerous substances should be identified and, where appropriate, be lockable to prevent malicious or accidental contamination of food.

Garbage bins

Garbage or swill is the waste resulting from pre-preparation, cooking and consumption of food. It includes inedible, spoilt food, peels, bones as well as plate waste. It should be collected in durable, covered, foot operated bins which have been lined with a wet strength bag. The bins should be fitted with a lid, be leak proof and easy to clean. Bins should be emptied and cleaned regularly.

DID YOU KNOW?

Untreated sewage is often released into water bodies contaminating our water supply. Small farms use it as a fertilizer. It should not come into contact with food, water, equipment or other food contact surfaces. Sewage should be separated from other wastes and treated before it is disposed.

Liquid Waste or Sewage- Includes wastewater from sinks and drains from the kitchen, bathroom, toilets and other areas like terraces and yard, which is usually carried away by underground sewers. It contains human excreta and chemicals like detergents, pesticides, oil and waste water from the kitchen rich in nutrients. Most dangerous source of human pathogens.

Gaseous Waste- Includes strong fumes emanating from food being cooked and smoke when wood or coal is used as the cooking fuel when food is cooked in a tandoor or barbequed. Kitchens and toilets should be fitted with exhaust fans. Gas ranges should have chimneys fitted with filters to trap grease and odour before expelling the air.

Disposal of Waste

METHOD OF DISPOSAL	TYPES OF WASTE
Land filling	All types of solid waste
Burial	Garbage, dead pests
Incineration	Soiled cotton, outdated pesticides
Composting	Garbage, toilet waste
Mechanical (pulpers)	Soft food waste, dry bulky waste
Vermiculture	Shredded food waste
Biogas	Toilet waste, dung, plant waste
Recycling	Paper, plastic, polythene, glass metal, waste food
Sewers and drainpipes	Waste water, crushed food waste
Soakpits	Waste water
Exhaust fans and chimneys	Strong food odour, smoke, grease

Three preferred options for disposal of food waste

- Vermiculture
- Recycling – feed for pigs
- Biogas along with animal droppings

Vermicomposting- The peels, stalks, seeds and other inedible or spoilt portions of food can ferment, attract flies and give off a foul odour if it is not disposed off immediately. This organic waste or biomass is bio-degradable and nutrients in the waste can be returned to Mother Nature by a simple process called Vermiculture.

Did you know?

- A special breed of earthworms feeds on our garbage and breaks it down in its gut into simple substances which can be easily assimilated by plants.
- It conserves the humus of the soil by its excreta which is a highly enriched manure containing hundreds of earthworm cocoons to continue the process.
- The burrowing action of the earthworm tills the soil ten times deeper than the traditional plough.
- Fruits and vegetables grown on such soils are healthier, tastier and more nutritious than those grown on farms fertilized by chemical fertilizers.
- Such foods are called 'Organic' and fetch a higher market price.

PEST CONTROL AND MANAGEMENT

Pests. Any animal, plant or microorganism that causes harm or damage to people or their food, animals, or destroys their crops is called a pest. Pests can also causes an epidemic disease in humans which is associated with high mortality. Insects, mites, ticks (and other arthropods), mice, rats, and other rodents, slugs, snails, nematodes, cestodes/ tapeworms are all examples of pests.

Transmit of disease from pest through food

Pests like houseflies and cockroaches breed in dirty places like garbage dumps and drains. Rats pass through food containers and contaminate food with their excreta, urine and parasites present on their bodies. They contaminate unprotected foods, utensils and other surfaces. Enroute, they collect many disease causing microbes on their bodies and in their stomachs. They spread diseases like diarrhoea, dysentery, typhoid fever, intestinal worms and food poisoning.

Do not let the fly have its meal before you

1. Flies cannot chew solid food so they vomit on food to liquefy it. They suck up the liquid vomit containing harmful microbes.
2. While feeding they drop excreta which contains pathogens. Fly specks include light drops of vomit and dark particles of excreta
3. They have sticky hair on their limbs which helps them carry bacteria from one place to another

Pests can be controlled by-

Pests pose a major threat to the safety and suitability of food. Pest infestations can occur where there are breeding sites and a supply of food. Pests can be controlled by good hygiene practices, good sanitation. Inspection of incoming materials and good monitoring can minimize the likelihood of infestation and thereby limit the need for pesticides.

Pest control management

Preventing access

- Buildings should be kept in good repair and condition to prevent pest access and to eliminate potential breeding sites.
- Holes, drains and other places where pests are likely to gain access should be kept sealed. Wire mesh screens, for example on open windows, doors and ventilators, will reduce the problem of pest entry.
- Animals should, wherever possible, be excluded from the grounds of factories and food processing plants.

Harborage and infestation

- The availability of food and water encourages pest harbourage and infestation.
- Potential food sources should be stored in pest-proof containers and/or stacked above the ground and away from walls.
- Areas both inside and outside food premises should be kept clean.
- Where appropriate, refuse should be stored in covered, pest-proof containers.

Monitoring and detection

Establishments and surrounding areas should be regularly examined for evidence of infestation.

Eradication

Pest infestations should be dealt with immediately and without adversely affecting food safety or suitability. Treatment with chemical, physical or biological agents should be carried out without posing a threat to the safety or suitability of food.

KEY TERMS (Module 4)

Food hygiene includes all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain.

Food handler any person who directly handles packaged or unpackaged food, food equipment and utensils, or food contact surfaces and is therefore expected to comply with food hygiene requirements.

Food safety Assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.

Food suitability Assurance that food is acceptable for human consumption according to its intended use.

Cleaning The removal of soil, food residue, dirt, grease or other objectionable matter.

Contaminant Any biological or chemical agent, foreign matter or other substances not intentionally added to food that may compromise food safety or suitability.

Contamination The introduction or occurrence of a contaminant in food or food environment.

Disinfection The reduction, by means of chemical agents and/or physical methods, of the number of micro-organisms in the environment to a level that does not compromise food safety or suitability.

Hazard A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.

Module 5 Introduction to Nutrition

FOOD AND ITS FUNCTIONS

Food is any substance which nourishes the body and is fit to eat. Food is essential for human life because it is the source of energy and nutrients. Our body is made up of the foods we eat. Food contains chemical components similar to those that make up the body. These chemical components of food are called nutrients.

No single food contains all nutrients. Therefore, a combination of varied foods is needed.

Food is very essential as it supply the body with specific nutrients which are needed to sustain life and physical activity. These nutrients are necessary for physical growth and development**;** repair and maintenance of all cells and tissues**;** regulation of normal body functions; protection against infections.

Nutrition is the science of food and its relation to health. It deals with food and is a basic prerequisite to sustain life. The way our body makes use of these nutrients affects our health and wellbeing.

Variety in food is not only the spice of life but also the essence of nutrition and healthy.

Our diet must provide all essential nutrients in the required amounts. Requirements of essential nutrients vary with age, gender, physiological status and physical activity. Eating too little food during infancy, childhood or adolescence, pregnancy etc. or too much food at any age can lead to permanent harmful consequences. Therefore, an adequate diet, providing all nutrients, is needed throughout our lives.

Food performs the following functions

1. **Physiological function**
   - Providing energy to carry out voluntary work
   - Growth or body building
   - Repair or maintenance of the body cells
   - Regulation of body processes
   - Protective function, increasing one's resistance to infection

Nutritious food can enhance your physical and mental potential

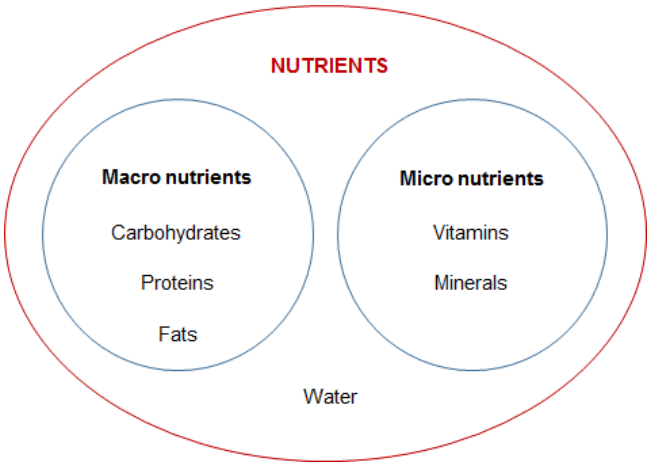
2. **Psychological function**

   Food satisfies our emotional need for love, attention and security.

3. **Social function**

   Food is an important part of festivals and social functions.

NUTRIENTS AND THEIR FUNCTIONS



Nutrients are defined as the substances found in food that keep your body functioning. The food you eat is a source of different nutrients.Our body needs nutrients to fuel our energy; help you grow; repair itself; protect us against infections and regulate basic body functions.There are six groups of nutrients which are essential. They are broadly classified as Carbohydrates; Proteins; Fats; Vitamins; Minerals and Water.

Types of Nutrients: Food is eaten and digested in the body to allow the absorption of nutrients. Nutrients can be broadly classified into two main groups:

- Macronutrients and
- Micronutrients.

Macronutrients

There are three **macronutrients** that are required in large amounts and are essential for good health. These are Carbohydrate; Protein and Fat. Macronutrients are measured in grams (g).

CARBOHYDRATES. Carbohydrates are the body's main source of energy and provide the body's need for dietary fiber. They provide 4 kcals/g. Carbohydrates are of two typesSugars or Simple Carbohydrates and Starches or Complex Carbohydrates.

Food Sources of carbohydrates are Cereals such as wheat, rice, millets (jowar, bajra, ragi etc.), pulses, fruits, roots and tubers; and sugar, jaggery, sweetmeats and preserves.

Simple Carbohydrates includes fruit and vegetables (fructose)**;** milk and dairy products (lactose)**;** honey**;** jam**;** fruit juice**;** table sugar (sucrose)**; j**aggery, khand (brown sugar)**;** sweets and chocolate**;** sweets like mithais, laddus, etc**;** glucon D (glucose).

Complex Carbohydrates

Starchy or complex Carbohydrate- Starch is found in a variety of foods. It is made up of many sugar molecules. Cereal and cereal products are the main source of carbohydrate for Indians. For eg. whole grain chappatis, bhakris, rice, breads, pasta and all cereal products, roots, tubers and other vegetables, and legumes. It acts as an excellent source of fuel (energy) for the body and is rich in vitamins, minerals and fibre.

Fibre is the plant material that doesn't break down when you digest food. Hence does not provide any calories. Many, but not all, grains, fruits and vegetables contain fiber.

For eg. Whole grain cereals and pulses, bran, green leafy vegetables, fruits and vegetables with edible seeds and skin, nuts and oilseeds. It increases gastric motility and aids in digestion.Also may reduce the risk of developing some diseases like heart disease, diabetes and obesity, and certain cancers.

Functions of Carbohydrates

- Carbohydrates are the main energy source for the human brain. The body cannot function properly in its absence.
- The simple carbohydrates are high in calories and low in nutritional value. They are present in high amounts in junk foods or unhealthy foods.
- Complex carbohydrates may also contain dietary fibre which cannot be digested in the human digestive tract. Sources are fruits and vegetables, whole grain cereals, millets, pulses and legumes.

PROTEINS are essential for growth and repair and keeping cells healthy.1 gram of protein provides 4 kcal. There are 22 different amino acids. The human body is capable of producing 13 of them. The other 9 called, "Essential Amino Acids" must be supplied by food sources. Sources include Milk and dairy products, meat, fish, eggs, poultry, pulses and legumes, nuts and seeds (Breads, cereals and vegetables also contain small amounts of incomplete protein). Proteins are broadly classified as complete proteins and incomplete proteins. Complete Proteins contain all 9 essential amino acids. They are found in animal food sources. For eg.milk, egg, poultry, fish, quinoa etc.Incomplete Proteins are one that lack one or more of the essential amino acids. They are found in plant food sources. Cereals lack some amino acids while pulses are lacking in others. The best way to provide the body complete proteins in a vegetarian diet is to eat cereals and pulses together so that they supplement each other.

Function in the Body

- Proteins are the major structural component of cells. Help to build, maintain, and repair body tissues.
- Regulates body functions
- Protein is broken down into amino acids, which are building blocks of protein.

FATS are the most concentrated source of energy providing 9 kcal/g. Various sources of fat include butter, ghee, vegetable oils, salad dressings, nuts and oil seeds, dairy products made with whole milk or cream, and meats. Twenty percent of your daily energy/calorie intake should come from fats/oils.

Note-
High intakes of saturated fat may raise blood cholesterol and increase the risk of heart disease and stroke. A diet high in unsaturated fats is associated with a lower level of blood cholesterol and reduces the risk of heart disease.

Fat is made up of different types of fatty acids and glycerol. The structure of the fatty acids determines their effect on our health and their characteristics, e.g. melting point. Depending on their chemical structure, fatty acids are usually classified as:

- Saturated fatty acids;
- Monounsaturated fatty acids;(MUFA)
- Polyunsaturated fatty acids. (PUFA)

Functions of fat

- Fat provides substances needed for growth and healthy skin.
- Enhance the taste and texture of food.
- Fats are needed for the absorption of fat- soluble vitamins such as A, D, E and K.
- Choose healthy options such as omega-3-rich foods like fish, walnuts and seed oils like groundnuts, sesame, mustard.Omega-3 aids in growth and development.

Limit intake of saturated fats such as butter, ghee and hydrogenated fats and cholesterol from red meat and full-fat dairy. Not more than 10% of total calories from saturated fats and at least 10% of total calories should come from PUFA.

Micronutrients

There are two types of micronutrients Vitamins and Minerals

Their amounts are measured in milligrams (mg) and micrograms (µg). (For Eg. 1mg = 0.001g and 1µg = 0.001mg).

Note
Vitamins and minerals are needed in much smaller amounts than macronutrients.

VITAMINS are chemical compounds required by the body in small amounts. They must be present in the diet as they cannot be synthesized in the body. Vitamins are essential for numerous body processes and maintenance of structure of skin, bones, nerves, eye, brain, blood and mucous membrane. They are either fat- soluble or water- soluble. Fat –soluble vitamins can be stored in the body while water soluble vitamins are not and get excreted in urine. Vitamins B- complex and C are easily destroyed by heat, air or during cooking. There are **13 different vitamins** known to be required each day for good health.

FAT SOLUBLE VITAMINS

Vitamin A is needed for dim light vision; healthy skin and eyes; increasing one's resistance to infection. Vitamin A is found pre-formed in liver and whole milk. It can also be produced from beta-carotene provided by dark green leafy vegetables, and Carrots and orange coloured fruits such as papaya.

Vitamin D is needed for the absorption of calcium from foods to keep bones and teeth strong and healthy. Helps your body use calcium and phosphorus, two minerals you need for healthy bones. We get most of our vitamin D via the action of UV rays from the sunlight on skin. Vitamin D is also provided in small amounts by the diet from oily fish, meat, egg yolk, fortified milk, and fortified margarine/spreads.

Vitamin E supports the function of all your tissues by acting as an antioxidant. It prevents cellular damage, which would otherwise cripple cell function and lead to cell death.It is necessary for normal reproduction.Sources of vit E are whole-grain breads and cereals; dark green, leafy vegetables; dry beans and peas; nuts and seeds; wheat germ, vegetable oils; liver.

Vitamin K helps in clotting of blood. Its sources are dark green and leafy vegetables (such as spinach, fenugreek leaves, lettuce, cauliflower and cabbage), cheese, egg yolk liver and bacterial synthesis in the intestines

WATER SOLUBLE VITAMINS

Vitamin C is necessary for the synthesis of collagen, which provides structure to blood vessels, bone and ligaments. Collagen acts like cement and keeps cell together. It helps in healing of wounds, maintain healthy bones, teeth, and blood vessels and fight infection.

Did you know?

Vitamin C can help with the absorption of iron when foods or drink containing both vitamin C and iron are eaten at the same meal.

Various food sources includefresh fruit especially citrus fruits and berries. Eg. Sweet lime, orange, grapefruit, Kinu, tangerine, carambola (star fruit), lemon; Amla, karonda, blackcurrants, strawberries, raspberries, blueberries, cranberries, rose apple, zizyphus; sprouted grains**;** green vegetables; peppers; tomatoes; new potatoes.

B-complex Vitamins **–**There are many different B vitamins and each has a specific function in the body. They work in combination to ensure that cells can use the energy they need to function, by helping in breakdown of carbohydrates and fats.B-complex vitamins also help metabolize protein into amino acids. Helps brain, nerves, and muscles function.Vitamins B6, B12, and Folic acid help in formation of RBC's and help prevent anaemia.**These include** Vitamin B1 (Thiamine);Vitamin B2 (Riboflavin);Vitamin B3 (Niacin);Vitamin B6;Vitamin B12 (Cyanocobalamin);Folate/folic acid.

Sources of B-complex vitamins are whole grain and enriched breads and cereals; dry beans and peas; peanut butter; nuts; meat; poultry; fish; eggs; milk; bacterial synthesis in the intestines.

MINERALS are inorganic elements found in body fluids and tissues that assist with life-sustaining processes in our body. Our body needs macro-minerals in relatively large amounts such as calcium& phosphorous. Micro-minerals are required in small amounts such as iron, iodine, sodium & potassium while trace minerals are required in traces such as copper, zinc, chromium, selenium etc. They are required for maintenance and health of skin, hair, nails, blood and soft tissues. They also govern nerve cell transmission, acid/base and fluid balance, enzyme and hormone activity as well as in blood clotting processes. The body requires 16 minerals daily.

Calcium and Phosphorous- Helps to build and maintain healthy bones and teeth. Helps heart, nerves, and muscles work properly. Its deficiency leads to rickets and osteoporosis. **Rich sources** are dairy Products: milk, cheese, ice cream, green leafy vegetables, ragi, sesame seeds, and small fish eaten with bones.

Iron is essential for the formation of haemoglobin in red blood cells (RBC's).Red blood cells carry oxygen and transport it around the body. Iron is also required for normal metabolism and removing waste substances from the body. Its deficiency leads to a lack of iron in the diet means that the stores in the body will run out. This can lead to anaemia.

Note

- *The body contains more calcium than any other mineral. It is essential for a number of important functions such as the maintenance of bones and teeth, blood clotting and normal muscle function.*
- *The skeleton contains about 99% of the body's calcium with approximately 1kg present in adult bones.*

Sources of iron are liver, red meat, pulses- black gram, red gram, nuts, eggs ,dried fruits, fish, whole grains, dark green leafy vegetables, garden cress seeds, niger seeds**,** flax seeds.

Sodium is found in all cells and body fluids. It is needed for regulating the amount of water and other substances in the body. High sodium intake is considered to be one of the risk factors for high blood pressure, which may lead to heart disease and stroke.

Various food sources are processed& prepared foods, canned foods such as RTE vegetables, soups etc**,** preserves -pickles, wafers, papads and farsan, salt used in cooking and table top, condiments, table salt, soy sauce, ketchup, mustard spread, sauces, chutneys, natural sources include some meats, poultry, dairy products (esp. cheeses) and green leafy vegetables.

Water- Getting enough water -- both from water-rich foods, such as fruits and vegetables, and through drinking fluids keeps your cells and tissues functional. Your body uses water to remove waste products from your cells. Water flushes out toxins that might impede cell function. It helps transport nutrients needed for your cellular metabolism. It also helps you avoid an abnormally high or low body temperature that would hinder enzyme function. Our body is nearly two-thirds water, so drinking enough fluid to stay hydrated is very important. Water is essential for life and it is very important to get the right amount of fluid to be healthy.

Water is the major component of body fluid and has many functions in the body:

- It acts as a lubricant for joints and eyes;
- It is the main component of saliva;
- Carries nutrients to body cells
- Helps get rid of waste;
- Helps regulate body temperature.

Sources of water include water provided by food and drinks. It has been estimated that roughly 20% of water consumed is from food (e.g. soups, curd (yogurt), fruits and vegetables), while 80% is from drinks (water, milk and fruit juice).

Note:

- *Humans can survive for a few weeks without food, but they cannot go without fluids for more than two to three days.*
- *The body loses water all the time, when we go to the toilet, from sweat and also by evaporation from skin. If we do not consume enough water, we become dehydrated.*

Recommended Dietary Allowances (RDA)ENERGY REQUIREMENTS FOR DIFFERENT ACTIVITIES

The amount of food which should be eaten to ensure good health differs from one person to another. The requirement for nutrients depends on many factors such as age, gender, type of activity, state of health etc. Protein requirement depends on age and body weight. It is expressed as 1g/kg desirable body weight. Calorie or energy requirement depends on activity. A person doing a seated office job requires much less calories as compared to a gardener or a coolie.

RDA is defined as the amount of nutrient sufficient for the maintenance of health in nearly all people. The RDA for all nutrients have been calculated for Indians for all age groups based on activity:

- Levels to ensure good health.
- The RDA's are suggested for a reference man and reference woman.

RDA=minimum requirement + safety margin (individual variation)

RDA does not apply to sick people.

Who is a reference man and a reference woman?

Reference man:

- Age:20-39 yr and Weighs.:60 kg
- Healthy, free from disease and fit for active work
- He spends 8 hrs daily on occupational work (moderate activity)
- While not at work he spends 8 hrs in bed,
- 6 hrs sitting & moving around,
- 2 hrs walking & household work

Reference Woman: has the same criteria as for reference man except her weight is 55kg

Recommended Dietary Allowance for Indian Children

Group	Age Years	Energy kcal/d	Proteins g/d	Fat g/d	Iron mg/d	Vitamin A Carotene µg/d
Children	4 – 6 years	1350	20.1	25	13	3200
Children	7 – 9 years	1690	29.5	30	16	4800
Boys	10 – 12 years	2190	39.9	35	21	4800
Girls	10 – 12 years	2010	40.4	35	27	4800
Boys	13 – 15 years	2750	54.3	45	32	4800
Girls	13 – 15 years	2330	51.9	40	27	4800

Total Energy Requirement

Energy for basal metabolism 1 kcal/hr/kg body wt./per day + Energy for digestion of food (SDA) + Energy for occupational work (heavy/ moderate/ sedentary

How are the energy requirements calculated?

- The energy requirement for an average healthy person is based on the energy required to carry out basal processes as well as the energy cost of activities one indulges in.
- Therefore, while calculating the energy requirements, we have to consider that the energy in the body is required for:
    1. Maintenance of Basal Metabolic Rate (BMR)
    2. Specific Dynamic Action (SDA)or Thermogenic effect of food and
    3. Performing physical activities.

Factors Affecting Energy Requirements

- Age
- Gender
- Working condition
- Body composition
- Physical Activity
- Vulnerable - At risk
    - Pregnant & lactating women
    - Infants and children
    - Elderly and immune-compressed

What is BMR?

- The Basal Metabolic Rate (BMR) is the energy required by an awake individual during physical, emotional and digestive rest.
- It is the minimum amount of energy required to maintain life or sustain vital functions like the working of the heart, circulation, brain function, respiration, etc. The metabolic rate during sleep is lesser than BMR.

Factors that affect BMR

- Age – BMR is higher in periods of rapid growth. It is higher in infancy, children and during puberty.
- Pregnant and lactating women have higher BMR's
- Body size - Tall people have larger surface area and lose more heat than a short person
- Gender – Higher in men than in women.
- Body Composition- The amount of muscle tissue and adipose fat in the body affects the BMR. It is higher in an athlete than a non- athlete with more body fat for the same weight.
- Hormones- Thyroid gland disorders markedly influences BMR. In hyperthyroidism it increases whereas, in hypothyroidism it decreases.
- Fever- BMR increase sharply during fever.
- Stress- Increases the BMR

What is Specific Dynamic Action or Thermogenesis of food?

It is the estimated energy used in digestion and absorption of food.

- Suppose a person takes 250 g of carbohydrates; this should produce 250 × 4 = 1000 kcal. But before this energy is trapped, about 10% energy (=100 kcal) is drawn from the reserves of the body. Thus the net generation of energy is only 1000 minus 100 = 900 kcal.
- If the person wants to get 1000 kcal, he should take food worth 1100 kcal. Thus additional calories, equivalent to SDA have to be added in diet.

Total Energy Expenditure= Basal metabolism + Digestion Thermic effect of food + Physical activity

Physical Activity and Energy Requirement are

- Most variable and changeable
- Voluntary
- It can be significantly different in weight loss and weight gain
- The energy requirements would depend on the
    - occupation
    - physical activity and
    - lifestyle of the individual

Types of Physical activity

- The energy requirement for an average healthy person is based on energy required to carry out involuntary work as well as the voluntary work.
- Physical activity increases the energy requirement.

On the basis of occupation, activities are grouped under 3 heads

- Sedentary work – office work, teaching, housewife
- Moderate work – Farmer, maidservant
- Heavy work – Wood cutter, miner

Do you know what voluntary and involuntary functions of the body are?

Voluntary: Responses are mainly under conscious control for e.g. walking, playing etc.

Involuntary: responses are not in our control for e.g. pumping of heart, breathing, digestion of food etc.

Categorization of Workers:

Light Worker	Moderate Worker	Heavy Worker
Office worker	Railway worker	Coal miner
Driver	Postman	Steel worker
Shopkeeper	Plumber	Army recruit
Teacher	Bus conductor	Docker
Lawyer	Tailor	Labourer
Doctor	Carpenter	Coolie

Sample Activity Record for 16yr old boy

Activity	Time hrs/minute	Energy cost of activities Kcal/hr	Energy Used up
Sleeping	8 Hours	65	520
Bathing & dressing	30 Minutes	160	80
Washing clothes/ironing	30 Minutes	160	80
Tidying your room	10 Minutes	240	40
Riding a cycle	15 Minutes	240	60
Climbing stairs	15 Minutes	420	105
Studying	1Hour15 Minutes	100	125
Attending theory classes	4 Hours	100	400
Sitting talking	1 Hour	100	100
Attending practical classes	3 Hours	160	480
Walking	50 Minutes	160	130
Having meals	2 Hours	100	200
Watching Television	2 Hours	100	200
Brisk Exercises	15 Minutes	500	125
Time	24 hrs		
Total energy required in 24 hours			**2645**
RDA for a 16 year old boy			**2640**

Approximate Calorie Expenditure in different activities

Activity	Kcal/hr
Cleaning/Mopping	210
Gardening	300
Watching TV	86
Cycling, 15 (km/hr)	360
Running	
12(km/hr)	750
10(km/hr)	655
08(km/hr)	522
06(km/hr)	353
Walking – 04(km/hr)	160
Badminton	348
Table tennis	245
Tennis	392
Volley ball	180
Dancing	372
Fishing	222
Shopping	204
Typing	108
Sleeping	57
Standing	132
Sitting	86

ENERGY VALUE OF FOOD

What is Energy?

Energy is the capacity to do work, such as moving around or doing a task.

Calorie is the unit used to measure energy

- kilocalorie is a unit of energy
- Commonly used to express energy value of food.
- A calorie is too small a unit to be used in Nutrition. Therefore, it is more conveniently expressed as kilocalorie(kcal)

Food- An Energy Powerhouse:

- When we consume food and drink, energy provided by carbohydrate, protein, and fat is metabolised and used by our bodies.
- Carbohydrate, protein, and fat are broken down into smaller compounds which are then oxidised in the cells of the body (respiration).

Energy Providing Nutrients

Energy in the diet is provided by the nutrients carbohydrate, protein, and fat.

- 1 gram of carbohydrate provides 4 kcal.
- 1 gram of protein provides 4 kcal.
- 1 gram of fat provides 9 kcal.

Why is food required by the body?

- Just like an engine requires fuel to run, the body requires food as a continuous source of energy to stay alive and keep all parts functioning smoothly.
- The first and foremost function of food is to supply energy to the body.
- When food is digested, complex nutrients like carbohydrates, fats and proteins are broken down into simpler forms which the body cells can utilize.
- These are absorbed into the blood stream and supplied to the millions of body cells as energy to carry out the voluntary as well as involuntary work of the body.

What is Energy Balance?

- Energy in = calories consumed per day.
- Energy out = basal metabolic rate (BMR) + thermic effect of foods, + physical activity per day.
- Small increments in calories consumed per day or week can contribute to weight gain over time.
- Energy balance: energy in = energy out.
- When energy in = energy out, we are in Energy Balance and we neither lose nor gain weight.

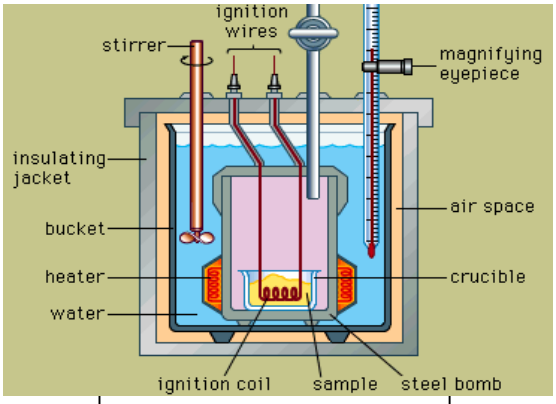
What is Energy value of food?

- Energy value: The calorific value or (energy content) of a food is calculated from the heat released by the total combustion of food in a calorimeter.
- The energy content of various foods can be measured either by bomb calorimeter or by chemical analysis of foods in a laboratory.

Unit of heat: Calorie is the unit of heat. One calorie represents amount of heat required to raise the temperature of one gram of water by 1 ^{0}C.

How is Energy Measured?

It measures the heat produced when the food sample is ignited by an electric spark in the presence of oxygen. This is called as the potential energy value of food. This is higher than the energy released in the body as some losses take place during digestion and absorption of food.



Bomb Calorimeter

Energy value of Foods

Nutrients	Physiological Fuel value (kcal/g)
Carbohydrates	4.0
Proteins	4.0
Fats	9.0
Vitamins	0
Minerals	0

Which food items of the following gives most nutrients?

Per Serving	Energy	Carbohydrate	Fat	Protein
Chapatti (20gm)	70kcal	15g	0g	2g
Ghee (10gm)	90kcal	0g	10g	0g
Milk 3% fat 1 glass/240ml	145kcal	12g	7g	8g

Calorie Content of Commonly used food

Cereals and Pulses

Preparation	Quantity for 1 serving	Calories (kcal)
Rice	1cup	170
Fulka	No.1	80
Parantha	No.1	150
Puri	No.1	100
Bread	2 slice	170
Poha	1 cup	270
Upma	1 cup	270
Idli	2 no.	120
Dosa (plain)	No.1	125
Khichdi	1 cup	200
Wheat Porridge	1 cup	220
Semolina Porridge	1 cup	220
Cereal Flakes with milk (corn/wheat/ rice)	1 cup	220
Plain Dal	½ cup	100
Sambhar	1 cup	110

Snacks

Preparation	Quantity for 1 serving	Calories (kcal)
Bhajji or Pakoda	8 No.	280
Besankapura	No.1	220
Chaat (dahipakodi)	5 piece	220
Cheese balls	2 No.	250
Dahivada	2 No.	180
Vada	2 No.	140
Masala vada	2 No.	150
Masala dosa	No. 1	200
Pea kachori	2 No.	380
Potato vada	2 No.	200
Sago vada	2 No.	210
Samosa	No. 1	200
Sandwiches (butter 2 teaspoonful)	2 No.	200
Vegetable puffs	No.1	170
Pizza (cheese and tomato)	1 slice	200

Sweets and Desserts

Preparation	Quantity for 1 serving	Calories (kcal)
Besanburfi	2 pieces	400
Chikki	2 pieces	290
Fruit cake	1 pieces	270
Rice puthu	½ cup	280
Sandesh	2 No.	140
Double kameetha	½ cup	280
Halwa (kesari)	½ cup	320
Jelly/ jam	1 teaspoonful	20
Custard (caramel)	½ cup	160
Shrikhand	½ cup	380
Milk chocolate	25 grams	140
Ice Cream	½ cup	200

Beverages

Preparation	Quantity for 1 serving	Calories (Kcal)
Tea (2 teaspoonful sugar + 50ml toned milk	1 cup	75
Coffee(2 teaspoonful sugar+100ml toned milk)	1 cup	110
Cow's milk (2 teaspoonful sugar)	1 cup	180
Buffalo's Milk (2 teaspoonful sugar)	1 cup	320
Lassi (2 teaspoonful sugar)	1 glass (200ml)	110
Squash	1 glass (200ml)	75
Syrups (Sharbat)	1 glass (200ml)	200
Cold Drinks	1 bottle (200ml)	150
Fresh Lime Juice	1 glass (200m)	60

Nuts

Name	Quantity for 1 serving	Calories (Kcal)
Almonds	10 No.	85
Keshar Nuts	10 No.	95
Coconut Fresh	One fourth	130
Coconut Dry	One fourth	140
Peanuts	50 No.	90

Fruits

Name	Quantity for 1 serving	Calories (kcal)
Apple	1 medium	65
Banana	1 medium	90
Grapes	30 No.	70
Guava	1 medium	50
Jack fruit	4 pieces	90
Mango	1 medium	180
Mosambi/Orange	1 medium	40
Papaya	1 piece	80
Pineapple	1 piece	50
Sapota	1 medium	80
Custard Apple	1 medium	130
Water Melon (Musk melon)	1 piece	15

KEY TERMS (Module 5)

Basal Metabolic Rate –It is the minimum amount of energy required to maintain life or sustain vital functions like the working of the heart, circulation, brain function, respiration, etc. and maintain body temperature.

Bomb Calorimeter – A thick-walled steel container used to determine the energy contained in a substance by measuring the heat generated during its combustion.

Energy – It is the capacity to do work, such as moving around or doing a task.

Energy Value – It is thecalorific value or (energy content) of a food and is calculated from the heat released by the total combustion of food in a calorimeter.

Food –Any substance which nourishes the body and is fit to eat is called food.

Kilocalorie – It is the unit for measuringthe energy value of foods or the energy needs of our body. It is defined as the amount of heat required to raise the temperature of 1,000 g water by 1^0 C. 1 kcal = 4.184 kilojoules.

Nutrients –Nutrients are the chemical substances found in food that keep your body functioning.

Nutrition –Nutrition is the science of food and its relation to health.

Recommended Dietary Allowances (RDA) –RDA is defined as the amount of nutrient sufficient for the maintenance of health in nearly all people.

Specific Dynamic Action (SDA) –It is the energy required for the digestion of food. It is also known as the thermogenic effect of food.

Tissue – A group of similar cells

MODULE 6 Overcoming Common Deficiency Diseases

INTRODUCTION

In Module 1 we have learnt about the relationship between malnutrition and infection. A malnourished child has a lowered resistance to infection and the vicious cycle continues. In Module 5 we were introduced to different nutrients present in food. Good health through proper nourishment and an increased immunity would be our focus in this module. Let us understand the term malnutrition and study the signs of good physical health, so that we can identify signs and symptoms of various nutritional deficiency diseases.

When our food does not supply all nutrients in required amounts, it results in ill-health or malnutrition. Malnutrition (mal means faulty) occurs because of a deficiency, excess or imbalance of nutrients in the diet and includes both over-nutrition and under-nutrition.

Good nutrition and health are closely interlinked. Clean, wholesome and nutritious food promotes health, keeps disease away and results in a good nutritional status.

Signs of Good Physical Health

S.No.	Body part/Characteristic	Signs of Good Health
1	Hair	Shiny, scalp clean
2	Skin	Smooth, slightly moist, healthy glow
3	Eyes	Bright, clear, no dark circles
4	Lips	Good colour, moist
5	Tongue	Pink colour without lesions
6	Gums	Firm, no bleeding or swelling
7	Teeth	Straight, no discolouration or cavities
8	Abdomen	Flat
9	Legs/ feet	No pain or swelling/ no flat feet
10	Nervous control	Good concentration, not irritable or restless
11	Weight	Normal for height, age and body build
12	Posture/ muscles	Stands straight with tummy in & chest out
13	Appetite/ Digestion	Good/ normal regular bowel movements
14	Sleep	Sound sleep, wakes up refreshed

NUTRIENTS AND DEFICIENCY SYMPTOMS

Malnutrition is an impairment of health resulting from a deficiency, excess or imbalance of nutrients. A deficiency is a state or condition caused due to inadequate dietary intake of on or more nutrients in the diet.

A deficiency of calories and/or one or more nutrients in the diet is called under-nutrition. An undernourished child is underweight and manifests various symptoms of deficiency depending on the nutrient/nutrients deficient in the diet. An undernourished child is prone to infection.

Over nutrition refers to an excess of calories and/or one or more nutrients in the diet. An excessive intake of calories results in overweight which can lead to obesity while an excessive intake of fat-soluble vitamins can cause hypervitaminosis or vitamin toxicity.

Both over- and under-nutrition are harmful to the body.

What are Nutritional Deficiencies?

Symptoms of nutrient deficiencies are seen when the diet is deficient in the nutrient for some time. Some nutrients can be stored in the body if consumed in excess of daily requirement like Vitamins A and D. If body stores are good it would take time before deficiency symptoms appear. Vitamins C and B-complex are water soluble and any excess intake is excreted by the body. So these nutrients need to be supplied on a daily basis and deficiency symptoms appear in a few days.

Some common symptoms of mild Vitamin B-complex deficiency are easy fatigue, irritability, loss of appetite, lassitude and loss of weight. As deficiency becomes more marked, specific symptoms appear. **Let us study the specific symptoms of nutrient excess or deficiency.**

S.No.	Nutrient Deficiency	Symptoms
Macronutrients		
1	Protein	**Deficiency Symptoms** • Loss of weight, fatigue, anaemia, lowered resistance to infection, poor healing of wounds and oedema. • Severe protein deficiency results in Kwashiorkor. Symptoms of kwashiorkor are: ○ Puffy or moon-shaped face, ○ Puffiness or oedema on hands and feet, ○ Poorly developed/ weak muscles leading to pot belly, Rough/weak hair and nails, easy pluckability of hair, bleached/brown coloured hair. • Growth is retarded Severe deficiency of both proteins and calories results in Protein Calorie Malnutrition (PCM) and is commonly seen in preschool children.

S.No.	Nutrient Deficiency	Symptoms
		Macronutrients
2.	Carbohydrates	**Deficiency Symptoms** • Listlessness, inactive • Underweight • Malnourished • Deficiency is uncommon in India as our diet is cereal based. • Marasmus results from a severe food deficiency • Seen in starvation and deficiency of carbohydrates and is called Marasmus. Symptoms of other nutrient deficiencies may occur. **Deficiency of Fibre** Deficiency of fibre causes constipation **Effect of Excessive intake** • Excess carbohydrates are converted to fat and stored in the body. • Excessive consumption of sugar leads to tooth decay and depressed appetite. • Excess fibre interferes with absorption of minerals and can cause bloating or gas.
3	Fats	**Deficiency Symptoms** • Deficiency of essential fatty acids linoleic and linolenic which are present in oils will lead to toad skin. • Dryness of skin, • Poor growth and • Low body weight is seen. • Deficiency of all fat soluble vitamins can occur as fat is needed for their absorption. **Effect of Excessive intake** • Excess fat causes overweight (body weight 10 % or more than desirable weight) or obesity(body weight 20 % or more than desirable weight) • High intakes of saturated fats and cholesterol increases risk of cardiovascular diseases
4.	Water	**Deficiency Symptoms** • Mild to severe dehydration – dry mouth, sunken eyes, and skin when pinched remains elevated. • Restlessness • Irritability • Lethargy • Unconsciousness in extreme cases

S.No.	Major Category	Specific Nutrient	Symptoms
Micronutrients			
1.	Fat Soluble Vitamins	Vitamin A	**Deficiency Symptoms** • Night blindness • Eyeball dry and lustreless • Eyes sensitive to bright light • Rough, dry, scaly skin • Growth failure and stunted bones • Severe deficiency can result in blindness **Effect of Excessive intake** • Hyper-vitaminosis or high doses of Vitamin A are toxic. • It is stored in the body and results in symptoms of toxicity like nausea, vomiting etc.
2.	Fat Soluble Vitamins	Vitamin D	• Deficiency Symptoms • Knocked knees/bowed legs • Bones break/fracture easily • Poor posture • Pain in bones of legs and lower back. • Severe deficiency results in Rickets in children and Osteomalacia and Osteoporosis in adults **Effect of Excessive intake** • Hypervitaminosis or high doses of Vitamin D are toxic. • It is stored in the body and results in symptoms of toxicity like nausea, vomiting etc.
3.	Fat Soluble Vitamins	Vitamin E	**Deficiency Symptoms** • Deficiency is uncommon. • Severe deficiency may result in Premature ageing • Acne and skin problems
4.	Fat Soluble Vitamins	Vitamin K	**Deficiency Symptoms** • Deficiency is uncommon in adults. • Bacterial synthesis in the intestine supplies half the daily need. • Bleeding tendency in infants

S.No.	Major Category	Specific Nutrient	Symptoms
Micronutrients			
5.	Water Soluble Vitamins	B-Complex Vitamins	**General Deficiency Symptoms** • General Apathy • Irritability • Depression • Loss of appetite • Indigestion • Tiredness/fatigue
6.	Water Soluble Vitamins	Vitamin B1	**Deficiency Symptoms** • Beri-beri or rice eaters disease • Tingling and Numbness in hands and feet • Muscle weakness • Cramps **Effect of Excessive intake** • Being water soluble, excess intake is excreted by the kidneys
7.	Water Soluble Vitamins	Vitamin B2	**Deficiency Symptoms** • Eyes sensitive to bright light • Cracks at angles of mouth • Swollen lips and tongue, • Sore mouth **Effect of Excessive intake** • Being water soluble, excess intake is excreted by the kidneys
8.	Water Soluble Vitamins	Vitamin B3/Niacin	**Deficiency Symptoms** • Sore and swollen tongue, • Confusion, • Poor memory, • Depression **Severe Deficiency causes Pellagra** • Diarrhoea, • Dermatitis or symmetric lesions on skin exposed to light, • Dementia or hallucinations • Death **Effect of Excessive intake** • Being water soluble, excess intake is excreted by the kidneys.

S.No.	Major Category	Specific Nutrient	Symptoms
Micronutrients			
9.	Water Soluble Vitamins	Folic acid	**Deficiency Symptoms** • Anaemia, • Weakness, • Loss of weight, • Sore mouth, • Pallor • Low haemoglobin levels. Some bacterial synthesis takes place in the intestine **Effect of Excessive intake** • Being water soluble, excess intake is excreted by the kidneys.
10.	Water Soluble Vitamins	Vitamin B12	**Deficiency Symptoms** • Anaemia and pallor • Hyperpigmentation/darkening of knuckles • Mouth ulcers, sore mouth • Tingling and Numbness in hands and feet **Effect of Excessive intake** • Being water soluble, excess intake is excreted by the kidneys.
11.	Water Soluble Vitamins	Vitamin C	**Deficiency Symptoms** • Bleeding gums • Frequent colds and fever • Low resistance to infection, • Easy bruising, • Slow healing of Wounds **Severe deficiency causes scurvy and anaemia** **Effect of Excessive intake** • Being water soluble, excess intake is excreted by the kidneys
12.	Minerals	Calcium	**Deficiency Symptoms** • Knocked knees/bowed legs • Bones break/fracture easily • Poor posture and tooth decay • Pain in bones of legs and lower back **Severe deficiency results in rickets in children and Osteomalacia and Osteoporosis in adults** **Absorption** • Absorption of all minerals depends on body's need. • Acidic medium favours absorption. • Excess minerals are not absorbed and are excreted through the faeces

S.No.	Major Category	Specific Nutrient	Symptoms
Micronutrients			
13	Minerals	Iron	**Deficiency Symptoms** • Anaemia • General fatigue • Poor performance/concentration in school • Pallor, • Breathlessness on exertion • Spoon shaped nails with rough nails **Factors which affect the absorption of iron.** • Vitamin C, proteins and gastric juice (acidity) favour absorption, • Tea and coffee with meals, and phytates in cereals and oxalates in green leafy vegetables hinder absorption.
14	Minerals	Iodine	**Deficiency Symptoms** • Goitre or swelling in the neck, hypothyroidism, myxoedema, cretinism. • Flabby muscles, • Dry skin **In severe deficiency stunted growth (cretinism) and mental retardation occurs** *Deficiency occurs in hilly areas where iodine content of soil is low.* **Effect of Excessive intake** • Leads to Hyperthyroidism
15	Minerals	Fluorine	**Deficiency Symptoms** • Tooth decay/ painful cavities • Deficiency occurs in areas where fluorine content of water is low **Effect of Excessive intake** • Fluorosis or mottling of teeth occurs in areas where drinking water contains high levels of fluoride. • Teeth lose their lustrous appearance and get chalky white patches
16	Minerals	Sodium	**Deficiency Symptoms** • Weakness, giddiness, nausea and muscle cramps • Dehydration(due to excessive sweating/ hot weather/severe vomiting and diarrhoea) **Effect of Excessive intake** • Excessive intake predisposes a person to hypertension (high blood pressure). • Sodium content of food additives needs to be considered along with salt used in cooking while planning low sodium diets

Simple Steps to Overcome Deficiencies

- Eating a balanced diet with a variety of fresh wholesome food.
- Following proper cooking and storage practices to retain nutrients.
- Using simple measures to enhance the nutrient content of food like sprouting of grains and fermentation of cereal/pulse batters, will help prevent development of nutritional deficiencies and promote good health.

SUPPLEMENTARY VALUE OF PROTEINS

We have learnt in Module 5 that animal proteins contain all 9 essential amino acids in correct proportions and amounts and are complete proteins. Animal proteins are good quality proteins.

Proteins in plant foods are generally deficient in one or two of the essential amino acids and are partially complete/incomplete proteins. Our body needs all essential amino acids or complete, good quality proteins for building new tissues and for proper growth to take place.

However the protein quality of a vegetarian meal can be easily improved to ensure that all essential amino acids are present at the same time in the meal.

The protein quality of a vegetarian meal can be improved in the following ways:

1. Include a small quantity of complete protein food in every meal. Complete proteins such as milk, curd, paneer, buttermilk and eggs could be used in small quantities in various preparations like raita, curd rice, kadhi, French toast etc. This improves the protein quality of the meal while at the same time does not increase the cost significantly.
2. Cereal and pulse combinations: When cereals and pulses are eaten together they complement each other as essential amino acids deficient in cereals is present in pulses and vice versa. This is possible because the same amino acids are not missing from all plant foods.Missi roti, rajmahchawal, chholebhature, dal rice, puranpoli, chiwda and idli are some popular examples of cereal pulse combinations.

   Correct mixtures of several plant foods can give high quality proteins. For example, the protein quality of a meal made from a combination of cereal, pulses and green leafy vegetables would be as good as eating meat.

CEREAL + PULSE + GREEN LEAFY VEGETABLE = FLESH FOODS

3. Textured Vegetable Proteins (TVP) and synthetic amino acids are used successfully to improve the protein quality and reduce the cost of protein-rich foods. For example soya nuggets, lysine enriched bread and biscuits.

   Plant proteins are being used to produce textured protein products also called protein analogs. They form an important substitute for expensive animal products. They can be manufactured from oilseeds after oil has been expelled. The protein extracted from oilseed cake is spun into fibres and treated to resemble meat. It is enriched with B-complex vitamins and iron. Such products are acceptable to vegetarians, have a long shelf-life, are equally nutritious as meat and low priced.

SIMPLE MEASURES TO INCREASE THE NUTRITIVE VALUE OF FOOD

S. No.	Nutrient Deficient	Food Sources	Other Measures
1	Proteins	• Cereal + Pulse combinations, • Including small serving of milk/curds in the meal • Processed Soya products like Textured Vegetable protein (TVP) – Nutri-nuggets etc.	Use processed foods which have been fortified with essential amino acids such as Lysine enriched bread and biscuits
2	Carbohydrates	• Whole grain cereals, • Roots and tubers • Fruit and jiggery	Eating at least 3 meals/day
3	Fats and Oils	• Consuming a variety of good fats and different oils like clarified butter, groundnut oil, sesame oil, mustard oil etc. • Avoid trans fats like margarine and vanaspati which are used in fried snacks and bakery products	
4	Water	• Drink 8 glasses of water/day. • Beverages such as lime juice,cocum sherbet, pannah, tender coconut water, fruit juices, lassi, etc. are refreshing and nourishing. • Avoid sweetened carbonated beverages as they are hollow calorie foods	
5	Vitamin A	• Eat yellow orange coloured fruits and vegetables and green leafy vegetables rich in pigment carotene. Carotene is converted to Vitamin A in the body. • Eat butter, ghee, egg yolk, liver and whole milk	
6	Vitamin D	• Foods fortified with Vitamin D and fish liver oils	UV rays of sunlight. Exposure of the body to early morning sunlight.

S. No.	Nutrient Deficient	Food Sources	Other Measures
7	Vitamin B1	Food rich in protein and whole grain cereals	• Parboiling of rice to retain B1 • Enriched cereals • Sprouted pulses • Fermented foods
8	Vitamin B2	Milk, cheese, liver, eggs	• Avoid exposure of milk to light as B2 is destroyed. • Enriched cereals • Sprouted pulses • Fermented foods
9	Vitamin B3/Niacin	Food rich in proteins, groundnuts	• Protein (essential amino acid Tryptophan) is converted to Vitamin B3 in the body • Sprouted pulses • Fermented foods
10	Vitamin C	Consume fresh uncooked fruits and salad vegetables, amla, cashew fruit, berries, guava and citrus fruits	Sprouted pulses
11	Calcium	• Drink at least 200 ml milk daily • Ragi, green leafy vegetables, drum stick leaves, nuts and oilseeds specially sesame seeds	
12	Iron	Meat, egg yolk, green leafy vegetables, whole grain cereals and pulses, dry fruits like apricots, peaches, manukas, figs; gardencress seeds and niger seeds	• Use of iron utensils for cooking • Use salt fortified with iron
13	Fluorine	Checkfluoride content of drinking water. Add fluorine at a level of 1 ppm (1 mg in 1 litre of water)	• Use fluoridated toothpaste • Paint the teeth with stannous fluoride
14	Iodine	Sea food if possible	Iodized salt

SIMPLE MEASURES TO RETAIN NUTRIENTS IN FOOD

Water soluble Vitamins C and B-complex are highly soluble in water and easily destroyed during cooking. They are lost when food is –

1. Cut and exposed to air by oxidation. Example: cutting salad or vegetables much in advance and leaving uncovered.
2. Cut and soaked in water or cooked in too much water which is later thrown away (vitamins leach into the water). Example: washing vegetables after chopping them, cooking in excess water or throwing water while boiling rice.
3. Cooked, as high temperatures destroy vitamins. Example: repeated reheating of food, over cooking.
4. Cooked with alkali such as cooking soda as alkaline medium destroys vitamins. Example: adding soda while cooking to: a) retain bright green colour of green vegetables, b) soften channa and cook it quickly.
5. Dehydrated as vitamins are destroyed by heat and oxidation.
6. Stale or stored in warm places

Fat soluble vitamins are lost by oxidation and when food is deep fried, fat soluble vitamins dissolve into the oil used for frying

Minerals are lost by leaching into the water used for washing or cooking food. They are not affected by oxidation, high temperature or alkali.

FOOD FADS

Millions of people across the globe fall prey to food faddists who ascribe special curative properties to certain foods. They claim certain foods have miraculous properties for promoting good health. The consumer today is more health conscious and does not mind spending more for foods with tall claims, not realizing the fact that we need all nutrients in moderate amounts everyday and that such diets can cause permanent damage to our body.

What is a food fad?

A nutritional regimen, generally of an extreme nature, intended to produce results more quickly than a traditional diet-exercise combination, often of a dubious nature. For example, consumption of only one type of food/ nutrient throughout the day or week.

THE KEY TO HEALTH AND NUTRITION IS MODERATION

However, fad diets to lose weight or detox the body are gaining popularity. We must remember that:

- They are extreme diets and can have adverse effects in the long run.
- Can be an additional burden for vital internal organs
- Most weight loss is fluid loss and not fat loss

ALWAYS REMEMBER THAT A FAD DIET CANNOT REPLACE A WELL BALANCED DIET AND EXERCISE

Some Common Myths associated with food

- Fat free food is healthy
- Fish and milk should not be eaten together as it causes leucoderma
- Drinking tea will make you dark
- Eating sugar causes Diabetes
- Eating salt raises Blood Pressure
- Fresh fruit should not be eaten at night
- Food cravings are a sign of nutrients missing from your body
- Highly processed vegetable oils are healthy
- Eat dry fruits in winter only
- Foods like meat, eggs and dals are 'hot foods' and produce heat and boils.
- Fruits, vegetables and milk are 'cold foods' and should not be given during a cold or sore throat

Why Food Fads are harmful?

Food fads, myths and faulty food habits are the main cause of malnutrition amongst the vulnerable age groups.

JUNK FOODS AND HEALTHY FOODS

Junk Food is defined as "any food, which is low in essential nutrients and high in particular calories and sodium. Junk foods contain little or no proteins, vitamins or minerals but are rich in salt, sugar, fats and are high in energy (calories). For e.g. highly salted chips, food high in refined carbohydrates (empty calories) sugars -like candy, soft drinks and food high in saturated fats like cake and chocolates." (CSE, 2012)

Hollow calories or empty calories is a term used to describe foods which only supply energy and have very few or no nutrients.

Why is Junk food popular?

Junk food is popular because:

- It is tasty (but it is unhealthy).
- It is low in fiber.
- It is high in fat.
- High in sugar in liquid form.

Why is Junk Food Bad?

An "Unhealthy diet is one key cause of the growing global burden of disease."(WHO).

Changing Diet – Low on nutrients and high on salt, sugar and fat, are directly indicated to disease. Junk food is responsible for rising cases of obesity and non-communicable diseases (NCDs) like cardiovascular diseases and diabetes.

Health Implications of Consumption of Junk Food

Studies have shown that despite being unhealthy, junk food induces gorging that leads to obesity. The fat from fatty acids affects the brain. When we eat something high in fat, the brain gets 'hit' with the fatty acids, and the fat molecules cause the brain to send messages to the body's cells, warning them to ignore the appetite-suppressing signals from leptin and insulin, hormones that are involved in weight regulation. Since the body does not get the signal that it is satiated it leads to over eating.

Salt Content of Junk Foods

Salt- The amount of dietary salt consumed is an important determinant of blood pressure levels and overall cardiovascular risk. Junk foods are high in sodium. Salt intake should not be more than 5 g per person per day.

Fat Content

Fats- Junk foods like potato chips, burgers, pizza, fried chicken etc. have a high fat content. The link between saturated fat and trans-fat and increased risk of heart disease is well established.

Trans Fat Content

Trans Fat- High levels of trans-fatty acids (TFA) are a public health concern due to some evidence associating TFA with coronary heart disease.

Why is Healthy Food Good

Healthy food is good for us because it helps in maintaining good health and supports growth and body building. It Increases our immunity and prevents us from falling ill often. Healthy food provides us with essential nutrients and energy to carry out our day to day activities.

Examples of healthy foods include:-

- Protein rich foods like Milk shakes, lassi, smoothies, omlette, fish fillet, Besan chillas, dal wadas help in body building and growth
- Sprouts and salads, fruits and fruit juices are rich in vitamins and minerals which provide protection against infections
- Carbohydrate rich foods such as khati roll, vegetable stuffed paratha, biscuits, etc help in providing energy

Benefits of Healthy Food

Healthy food promotes healthy growth and development. It improves learning potential and school performance. It improves our wellbeing and reduces risk of developing NCD's.

It keeps our gums and teeth healthy. It helps in social development by sharing knowledge of a healthy diet.

LIFE-STYLE RELATED DISEASES or NON-COMMUNICABLE DISEASES(NCD)

Lifestyle related diseases also known as Non-Communicable Diseases (NCD) are the main diseases of our times. They are called lifestyle or life course diseases because they occur due to a change in our lifestyle. Non-Communicable Diseases are not contagious or communicable. They have an early onset and lifelong consequences. NCD's can be effectively prevented at no or minimal cost, but prevention needs to be started early in life.

The main NCD's include the following disease groups:

- Cardiovascular(heart) diseases (CVD's)
- Diabetes
- Cancer
- Obesity
- Chronic obstructive pulmonary(lung) diseases

Other important NCD's that particularly affect school children include the following

- Dental caries or tooth decay
- Injuries
- Mental diseases
- Depression
- Hormonal imbalances

Cardiovascular (heart) diseases (CVD's) are a group of diseases that involve the heart and blood vessels like coronary heart disease, stroke and atherosclerosis.

Diabetes includes a number of conditions characterized by high levels of blood sugar. If Diabetes is uncontrolled, it can seriously damage the body's systems, especially the nerves and blood vessels, thus affecting the heart, kidneys, eyes, lower limbs, feet and most other organs. Paediatric diabetes is on the rise. Teachers should pay special attention to children suffering from diabetes while distributing sweets, cake and bananas in class, especially those on insulin injections to prevent drastic changes in blood sugar levels.

Cancer is caused by the rapid and uncontrolled growth of abnormal cells. These cells outlive normal cells and have the ability to spread to other parts of the body.

Obesity is the condition where a persons' body weight is 20% or more than desirable body weight. Obese individuals are at a greater risk of getting cancer, high blood pressure, atherosclerosis, diabetes and heart disease.

Chronic obstructive pulmonary (lung) diseases are long-standing diseases of the air passages of the lungs, which restrict normal breathing.

Dental caries or tooth decay results from action of acids on the tooth enamel. Sugars are metabolized to acids by oral bacteria which in turn corrode dental tissue causing painful cavities, infection and tooth loss.

Injuries in school children may be unintentional such as road accidents, burns, falls, drowning as well as intentional such as violence, abuse, rape and self-harm

Mental diseases in childhood are often related to experiences of violence, drug and alcohol use, or extended periods of stress.

Depression in children and adolescents is a serious mental health condition that needs medical assessment and treatment. If a child is persistently sad, lonely or depressed the problem needs to be addressed. If left unattended it can lead to suicide. Depression can be caused by any combination of a number of factors and children show varying symptoms when they are depressed like changes in sleep pattern, eating pattern, difficulty concentrating, anger, withdrawal etc.

Hormonal imbalances – Hormonal balance is important to lead a healthy life, but often imbalances are created at any age specially during puberty. They can occur because of toxins or an unbalanced lifestyle. Symptoms vary from craving for food and excessive eating, fatigue, irritability, anxiety, insomnia, weight gain and depression. They need medical assistance and change in lifestyle

NCD's need to be taken seriously because they are the most important cause of mortality worldwide. They are widely prevalent in the South-East Asia Region – in India. The number of deaths is increasing every year. They can affect any and every one. They have an early onset. They have lifelong consequences affecting our quality of life and requiring lifelong care or medication. They affect people in their productive years leading to missed days at work or school. The good news is that they can be effectively prevented at no or low cost if started early in life.

What causes NCD's?

Factors such as globalization, rapid urbanization, mechanization and marketing have led to changes in living conditions, lifestyles and consumption patterns. Children are exposed to a set of key risk factors responsible for causing most NCD's. They include:

1. Unhealthy Diet
2. Physical Inactivity/sedentary lifestyle
3. Use of Tobacco
4. Harmful use of Alcohol
5. Inadequate precautions for injury prevention and Medical treatment
6. Lack of Oral Hygiene

All schools should have a well-equipped first aid box located in an accessible place and all supplies should be checked for expiry dates. The wellness coordinator should be trained in basic first aid and should be able to handle common problems like nose bleed etc.

NCD's can be prevented by controlling the key risk factors. We have learnt about lack of oral hygiene and physical inactivity in Module 2 on Personal hygiene. Let us now learn about the role of an unhealthy diet in causing NCD's.

UNHEALTHY DIET

In an unhealthy diet the intake of fresh fruits and vegetables is low and the intake of processed foods rich in salt, sugar, saturated fats and trans fats (bad fats) is high. High salt consumption is the key risk factor for developing high blood pressure, osteoporosis, stomach cancer and obesity. High consumption of "bad fats" (saturated and trans fats) raises the level of cholesterol in the blood which is linked to heart disease. Foods high in bad fats include red meat, butter, cheese, ice cream as well as processed foods made using the trans fats like margarine and vanaspati. High and frequent intake of free sugars in the form of snacks and sugar-sweetened beverages such as soft drinks can lead to dental caries and obesity. Fats and free sugars may often be hidden in processed foods. These foods are rich in calories and may result in a reduced intake of qualitative nutritious food and an increase in total caloric consumption. This can result in overweight and obesity, which are in turn key risk factors for development of cancer, high blood pressure, atherosclerosis, diabetes and heart disease.

We can improve diet and nutrition by following the guidelines listed below:

- Reduce overall intake of salt and sodium from all sources. Use only iodized salt/iron fortified salt. The daily intake of salt from all sources should not exceed 1 teaspoon or 5g of salt. Remember that salt is 40% sodium. This means 5g salt contains 2g sodium.
- Recap that processed foods contain sodium in different forms. Revise sodium from the topic on Minerals in Module 5.
- Reduce the consumption of total fats. Reduce the number of fried foods, savoury processed snacks and high fat bakery products like 'Khari' and pastry from the diet. Replace some saturated fats with mono- and polyunsaturated fats. Avoid partially hydrogenated vegetable oils as they contain trans fats.

We can improve diet and nutrition by following the guidelines listed below:

- Reduce the total amount and frequency of free sugar consumption throughout the day. Free sugars should provide less than 10% of the total energy intake and should not be consumed more than four times a day.
- Increase the consumption of fresh fruits and vegetables to at least five servings per day (1 serving is 80 – 100 g or one fistful of cut food).
- Increase the intake of pulses, whole grains, nuts and seeds which are high in fibre, vitamins and minerals.
- Limit excess calorie intake, and reduce portion size of energy dense foods to be in energy balance and maintain healthy body weight and consume right amount of nutrients.

A healthy diet along with regular physical activity, staying away from tobacco and alcohol and keeping our surroundings safe, will go a long way in reducing the risk of contracting NCD's.

SELECTION OF SAFE AND HEALTHY FOOD

- Purchase food from licensed outlets.
- Read food labels, check ingredients and 'Best before date'.
- If you have to eat out and are unsure about safety of food then.
    - Prefer foods which need to be freshly prepared like eating a dosa instead of a burger.
    - Select fruits which need to be peeled like bananas and oranges.
    - Choose foods with a protective covering like boiled eggs in shell.
- Eat as much natural fresh foods as possible and less of processed foods.
- Prefer intact whole fruits to fruit juices.
- Consume local seasonal foods as far as possible.
- Avoid foods with excessive salt, spices and additives.
- Avoid too many sweets, especially sugar.
- Reduce the consumption of foods rich in refined cereals and high in fats like bakery products.
- Eat foods that contain starch and fibre like whole grains.
- Select foods rich in protein like milk, lean meat, eggs, fish and sprouted pulses.
- Prefer oils extracted from seeds like groundnut, mustard, gingelly/sesame instead of soya bean and sunflower.
- Consume ample amounts of fresh vegetables both cooked and raw.
- Eat a variety of foods from all food groups.

KEY TERMS (Module 6)

Dietary fibre – Term used to describe unavailable polysaccharides such as cellulose, hemicelluloses, pectin, gums and mucilage's, sea weed and lignin (a non-carbohydrate) which are not digested by humans but are essential in the diet.

Fast food – These are processed foods available in the market that require little or no preparation before cooking

Food fad – A style of eating that remains in vogue for some time

Hollow calorie food–Hollow calories or empty calories is a term used to describe foods which only supply energy and have very few or no nutrients

Junk food – These are processed foods which are low in essential nutrients. Junk foods contain little or no proteins, vitamins or minerals but are rich in salt, sugar, fats and are high in energy.

Malnutrition –Malnutrition is an impairment of health resulting from a deficiency, excess or imbalance of nutrients.

Nutrient dense food – These are healthy foods packed with nutrients

Nutritional status – The condition of health as influenced by the utilization of nutrients in the body.

Obesity – A condition of overweight in which weight exceeds more than 20% of desirable body weight.

Over-nutrition–A state of health resulting from an excessive intake of energy or one or more nutrients

Trans fats – Geometrical isomers of unsaturated fatty acids that assume a saturated fatty acid like configuration giving the fat a higher melting point and making the baked product crisper.

Under-nutrition– A state of health resulting from a deficiency of calories and/or one or more nutrients in the diet.

Vulnerable age group –Vulnerable age groups are the ages when nutritional needs are high and includes infants, preschool children, adolescents, pregnant and lactating women, the elderly and immuno-compromised patients.

Module 7 Planning Wholesome Meals

NEED FOR BALANCED DIETS

Why do we need a balanced diet?

- It promotes and preserves good physical and mental health.
- It meets the RDA for all nutrients.
- It maintains acceptable body weight for height.
- It provides a safety margin for nutrients.
- It includes all nutrients in correct proportions.
- It includes a variety of food items.
- Non-nutrients such as dietary fibre and antioxidants confer positive health benefits.

Dietary Goals for a balanced diet

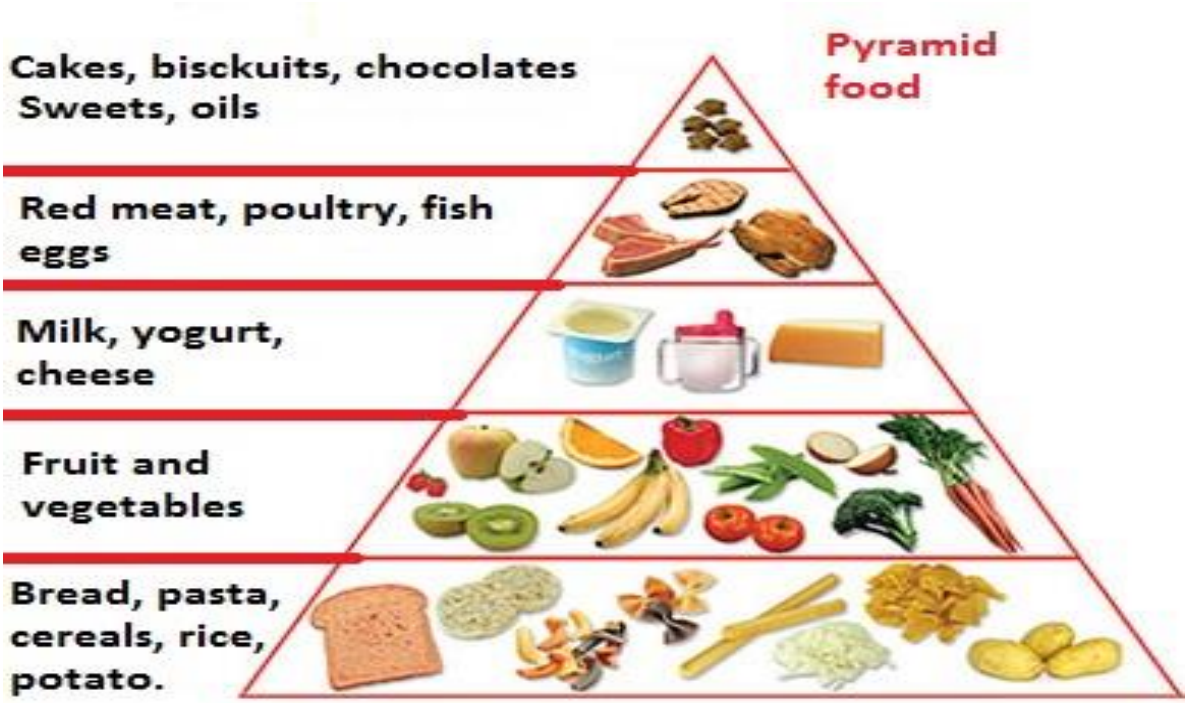
- **Choose a variety of foods** in amounts appropriate to age, gender, physiological status and physical activity.
- **Include all food groups** which provide all the required nutrients in proper amounts.
    - **Cereal, millets and pulses** are major sources of most nutrients.
    - **Milk provides** good quality proteins and calcium and is essential in the diet, particularly for infants, children and women.
    - **Prefer, fresh locally available vegetables and fruits** in plenty to fulfill the need for protective substances such as vitamins and minerals.
    - **Include eggs, flesh foods and fish** to enhance the quality of diet. However, **vegetarians** can derive almost all the nutrients from well-planned diets consisting of cereals, pulses, vegetables, fruits and milk based diet.
    - **Oils, fats, sugars and nuts are** calorie rich foods- limit their intake

THE FOOD PYRAMID

What is a Food Pyramid?

- The Food Pyramid is a carefully drawn plan of exactly what the human body needs nutritionally.
- It is a guide which helps us plan our meals in such a way that we get correct amounts of nutrients every day to keep us fit and healthy.
- The three dimensional food pyramid has been designed to help us understand the concepts of variety, moderation and importance of physical activity and exercise.

The Food Pyramid



The food pyramid helps in selecting foods from various food groups to ensure a balanced diet. It promotes consumption of foods from the following groups.

- ***Cereals, millets, pulses and milk & milk products*** *adequately.*
- ***Fruits and vegetables*** *liberally.*
- ***Meat, fish, poultry, fats****, moderately and*
- ***Processed foods rich in salt, sugar and fats*** *sparingly.*

THE HEALTHY EATING PLATE

The healthy eating plate helps you to plan a balanced diet in a simple graphic format.
It shows how much of what you eat should come from each food group.

The healthy plate for children

- The diet should be based on **cereal grains**, potatoes, pasta and other starchy foods and fruits and vegetables.
- A variety of foods from these two groups are needed, with each group making up one-third of the diet.
- Most of the remaining **third of the diet** should be made up of milk and dairy foods and meat, fish, eggs, pulses and legumes.
- Only a small amount of foods and drinks **high in fat and/or sugar** should be included.

Fruits and vegetables

- This is the fruit and vegetables group. This group of foods should make up at least one-third of the diet.
- Fruit and vegetables provide dietary fibre, folate, vitamin C, vitamin A, some minerals and water.
- Choose a wide variety of different fruit and vegetables and aim to eat at least 5 different portions every day (5 A DAY).
- Ensure that at least 2 portions are citrus /green leafy vegetable or orange coloured fruits and vegetables.
- Fresh, frozen, dried, canned and juiced ones all count. Potatoes are not included because they are a starchy food.
- A 150ml glass of 100% fruit or vegetable juice counts as 1 portion no matter how much you drink.
- Smoothies can count as 2 of your 5 A Day (if they include at least 80g crushed fruit or vegetable and at least 150ml fruit juice).

Cereals, millets, potatoes, pasta and other starchy foods

- This is chapatti, missi roti, bread, rice, potatoes, pasta and other starchy foods group. About a third of what we eat should come from this group.
- This group also includes all cereal products like poha, rawa, tapioca, sago, breakfast cereals, yam, and other types of starchy foods.
- We should include at least one food from this group at each meal time, such as cereals at breakfast or roti, or khichdi at lunch/ dinner.
- Some examples of cereals for breakfast
    - *Dalia / porridge or with milk*
    - *Missi roti*
    - *Poha, upma,Uttapam*
    - *Dosa/ idli*
    - *Sago khichdi*
    - *Thalipeeth*
    - *Parantha*

This group provides starchy carbohydrate, dietary fibre, B vitamins and some minerals, like iron and calcium. Wholegrain or wholemeal varieties such as wholegrain breakfast cereal or wholemeal chapatti and millets are high in dietary fibre. Parboiled rice or sela has more B complex than polished rice.

Milk and dairy foods

- This is the milk and dairy foods group. A moderate amount of these foods is needed in the diet, for growing children.
- This group includes milk, curds, paneer, and processed cheese, and yogurt.
- This group does not include butter, clarified butter (ghee) and cream as these belong to other food groups.
- A range of nutrients is provided by this group, including protein, B - Complex vitamins, vitamin A and minerals like calcium & zinc.

Meat, fish, eggs, pulses and other non-dairy sources of protein

- This is the meat, fish, eggs, pulses and other non-dairy sources of protein group. A moderate amount of these foods is needed in the diet.
- This group also includes legumes, nuts, seeds, soya beans and TVP, bean curd and hummus.
- A range of nutrients is provided, including protein, B vitamins, vitamins A and D and some minerals like iron and zinc.
- Sources
    - Meat includes all types of fresh and frozen meat and meat products such as bacon, salami, sausages.
    - Fish includes fresh, frozen and dried fish as well as shellfish
    - Poultry and chicken
    - Non-dairy sources of protein include:
        - Legumes such as *rajma, soya, channa* etc.
        - Pulses such as lentils,tur dal etc
        - nuts;
        - tofu;
        - textured vegetable protein (TVP);

Consumption Quantities

- Red and processed meat: no more than 70g per day;
- Fish: at least two portions of fish each week, one of which should be an oily fish (e.g. salmon, mackerel, trout, sardines or fresh tuna).

OR

- 2 bowls of beans or pulses 60 g per day and sprouted pulses also count towards the 5 A DAY fruit and vegetable target, but can be only counted once, no matter how much is consumed.

Foods and drinks high in fat and/or sugar

- This is the foods and drinks high in fat and/or sugar group.
- These foods should be used in moderation if eaten every day (such as butter, ghee and spreads) or not eaten too often (such as sweets, khari biscuits, cream cakes and some fried savoury snacks).
- The following foods are high in fat
    - margarine, butter, ghee and other spreads and reduced fat spreads;
    - cooking oils and oil-based salad dressings;
    - mayonnaise;
    - cream;
    - fried foods like samosa, kachori, aloo bonda, namakparas, chips;
    - most chocolate, some crisps and biscuits;
    - pastries, cake, puddings and ice-cream;
    - rich sauces and gravies.
- The following foods are high in sugar
    - soft drinks (not diet drinks);
    - sweets;
    - jam and jelly
    - sugar and honey;
    - cakes, puddings and cream biscuits;
    - pastries and ice-cream.
    - Mithais or Indian sweetmeats

It is important to have a small amount of fat in the diet, but foods containing a lot of fat will be high in energy. Foods containing high amounts of saturated fat should only be eaten in small amounts.

Sugar adds energy, flavour and sweetness to foods, but frequent consumption of sugar-containing foods and drinks is associated with loss of appetite and an increased tendency towards tooth decay, especially in those with poor dental hygiene.

Composite foods

- Many recipes and dishes we eat are made up of foods from more than one group of the healthy eating plate. These are called composite foods.
- Examples
    - Idli/ dosa & sambhar
    - Stuffed vegetable Parantha/ Khathi rolls/ Methithepla
    - Sindhi Kadhi
    - Chivda,/ RagdaPattice
    - Nutritious Bhel
    - Pizza

Let's sum it up

- A healthy diet includes a large variety of foods from each of the food groups on The Healthy Eating Plate. This provides all the nutrients needed.
- We should eat more fruits and vegetables and whole grain cereals like roti, bhakri, and cereal/pulse combinations like khichdi and idli, and poha, dalia, unpolished rice, potatoes, and other starchy foods.
- Main meal dishes are usually made from two or more of these food groups and are called composite dishes.

5 BASIC FOOD GROUPS

What are Food Groups?

- A food group consists of a number of foods which have common characteristics.
- These common features may be the source of food, the physiological function performed, or the nutrients present.

Food Groups

- Food may be classified into 3, 4, 5, 7, 11 or 14 food groups.
- This classification is based on either
    - source,
    - functions performed or
    - the main nutrients present in them.

The five food groups based on nutrients present is a simple guide which can be used to plan balanced meals.

Classification of Foods based on function

Groups	Major Nutrients	Other Nutrients
ENERGY RICH FOODS	**Carbohydrates and fats**	
	Wholegrain cereals, millets	Protein, fiber, minerals, calcium, iron, and B-complex vitamins
	Vegetable oils, ghee, butter	Fat soluble vitamins, essential fatty acids
	Nuts and oilseeds	Proteins, vitamins, minerals
	Sugars	Nil
BODY BUILDING FOODS	**Proteins**	
	Pulses, nuts and oilseeds	B-complex vitamins, invisible fat, fiber
	Milk and milk products	Calcium, vitamin A, riboflavin, vitamin B_{12}
	Meat, fish, poultry	B-complex vitamins, iron, iodine, fat
PROTECTIVE FOODS	**Vitamins and Minerals**	
	Green leafy vegetables	Antioxidants, Vitamin C, B-complex Vitamins, Iron, Fiber and other carotenoids
	Other vegetable and fruits	Fiber, sugar and antioxidants
	Eggs, milk and milk products and flesh foods	Protein and fat

Five Basic Food Groups

1. Cereal and millets
2. Protein Foods
3. Protective Foods
4. Secondary Protective Foods
5. Fats, Oils, Nuts; Sugar and Jaggery

Cereals and Millets Group

- All cereals and their products such as wheat, rice, maize and millets such as jowar, bajra, ragi, oats; semolina, poha, puffed cereals etc.
- Serving size – 30 g
- No. of servings per day 6 to 12
- One serving provides 2 – 3 g protein and 80 – 100 kcals
- One serving is –
    - 1 Chapatti
    - 2 Poories
    - ½ cup cooked rice
    - ½ Bhakri
    - 1 large slice of bread

Protein Group

S. No.	One Serving is	Main Nutrients Provided
1.	30 g pulses (1 cup cooked dal)	Partially complete proteins, carbohydrates, iron, B-complex. Soya beans and oilseeds give fats. Sprouts give Vitamin C
2.	1 egg 40g mutton/fish/poultry (1 piece)	Complete proteins, iron, fat, cholesterol, Vitamins A, B-complex, B12
3.	1 cup milk (150 ml)	Complete proteins, Calcium, Phosphorous, fat, cholesterol, Vitamins A, B-complex, B 12

One serving gives us 7 g protein and 70-100 kcal

Protective Group

- Yellow, orange, red fruits and vegetables such as mango, papaya, carrots, pumpkin.
- Green leafy vegetables such as spinach, fenugreek, colocasia leaves, mustard leaves etc
- All citrus fruits
- Guava, tomato, pineapple, amla, berries
- One serving from this group is 50 – 75 g
- Vitamin A & C rich fruit or vegetable.

One serving gives us 1 g protein and 25 kcal No. of servings 2 or more

S. No.	One Serving is	Main Nutrients Provided
1	1 citrus fruit	Vitamin C, carotene, fibre
2	½ cup cut fruit/vegetable	Carotene, iron, calcium, folic acid, fibre, other vitamins and minerals, ascorbic acid
3	100 g green leafy vegetables	

Include at least one serving each of carotene rich fruit/vegetable and one serving of Vitamin C rich fruit/vegetable.

Secondary Protective Group

- All other fruits and vegetables such as -
- Banana, chikoo, apple, melon, custard apple
- Brinjal, cucumber, lady's finger, peas, all beans, all gourds.
- Roots and tubers like potato, onion, radish, yam, colocasia

S. No.	One Serving provides	Main Nutrients Provided
1.	1 g protein & 25 to 50 kcal (Note: No. of servings 2 or more)	Carbohydrates, fibre, small amounts of vitamins and minerals

One serving from this group is equal to 50 – 75 g (1/2 cup) cut fruit or vegetable

Fats, oils, nuts; sugar and jaggery

- All fats such as fresh cream, butter, ghee, vanaspati, margarine
- All oils such as groundnut, corn, soy, sesame, coconut, rice bran, palm, olive.
- All nuts and oilseeds.
- Sugar, jaggery, honey, molasses, chocolates, sweets, toffees, candy floss, jam, jelly, murabba etc.

S. No.	One Serving is equal to	Main Nutrients Provided
1.	• 5 g of fat/oil and 5 g of sugar • 1 serving of fat/oil provides 45 kcal. • No. of servings 5 of which 3 should be vegetable oil	• Calories • Oils provide vitamin E and essential fatty acids • Fats provide vitamins A and D
2.	• 1 serving of sugar/jaggery provides 20 kcal. • No. of servings 5	• Sugar provides only calories • Jaggery, honey and preserves also give us small amounts of minerals

PLANNING BALANCED DIETS USING THE FOOD GROUPS

Introduction

- The basic food groups provide a guide for the preparation of a balanced diet.
- When foods from all the food groups are included in a daily diet, one can be assured of meeting the daily requirements of all the essential nutrient which our body needs.
- By selecting food from each food group, meals can be made interesting as well as fully nourishing.

Factors Influencing Meal Planning

Many factors affect the acceptability of a meal.

- **Nutritional Adequacy** Foods from all basic food groups should be included in each meal so that the meal is balanced and nutritionally adequate.
- **Food habits** Tradition and religious considerations should be kept in mind while planning meals.
- **Availability** Locally available, seasonal fruits and vegetables should be given preference.
- **Meal Frequency and pattern** Follow meal timings, number of meals per day etc.
- **Variety**- Include ample variety in preparation, ingredients, colour, flavour and texture etc.
- **Economic considerations** Meals should be affordable.

Steps in Planning Balanced Meal

Collect the following information regarding the person whose diet has to be planned

- Age
- Gender
- Occupation/ Activity level
- Religion
- Socio economic background
- Food Habits
- Check the RDA for energy and proteins
- Prepare a food plan
- Select foods from each food group and state their amounts
- Plan a menu

Distribution of servings/meal for a 16 year old boy

Food Group	Food Exchange	No. of Servings	Servings per meal			
			Breakfast	Lunch	Tea	Dinner
Energy giving Foods	• Cereals	16	4	5	2	5
	• Roots & tubers	3	-	1	1	1
	• Sugar	7	2	2	1.5	1.5
	• Fat	8	2	2	2	2
Body building Foods	• Milk	2	1	0.5	-	0.5
	• Pulses	2	-	1	-	1
	• Egg	1	1	-	-	-
Protective Group Foods	• Green leafy vegetables	1	-	1	-	-
		3	-	1	1	1
	• Other vegetables	2	1	-	-	1
	• Fruits					

Sample Menu Plan

Meal time	Menu	No. of servings from each Food Group
Bed Tea	• 1 cup with milk	50 ml milk +1tsp sugar
Breakfast	• Cornflakes with milk+ sugar • 3 toast with butter • 1 boiled egg • 1 orange	1 cereal+150 ml milk+1 tsp sugar 3 cereal +2 fat 1 body building 1 protective food
Lunch	• Palak Aloo • Dal • Rice+ 3 Rotis • Carrot halwa	1 each green leafy vegetable and roots and tubers+ 1 tsp fat. 1 pulse/ body building 2+3 cereals 1 protective group+ 1fat+2.5 sugar, 0.5 milk
Tea	• 1 cup with milk +sugar • 2 samosas	50 ml milk +1tsp sugar 2 cereal+ 1 roots and tubers+ 1 other vegetable+2 serving fat
Dinner	• Rajma • Colacasia dry • Green salad • 2 chapatti+ Rice • Banana custard	1 pulse+0.5 other vegetables+1 fat 1 roots and tubers+ 1 fat. 0.5 other vegetables 3 + 2 cereals 1 fruit + 0.5 milk+1.5 sugar

THE HEALTHY LUNCH BOX

Why a Healthy Lunch box?

A healthy lunch every day will provide the child with:

- The energy and nutrients required to grow, develop and learn.
- The key to a balanced, nutritious lunch box is variety.
- A healthy, balanced and nutritious packed lunch should include foods from the following four food groups
    - **Starchy food–**such as cereals, bread, potatoes, rice, pasta – these foods provide carbohydrate to give your child energy for the afternoon.
    - **Fruit and vegetables –** these foods provide vitamins and minerals to help protect against illness.
    - **Meat, fish, eggs, beans and other non-dairy sources of protein–** these foods provide protein, iron and zinc to help your child grow.
    - **Milk and dairy foods –** these foods are a good source of calcium, for strong bones and teeth.

Foods to be eaten in moderation

- Foods and drinks high in saturated fat, sugar (and/or salt) – try to limit these types of food and drink.
- Too much salt and saturated fat can increase the risk of some illnesses in later life while.
- Too much sugar can damage children's teeth.

Dietary Goals for Healthy Snacks

Menu Planning Advice	**Plan menus for snacks to ensure that they are varied across a week and that the food provision across the day is balanced. Avoid sweet foods such as cakes, biscuits and confectionery between meals**
Food Group	**Food and Drink Guidelines**
Cereal and Millets	• Provide starchy food as part of at least one snack each day. • Provide at least three different varieties of starchy food across snacks each week. • Choose mixtures of cereals and pulses preferably not deep fried.
Fruit and Vegetable	• Provide fresh fruit or vegetables as part of some snacks. • Provide a variety of fruit and vegetables across the day, and each week. • Dried fruit should not be provided as part of snacks. • Fruit chunks, vegetable sticks and smoothies/shakes as part of snacks.
Protective and Secondary Proteins	• Foods from this group provide a useful source of iron and zinc and can be provided as part of snacks once or twice each week. • Children should have three portions of milk and dairy foods each day (including those provided at home): a portion of milk and dairy food can be provided at snack time.
Fats and Oils	• Avoid fatty foods, deep fried foods and sweet foods.
Drinks	• Children must have access to fresh drinking water. • Water and milk are the only drinks that should be provided between meals and as part of snacks. • Refreshing drinks like lime juice, cocum and pannah in season could be provided specially in summer.

Healthy Lunch Box

Menu Planning Advice	Each lunch should include a main course and a dessert
Food Group	**Food and Drink Guidelines**
Cereal and Millets	• Provide a portion of starchy food as part of each lunch. • Provide at least three different starchy foods as part of lunches each week. • Provide a variety of wholegrain and white starchy foods each week. • It is good practice to provide wholegrain starchy foods for at least 2 lunch each week. • Limit starchy foods which have been fried to once a week at lunch. • Limit canned pasta in sauce. • Avoid flavoured dried rice, pasta and noodle products.
Fruit and Vegetable	• Provide a portion of fruit and/or vegetables as part of lunch every day. • Provide a variety of fruit and vegetables across the week at lunchtime. • Check product. • Labels to choose canned vegetables and pulses without added salt and sugar, fruit canned in juice not syrup. And reduced salt and sugar baked beans. Use fresh fruits and vegetables. • If you offer fruit juice at lunch, this should be unsweetened and diluted (half juice and half water)
Protein	• Provide a portion of meat, fish, meat alternative, eggs or pulses as part of lunch each day. • Provide a variety of foods from this group as part of lunch across the week. • It is good practice to provide a portion each of red meat, poultry, fish and meat alternatives or different pulses/sprouts each week as part of lunch. • It is good practice to provide vegetarian or vegan children with a variety of meat alternatives, pulses/sprouts and nuts each week as part of lunch. • Provide one lunch for all children each week which uses a meat alternative or pulses as the protein source. • Provide a portion of oily fish at least once every three weeks, this can be provided as part of lunch. • Limit the provision of processed meat products, fish products and products made from meat alternatives to once a week for each of the three types. • Children should have three portions of milk and dairy food each day (including those provided at home- Kheer from vermicelli or rice); one portion of milk or a dairy food and/or a milk based pudding can be provided as part of lunch.

Menu Planning Advice	Each lunch should include a main course and a dessert
Food Group	**Food and Drink Guidelines**
Drinks	• Children must have access to fresh drinking water. • If fruit juices is provided as part of lunch, this should be unsweetened and diluted (half juice and half water) • Children must drink lassi, matha

Practical tips for healthy, safe and tasty packed lunches

Preparing the packed lunch

- Include your child in shopping, choosing and preparing what goes in their lunchbox, giving them choices within the food groups.
- Wash fruit and vegetables, and remove inedible seeds.
- Keep it fresh. Rinsing slices of apple in dilute lemon juice, for example, will stop the slices from turning brown.
- If fresh fruit/vegetable needs to be cut, keep thick pieces to prevent wilting
- Think sustainably. Use containers and cutlery that can be washed and used again.
- Label your child's packed lunch with their name.

What Foods to Choose?

- **Vary lunchbox contents** for a good balance of nutrients.
- **Seasonal fruits and vegetables** add colour and texture, and are often cheaper and tastier.
- **Read food labels-**Look out for the nutrition information on the packets.
- **Finger foods of all kinds,** particularly fruit and vegetables, will encourage children to try new foods.
- **Child-sized utensils, crockery, tables and chairs** may also make it easier for children to serve themselves and learn to eat independently**.**

Learning how to choose and enjoy many different nutritious foods in childhood can provide the foundation for a lifetime of wise food choices.

Ideas for Nutritious Snacks

- Choose any traditional snack made with local, seasonal foods. Cereal/pulse combination- Stuffed parantha, palak puri, thalipeeth, brown bread, thepla, idli, dhokla.
- Dairy foods such as cheese or plain curd with added fruit/vegetables/boondi.
- Fresh fruits such as peas, apple slices, banana, seedless grapes, slices of melon, mango, pineapple, plums or berries such as strawberries and raspberries. The fruit from canned fruit in juice can be added to flavour curds.
- Raw vegetables such as peeled carrots, sweet pepper, tomato, cucumber or celery, with dips such as hummus or greek yoghurt with chives.
- Home made plain popcorns, chiwda, bhel mixture.
- Mathri, shankarpali, rawa besan ladoo, chakli, murukku. Idli, dosa.

Ideas for a healthy lunch Box

A packed lunch should contain:

- A starchy food. For example, any sort of roti, bread, rice preparations or wraps.
- A protein food: such as whole pulses or their products, dal, sprouts, paneer, cheese, tofu, egg, chicken, fish or peanut butter.
- One portion of vegetables. For e.g. cooked vegetables or salad.
- One portion of fresh or canned fruit or fresh fruit juice.
- A drink. Water, milk, lassi or fresh fruit juice are good choices.

Two or more foods could be combined together for e.g. Paneer parantha

Additional snacks: such as plain popcorn, breadsticks, unsalted nuts, pumpkin or sunflower seeds, etc. could be added occasionally and curd provides a good source of calcium. For people who have higher energy needs, some more energy-dense foods like peanut chikki could be included.

Indian Food Choices for Lunch Box	
Healthy Foods	**Unhealthy Foods**
• Dry vegetable curries, vegetable curries, vegetables and pulse mixed baji, dal, channa dal, rajma, chhole, sprouts, usal, mixed pulses, usal, black eyed beans, sambhar.Tandoori chicken, baked/roast chicken/ fish. • plain boiled rice, rice preparations like lemon rice, curd rice, etc. chapatti or roti. • Curd, raita, dahivada, buttermilk. • Green salad, whole / cut fruit.	• Fried foods such as samosas and onion bhajias • Oily, creamy or coconut-based gravies (such as korma) • Fried rices (such as pilau rice) • Breads which have a lot of fat added (such as stuffed naan breads)

Chinese & Italian Food Choices	
Healthy Foods	**Unhealthy Foods**
• Stir-fried chicken, vegetable or prawn chop suey, • Steamed fish, • Vegetable dishes, • Boiled noodles, • Dishes with steamed tofu	• Battered dishes (for example, sweet and sour chicken, battered bananas or apple fritters), • Spring rolls and prawn crackers. • Avoid fried rice dishes and • Fried noodles.
Pizzas: • Choose thin-crust pizzas, • Pizzas without cheese in the crust. • Add more vegetable or fish toppings instead. • Encourage eating a salad with the pizza.	**Pizzas:** Avoid having extra cheese, pepperoni or salami.

Healthy Fast Food choices

Burgers: Go for standard rather than 'super-size' options. Choose a plain burger in a bun with a salad.

- Avoid extra cheese or mayonnaise, thick milkshakes, chicken nuggets or other battered dishes such as onion rings. Avoid French fries.
- **Sandwiches-** Look for sandwiches that donot contain mayonnaise. Check the nutritional content of sandwiches on the label, and choose those lower in fat and salt. Prefer brown or multi grain bread.
- **Salads-** Some ready-prepared salad bowls have a lot of mayonnaise and may be designed for two people. Check the labels for lower-fat single portions.

KEY TERMS (Module 7)

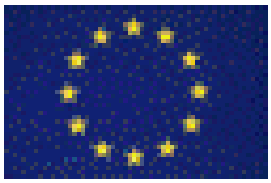
Balanced Diet-is one which contains different types of foods (from all food groups) in such quantities and proportions that the need for all the nutrients such as carbohydrates, proteins, fats, vitamins, minerals, water and fibre are adequately met.

Composite Food- are the food items that we eat which are made up of from more than one food group of the healthy eating plate.

Food Pyramid-helps in selecting foods from various food groups to ensure a balanced diet.

Food Groups-A food group consists of a number of foods which have common characteristics. These common features may be the source of food, the physiological function performed, or the nutrients present.

The Healthy Eating Plate- consists of a healthy diet that includes a large variety of foods from each of the food groups. This helps in providing all the nutrients needed.



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Additional information is available at the following contacts:

Mr. Franck Boccas

Team Leader, CITD project

Ms. Surbhi Datta

Junior Expert, CITD project

In India:

CITD project Office

D-1, West End, New Delhi-21

Mob. + 91 95 60 93 17 13

Tel. +91 (11) 42 90 88 60

franck.boccas@citd-standards.com

surbhi.datta@citd-standards.com

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389 Chiswick High Road
London W4 4AL
United Kingdom

In cooperation with:

17, Av. André Marie Ampère
Induspal Lons, 64140 Lons, France

Valencia Parque Tecnologico
c.Benjamin Franklin, 5-11,
E46980 Paterna, Spain

Agern Allé 5, DK 2970
Horsholm, Denmark

Skandiahamnen, Sydalanten 6
403 36 Gothenburg, Sweden

Erottajankatu 2, Po Box 512
00101, Helsinki, Finland