HOME SCIENCE

I PUC – Text Book

2014 - 2015

Department of Pre University Education

Malleshwaram, Bengaluru

www.puc.kar.nic.in

Revised Edition - 2017

Printed on 80 GSM Maplitho paper

Director's Message

Dear Students,

We at the Department of Pre-university Education, Karnataka strive to empower each student to dream big and equip them with the tools that enable them to reach new heights and successfully deal with the challenges of life. As Swami Vivekananda said, "**Real education is that which enables one to stand on one's own legs".**

The course contents in this book are designed with the objective of equipping you well for the next level of study.

We wish you well on your journey and look forward to you becoming a responsible citizen of the nation and give back to the betterment of the society.

With best wishes,

Sd/-
C. Shikha, IAS
Director
Department of Pre University Education
Bengaluru

Preface

Home Science is an inter-disciplinary subject which brings about holistic development in the students. The Home Science curriculum aims at empowering students by providing scientifically planned, multi-dimensional, value oriented education in the areas of health, family welfare and community development an attempt is also made to inculcates a spirit of service and provide education for holistic living.

This textbook of Home science for I PUC is written in view of the syllabus revision and restructuring. It is also in accordance with the spirit of the National Curriculum Framework (2005) guidelines. The subject matter is presented as fifteen units, which are grouped under five specializations of Home Science: Resource Management, Food and Nutrition, Human Development, Textile and Clothing, Extension Education and Communication. Each unit has a brief write-up preceding the unit highlighting the objectives and an introduction highlighting the essence of Unit. Where ever it is applicable, a pictorial representation / sketches in that area are included. At the end of each chapter a brief summary is provided. Glossary and Model questions are also provided at the end of each unit. Special emphasis has been given on the narrative style, illustrations, activity exercises, clarity of expression, coverage of topics.

A large number of extremely talented and dedicated faculties helped in bringing out this book. Our main purpose is to make sure that at PUC level Home Science is an interesting and useful subject for molding the students as a responsible citizens. I sincerely wish that teaching and learning Home Science would become an enjoyable activity.

ACKNOWLEDGEMENT

The curriculum and content developed on the basis of National Curriculum Framework-2005(NCF). An attempt was made to implement the basic ideas of upholding values imbibed in the constitution, providing quality education for all. Encouraging learning through activities and inculcate creativity in learners.

Keeping the guidelines of NCF-2005 the Department of Pre University Education in Karnataka has initiated and guided Text Book Committee to prepare a syllabus. Committee after several sittings, analyzing state and central syllabus, new syllabus and text book framed. The Committee believes that this will help learners in improving knowledge, understanding, skill and application. This syllabus provides a strong foundation to Pre University Home Science students.

Special thanks to Prof: O. Obaiah, Principal, Smt. V.H.D. Central Institute of Home Science for deputing Text Book Committee Members from the college for the development of the first prescribed Text Book for I P.U.C. in Home Science by the Government of Karnataka.

I thank and acknowledge the valuable suggestions of Heads of all the departments and staff members of Home Science, and the members of Review Committee Dr.Ushadevi .C, Dr.Madhumathi.S. Associate Professors in Home Science, Smt V.H.D. Central Institute of Home Science, Bangalore.

I thank Text Book Development Committee Member Coordinators and Members who extended their sincere efforts with dedication and teamwork sharing their knowledge, skill, ability and their valuable contribution in bringing out the first edition of the prescribed Text Book for I.P.U.C. in the subject Home Science.

I thank Sri S.S.Javeed, Intra ADS & Graphics, Bangalore for designing the cover page of the Text Book. I thank the CET Cell, Malleshwaram for providing the infrastructure for conducting the workshops and Sri Lokesh.M. for his efficient DTP work. The efforts of the Pre University Publication Department are also appreciated.

Bangalore Chairperson.

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CONTENTS

Total number of Teaching hours : 120

PRACTICALS

Number of Classes : 22 Duration : One Class : 2 Hrs.

1. Observe and list the human, non-human/shared resources available at home and in your neighbourhood 2 classes
2. Plan a family budget for the following income groups- low, middle, high 2 classes
3. Identification:
   a. Of Food and Equipment
   b. Weights & measures 4 classes
4. Methods of cooking
   a. Boiling, Steaming, Pressure cooking
   b. Frying-shallow and deep frying 2 classes
5. Plan a complementary food for an infant and evaluate 2 classes
6. Prepare an activity / to promote physical / Language / Cognitive development for an infant. 2classes
7. Identification of fibers- cotton, silk, wool, rayon, nylon
   a. Physical appearance
   b. Burning tests 2 classes
8. Basic stitches
   a. Tacking, running, back stitch, hemming, slip stitch, overcastting, whipping
   b. Decorative stitches - Stem Stitch, Chain Stitch, Satin Stitch, Lazy daisy, Herring bone, Blanket stitch, French knot 2 classes
9. a. List the different types of Education
   b. List the different types of communication 1 classes
10. Plan and prepare the audio-visual aids to be used for extension education and communication. 3 classes

UNIT – 1
CONCEPT AND SCOPE OF HOME SCIENCE

Learning Objectives

Enable students to:

- Understand the concept and scope of Home Science education
- Learn about disciplines of Home Science

1.1 Introduction

Home Science is a need based, professionally oriented education to inculcate life skills to individuals, families and society for holistic development. It is the education for better living and the core of this education is the family ecosystem.

Home Science has unique features which distinguishes itself from other subjects. It is a dynamic and ever growing subject having maximum practical application throughout life. Home Science as a field in education has come a long way. Since its humble beginnings as a domestic skill oriented course offering inputs in housekeeping, home decoration, scientifically and nutritionally planned balanced diet, child rearing and stitching. This type of education was appropriate in the past since it helped to draw women out of their homes and to improve their various skills which have been passed over to them by the elderly women of the family. Today the number of women in the work force has increased, thereby contributing to the family income. In this context, managing and balancing both household and professional life is very important in one's life and Home Science education provides a perfect interface between these two spheres.

Home Science, or the science of a home, includes all the aspects that concern the self, home, family and society. It deals with reciprocal relations between the family in its natural and manmade environments. It aims at

providing maximum satisfaction for the person and their family members since the matters including health, resources and relationships are dealt in a scientific way. It imparts the knowledge of the scientific procedures involved in making a home. Home Science education helps the students to explore different means to live happily with their families, social groups and communities. Home is a place where life begins and School is the place where formal education begins. Hence, only the values generated at home can be further enriched at school.

From times immemorial, down the ages of civilization, “Home and Family” have been the core of all human development and the society at large. By catering to the physical, psychological, social, cultural and spiritual needs of the members, the home gives meaning to life and refines the life of citizens, resulting into a developed nation. It explores the possibility of establishing the perfectionism in the social orders starting from the home to the community. In a nutshell, the goals of Home Science can be spelled out as an education which is value oriented and “resourceful” for leading happy, healthy and contented life.

- **Definition of Home Science**

  Home Science is an applied field built upon both the disciplines of science and humanities for the purpose of achieving the welfare and well-being of the family in an ever changing society.

  Rajammal P. Devadas defines Home Science as a synthesis of all the fine arts and sciences, interwoven together harmoniously, to foster and nurture the physical, social, cultural and spiritual development of the individual, family and community.

- **Aim of Home Science Education**

  Home science is the integration of all the arts and science subjects, imparting necessary knowledge about Food, Nutrition, Health, Clothing, Housing, Household Finance, Interior Decoration, Resource management, Health, Human growth and development, Community Science, etc. With the knowledge of basic sciences and arts which are essential, these branches of knowledge help to facilitate and enrich home life. They enable an individual to live holistically.

Home Science aims to empower students acquire scientific knowledge and skills to manage physical, emotional and monetary resources. This knowledge will help in achieving individual and family goals and enrich in family and professional life.

Quiz - 1

Home Science is the integration of all the arts and science subjects.

a. True

b. False

- **The Objectives of Home Science Education**
  - To foster the growth, all round development and well-being of the individual, families and communities.
  - Utilize the findings and advances of science and technology.
  - Develop the ability to manage homes and families, to achieve happiness in families and overall well-being of the society.
  - Develop aesthetic sensibilities.
  - To prepare for careers in related fields.

Successful home making and family life demand the best education to meet the challenges resultant of dynamic social order. Home Science education offers opportunities to achieve all these objectives.

Quiz - 2

The scope of Home Science begins from the conception till the death of the individual.

a. True

b. False

1.2 Scope of Home Science Education

The scope of Home Science begins from the conception till the death of the individual. Home Science education is vast and the curriculum is intrinsically weaved with both arts and science subjects and covers a

wide range of areas. Students are given an insight and are trained in skills to manage self, home and community. Home Science education encourages development and use of personal, social, material, and natural resources to meet human needs as producers/consumers.

The development of Home Science education reflects cultural and social pressures that are evident. It is need-based, professionally oriented and focused on holistic education to assist and train families and communities towards improved living. In the context of growing pressures in the work environment and external world, the family takes the responsibility and plays a significant role in shaping the citizens of tomorrow. Home Science subject highlights the importance of home and its ecosystem for making better human beings. The family is the main factor which protects the individuals from all external forces and provides the right type of atmosphere for children to grow into strong and independent personalities. Home Science, then becomes the key subject in shaping individuals.

Thus, the importance and significance of Home science education can be discussed as follows:

- **Use of scientific knowledge in managing home life**

Great advances have been made in the areas of health, nutrition, textile and clothing, human development, housing and managerial skills, which the home maker requires in day-to-day life of managing and maintaining the household. Hence, it is essential that such knowledge and skills are made available to every home maker to create a healthy, happy and enriched family life.

- **Use of available services and facilities**

Modern day society has changed a great deal in terms of availability of various services to each and every household. Therefore, a formal and systematic approach of understanding and utilizing these services has become necessary as a preparation for home making. Moreover, use of

modern technologies, its maintenance and management also is of great importance, which Home Science education fulfills. Home Science education empowers an individual to make the best use of available knowledge and skills for the optimum functioning of homes and betterment of family members.

- **Managing day to day family affairs**

Human relations are undergoing tremendous changes during the last few decades. Due to breakdown of joint families the traditional values like sense of belongingness, and family values, ethics are severely affected these days. People are becoming more and more self-centered in nature, contrary to our Indian collectivism. Children are growing up in a very complex psychological environment which leads to many problems. Today family problems are on the rise, leading to various types of domestic violence, abuse, crimes etc. Home Science education tries to educate and acquire the ability to manage this crisis at right time with proper emphasis.

- **Preparing for a healthier and purposeful life**

Happiness, Peace, Content, Sense of security and belongingness in the family are the ultimate goals of purposeful family life. Home Science education tries to create an environment and outlook, which will enable people to live happily and more purposeful lives. It tries to provide a wholesome knowledge and attitudes towards promoting optimum family health, nutrition, child care, home decoration, use of clothing, elderly care and management during risk and eventualities. It tries further to enrich the lives of each and every members of the family through better understanding of the human relationships for leading successful life.

- **Family Life Education**

Home Science education helps in preparing for home making, in the development of right values, appreciation, and understanding for better family life. It enables the pupils to understand the functions of parenthood, responsibilities of family membership and management of one's resources.

It helps them to develop a sound philosophy of personal and family living. Understanding oneself and others is the basic essence of family life. Moreover, it helps us in careful weighing of and balancing competing demands and making intelligent decisions. Home science recognizes homes as the foundation of human development and integrity of family as an inevitable requisite for the establishment of homes.

- **Career Opportunities**

The scope in the field of Home Science is large as there are a wide range of areas that the students are trained in. They are given an insight to the disciplines of Home Science, namely Human Development, Food and Nutrition, Resource Management, Textiles and Clothing; and Extension Education and Communication. The employment opportunities for Home Science graduates are continuously growing. There are excellent careers one can pursue with a Home Science Degree. After completing a graduate degree in Home Science, Home Scientists can either join various industries like production industry, hospitality industry, service industry or teaching, technical, sales or opt for further studies. The curriculum has been adapted to the changes in the industry and Home Science students now have a wider scope for research or employment. The career choice in the Home science will depend on the social and educational aptitude of the student. It is important that the students choose an area which interests them the most. The curriculum is planned to prepare students to be effective managers of the family and the Community by managing the human and material resources effectively. It should also enable them to develop professional competence for jobs in the private and public sector.

Activity: Group Discussion

Discuss and present about relevance of Home Science to Ones' self and profession

1.3 Disciplines of Home Science

We are living in the era of specialization and specialists are intrinsically trained in detail in their respective disciplines. This helps

them in expressing and utilizing their expertise in their professional life for providing better services to mankind. Life has become more competitive, complex and complicated. We now live in modern cities; our needs are changing constantly with the technological and economical advancement. Constant development is taking place in all phases of life both personally and professionally. In the process of achieving success one needs to update required knowledge with the changing trends and may also face innumerable challenges and learn to solve them and overcome the obstacles efficiently with rational thinking. Hence, the need has risen for specialization in education. Specialization must begin after a course of general education has been satisfactorily completed. The stage at which specialization should begin requires careful planning. Based on the interest, ability, aptitude, resources and merit of students further course of study should be planned.

Home Science education in India, although started as a composite course, was later branched out and evolved into separate disciplines / specializations, such as Resource management, Food and Nutrition, Textiles and Clothing, Human Development, and Extension and Communication, thereby widening the prospects of the students.

Specialization in Home Science concerns itself with equipping a student with a skill or efficiency, for turning out trained personnel. On the completion of each stage of Home Science education, students must pass on to more and more specialized lines of learning in the chosen disciplines of Home Science. The curriculum and the different areas of discipline provides scientific knowledge and helps in developing skills that are relevant to the modern day society in order to meet the growing demands in the present scenario.

- **Resource Management**

In the context of changing human ecology and environment, Resource Management is an evolving field which concentrates on effective and efficient use and management of resources. This specialization has

relevance for contemporary living with the main focus on Human Resources, Consumer Behavior, and Hospitality, Ergonomics, Housing etc. It aims at imparting various concepts and principles of management in managing a home, acquiring information regarding the selection of appropriate equipments, their operation, care and maintenance; knowledge about housing, interior decoration, work simplification, Sanitation, renewable energy sources, fuel and energy management, waste recycling and water management in relation to Environment, with the appropriate technologies available for better living.

- **Food and Nutrition**

The study of Food and Nutrition includes the components of foods, food analysis, their chemistry and metabolism, nutrients in relation to health and diseases. It also provides training and education regarding the types of diets required during special health conditions. It provides knowledge regarding different kinds of foods, its requirement by the individuals in different stages and conditions of life; nature and type of servicing to different institutions like schools, colleges, hospitals, hotels, industry and organizations etc. along with its knowledge regarding food values, nutrients, production, processing and preservation technology.

- **Textile and Clothing**

"Textiles and Clothing" is the study of fibers, yarns and fabrics used for clothing Construction. This science of fiber enables students to apply knowledge and explore the methods that would be beneficial for the textile and related industries. This area aims at providing knowledge regarding purchasing family's clothing - its construction, nature and types of fibers, fiber properties dyeing, printing and weaving of fabrics, garment design, textile design. Color combinations and skills needed to design and sew clothes. This will help people in selecting clothes that look attractive and wear well thereby increasing ones self-esteem and self-confidence. The first impression is the lasting impression achieved through appropriate clothing. It also deals with the care and maintenance of various types of

clothing, ease in laundering, ironing and storage. Selection of clothing, according to the climate, occasion and availability is valuable knowledge. This branch of Home Science requires a science background, as it deals with the understanding of the chemistry and physics of textile science. The course contains an integrated curriculum right from introduction to textile science, fabric construction, care of clothing, wet processing, fashion concepts and fashion illustration, technical textiles, creative designing, apparel construction, marketing, merchandising, quality control and textile economics.

● Human Development

Human Development is a study of different domains of development throughout life span. This specialization encompasses study of age specific developmental tasks, challenges, and concerns of each period of life span. It also offers solutions to deviant and abnormal development and behavior. This subject has a vast coverage and diverse application. It aims at creating awareness regarding the importance of early childhood, school going and adolescent years, adulthood, old age and the dynamics of contemporary family life. A happy family life requires cooperation and mutual understanding among all the family members and society. It focuses on understanding ways of promoting desirable personality throughout the life span by exploring the dynamics between people within their families as well as those between families and the greater world. The major purpose of studying Human Development is to understand child care, development, education, guidance, special needs of children and adolescents.

● Extension Education and Communication

Home Science extension is an applied science which aims at bringing about changes in the behavior of people through dissemination of science and technological information in the areas of Home Science. Extension Education has a crucial role in national development. Extension being the major thrust area of Home Science lays emphasis on fieldwork to rural communities. The major objectives is to extend and disseminate

the knowledge of other branches of Home Science, such as human development and family studies, resource management, food and nutrition and textiles and clothing for promoting general wellbeing of people. Extension Education aims at empowering people by enabling them to utilize the available technology and resources. The use of audio-visual aids, planning, execution, monitoring and evaluation of welfare and developmental programmes are a component of extension education. Home Science Extension and Communication aims to develop competencies among students for reaching out to target groups in communities and facilitating them to secure rewarding careers and vocations.

Activity: Assignment

Prepare a chart illustrating the different disciplines of Home Science

Summary

Home science is a dynamic and ever growing field of education. It is an applied field built upon both the disciplines of science and arts for the purpose of achieving wellbeing of the family in an ever changing society. It is the education for “holistic living”. Home science aims to foster the growth, all around development and well-being of individuals families and communities.

Home science is a multi-disciplinary subject which is scientifically planned. It draws principles from arts and science subjects and integrates it into various aspects of life of individuals for enabling better homes and society. Home Science empowers students to face new challenges, to cope with knowledge explosion, scientific and technological advancements and growing needs of individuals and families for successful living in society. Home Science subject trains students to face life with confidence. Home Science curriculum has the power to empower the learners with all these necessary skills. The science of the home is concerned with the maintenance and enrichment of human relationships through the

development and judicious use of all available human and material resources to achieve a maximal satisfying life for all members of the family.

Home Science has five disciplines namely, Human Development, Resource Management, Food and Nutrition, Textiles and Clothing and Extension Education and Communication. These specializations are very unique and each has its own identity and its application in one's life with varied prospects. The scope in the field of Home Science is large as there are a wide range of areas that the candidates are trained in.

Glossary

Holistic: Emphasising the importance of the whole and the interdependence of its parts.

Home Maker: One who manages the household, especially as one's main daily activity.

Family Eco System: Family ecosystem includes all the aspects that concern the self-home and society.

Model Questions

1. Define Home Science.
2. State the objectives of Home Science Education.
3. Mention any three career opportunities in Home Science.
4. Discuss the scope of Home Science Education.
5. Write a note on disciplines of Home Science.

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UNIT – 2
RESOURCES

Learning Objectives

Enable students to:

- Identify individual, family and community resources.
- Prioritise and utilize the resources based upon the needs.
- Identify the alternatives among the resources to accomplish goals.

2.1 Introduction

Resources play an important role in achieving the individual and family goals. Resources are used on a continuous basis in our daily life. We need to decide the optimum allocation of resources in various combinations to achieve what we want. Although we have many resources at our disposal, we are not aware of all of them.

As a result, we are not utilizing some of them to the fullest extent. Resources have potential and are valuable. The application and utilization of our resources present in our self, or in a system like family and community, will be used to accomplish their goals. Since primitive age, man has been evolving everyday by exploring and identifying the sources of resources to meet his daily basic needs, like food, clothing and shelter. During the process of human evolution, man has creatively utilized the available resources and also prompting fears that these resources will gradually disappear and produce a catastrophe. Eventually during the transition of civilization, advancement of science and technology, rapid industrial growth and urbanization, many people have continuously discovered and created new resources. The enormous number of discovered resources and combination of resources offer unlimited possibilities in Resource Management.

● Definition and Meaning of Resources

Resources are defined as those natural and human attributes that satisfy our wants. A Resource is a source or supply from which we benefit.

Resources are the supply reservoirs for use by the family to achieve their goals. Each family has many resources. These could be human, or non-human or community resources, depending on their source and origin. The qualitative and quantitative aspect of resources is taken into consideration in meeting the needs to accomplish the desired goals. The word resource signifies a means of supplying a want. They are a means of an end, something on which one can draw upon to achieve their goal. Resources are an integral part of the management process. The way in which the resources are handled reflects the quality of life, each family enjoys.

The concept of resource management involves:

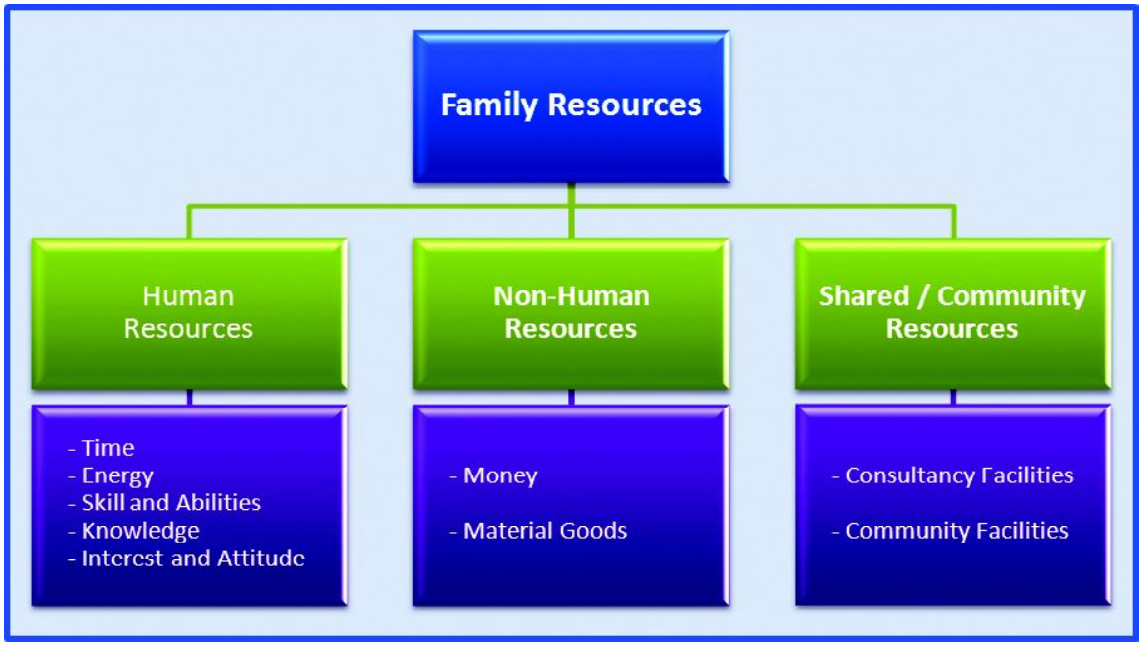
- Identifying the sources of resources
- Analyze the available resources
- Forecast the resource demand and supply
- Work on the specified objectives to reach the goals
- Identify the need and choose the best resource available

2.2 Classification of Resources

There are various classifications of resources. The most often used classification refers to human, non-human and shared resources. This classification of resources is based on the point of origin.

● Human Resources

Human resources are less tangible and cannot be easily determined. Some are more tangible than others. They are used for productive purposes. These include resources which are inherited in person i.e. they cannot be separated from oneself. Some of the human resources are more subtle than the material resources, e.g., knowledge, skill and abilities, time, energy, interest and attitude.



- **Time**

It is a fixed resource. It is the minute, the hour, the day or even the life time, which is available to all people, regardless of caste, creed, wealth or poverty. It is easily wasted and cannot be regained. So it is very important to spend time wisely. Managing time in a specific period and attaining the goal is very important. One has to plan continuously, to be able to utilize the time to finish the desired task.

- **Energy**

Energy refers to the capacity to do work. It is a basic requirement of man for the maintenance of life growth and physical output. It is needed for doing all household and other tasks. It is needed to carry out all the vital physiological and metabolic activities such as breathing, blood circulation, digestion and physical activities as well. The amount of energy available to different categories of people varies widely. It is dependent primarily on the physical, mental, age, sex and health of the person.

- **Skill and Abilities**

Abilities are inherent or they can be acquired during life time through education or from other family members. Skills can be learnt through formal training and practice.

- **Knowledge**

Knowledge can be acquired with education, experience, training, awareness and empowerment. Knowledge is a valuable human resource and one should use it appropriately to meet the demands of the individual. Knowledge has no end and is learned at every step.

- **Interests and Attitude**

Interest means concern, if one is interested to perform the task, the work can be finished early and successfully. Attitude is one's behavior, can be optimistic or pessimistic.

(2) Non-Human Resources

Non-human resources are easily identifiable. They are essential for the achievement of most goals. But they are limited in their availability. Non-human resources in general are material goods and money. These comprise of one's personal possessions and family possessions.

- **Money**

Money means purchasing power. It is the medium of exchange. Money resource varies from individual to individual. It is important to plan the budget money.

- **Material Goods**

All the other materials like house, food, clothing, furniture etc are known as material goods which can be possessed utilizing money. All the material goods have properties and characteristics useful to individual or a group in meetin g their demands and to accomplish their desired goals.

- **Shared/Community Resources**

These are those resources, which are available for the society to avail facilities according to one's interest and need to attain their goal. For example availing health care from a public hospital, public schools, and consultancy services for various activities. It also includes those facilities that a family can use as these are a part and parcel of society e.g. library, roads, parks, markets, cinema etc.

Activity – 1

Think of your own self and make a list of the human resources you have

2.3 Characteristics of Resources

All resources have certain basic characteristics. There are similarities among all the resources. Some may be more useful in a particular management situation than the others but in each case one must have more information available about the potential of all available resources to be able to tap (use) and also conserve some of them effectively and efficiently.

- **All Resources are Useful**

All resources have equal importance and usefulness in resource management. Unless we identify the uses for them, it is not recognized as a resource. All resources have a satisfying power. According to Gross and Crandell, the usefulness or value of a given element may be recognized only in relation to a specific goal. Thus usefulness of a particular resource would vary for different goals. For example, money may be the most valuable resource for procuring a house, but to do well in a test, your intellectual ability counts most.

- **All Resources are Limited**

All resources are scarce; some are scarcer than the others. If all resources are in abundance, management would be unnecessary. The challenge for management lies in the scarcity of resources and still being able to achieve the family goals. All resources are limited both quantitatively and qualitatively.

The quantitative limitations can be ascertained with accuracy in cases where they could be measured. Time is a limited resource for many since no one can have more than 24 hours per day. We cannot save the time from each day for future use. Energy too is a limited resource; the amount of energy available varies greatly from person to person. We cannot set

the limits for energy but one can assess whether one is able to do the job within the energy limitation.

The limitations on resources also could be qualitative in nature. But quality differences cannot be easily measurable. The quality differences could be identified in material goods in terms of various characteristics as well as the different services available to communities.

- **All Resources are Interrelated**

Resource management in family deals with the usefulness of individual resources but with their interrelationship. People often have to use combinations of resources to achieve the family goals, by analyzing the pros and cons of resources mix, and used it in varying limits.

Time and energy could be conserved if proper equipment is used to save the labour. Interest and abilities not only determine what goods are needed to achieve desired goals but also how effectively other materials would be used.

- **Quality of Life is Determined by Effective Use of Resources**

In management of resources, the essential thing to consider is the use of resources and not just the acquisition of goods. The quality and quantity of resources we utilize is a determining factor in accomplishing the goals desired.

For example, if a student effectively used his or her own skill, ability and knowledge in a proper way only then he or she can achieve desired goal of getting academic position. This will subsequently change his or her future life.

Activity – 2

List the resources you would need in order to secure good marks and study well. Compare your list with others.

Summary

Resources are essential for achieving the family goals. They are material, human and community attributes that satisfy our wants. The management of resources involves knowing the quantitative and qualitative aspects, the type of resources, their function and allocation.

Non-human resources are more tangible and their importance is more frequently recognized than that of human resources, which are less tangible. Families and individuals need to be aware of their total resources in order to be able to make use of them fully. Human resources are the most needed, limited and important resources for carrying out management process in any task. Resources have some common characteristics. They are limited, have alternate uses, can be managed to become more productive and its use determines the quality of life.

Glossary

Resources: are cultural and human attributes that satisfy our wants.

Human Resources: are inherited in person

Non–Human Resources: comprise of one's personal possessions and family possessions.

Shared/Community Resources: are available for the society to avail facilities according to one's interest and need to attain their goal.

Model Questions

1. Define Resources
2. Classify Resources.
3. Mention Non–Human Resources.
4. What are shared or community Resources?
5. Explain the characteristics of Resources.

UNIT – 3
FUNDAMENTALS OF MANAGEMENT

Learning Objectives

Enable students to:

- Understand the concepts of Management and its process
- Take appropriate decisions in Management process to accomplish the desired goals

3.1 Introduction

Management is an essential component for an organization e.g. home, educational institution, business firm, hospitals etc. Every day, individuals and family groups make choices or decisions to use the resources to achieve their goals. Management is the activity of facing and solving problems. Management is a process of planning, organizing, controlling, evaluating the use of resources to accomplish goals. Management is the art of getting the best result from the use of all resources with the least effort to secure maximum welfare and happiness for all family members. Management working at its best, requires imagination and creative thinking.

The role of management in a family is to provide optimal development of individual members and famiZly. The process of management should bring about greatest returns in health, satisfactions and social usefulness to all members of the group. Management must be seen as a way of life and a manager should be prepared to coordinate social, cultural, economic and technical factors which would enrich family existence as well as to develop skills.

- **Definition**
  - According to Nickel and Dorsey, “Home Management is planning, controlling and evaluating the use of resources for the purpose of attaining family goals.

- According to Goodyear and Khobar, Home Management is the process of realizing values and goals through the effective use of human and non-human resources.
- Home Management according to Kortzin is a practical science.
- Home Management is the administrative side of family living.
- Management is defined as the mental process of utilizing the available resources to achieve what you want in life.
- Management is an integrated process which consists of some basic functions for achieving the objectives of an organization.

Need for Management

The term management conveys different meanings depending upon the context in which it is used e.g., management as an economic resource, management as an academic discipline and management as a process etc. with the changing environment. The need for management also becomes inevitable to identify and deal with problems which emerge from change. Effective management in the home depends to a large extent on the managerial ability, interest and leadership quality of the homemakers and also their ability to motivate the family members in the right direction for achieving desired goals since management plays a significant role in shaping all lives, it is essential to understand basic concepts of management in the home.

Home Management consists of a series of decisions and making up the process of using family resources. In this context family goals which brings maximum satisfaction to the family. Family goals are the concept of family values. Clarification of values is essential for decision making and defining goals. The resources families have are another important concept in home management. Management process is applicable for all resources and finally, the quality of life an individual achieves is dependent upon its use.

Activity – 3

List the qualities of a manager.

3.2 Management Process

Each day we use management process consciously or unconsciously. Sometimes we are not aware of the extent to which it affects the total process of daily living. There are choices which one is forced to make. In some cases, people follow very systematic procedures and in other cases they act on impulse. But in scientific management one has to make very conscious decisions to achieve what you want in life. Management is indeed a complex process. Resources are limited, but the goals are many, hence, struggle to strike a healthy balance.

Home Management is the practical application of the principles of the management to the home. It is the natural outcome of the human relationships in the home environment. It is necessary that all persons work together for a common goal, plan and share the responsibilities and thus organize and control the use of all available human and material resources.

The process of management means planning, organizing, implementation, controlling and evaluation of what one has in order to achieve what one wants for the family. Effective Management enhances one's chances of reaching the goals through wise decisions and effective use of resources to attain a quality of life. Every family sets its own goals and each goal can be ranked according to the priority of demands. Resources on the other hand, need to be assessed and analyzed and used accordingly to achieve the maximum of goals, for the happiness and satisfaction of all the members of the family.

● Steps in Management Process

Management process essentially consists of 5 steps – planning, organizing, implementing, controlling and evaluating.

ı Planning

Planning is the first step in the management process. It covers a wide range of decisions dealing with family activities, resources and changing

family demands. Because of its important role in management, planning is considered the key activity in the management process. It is a necessary for guiding action in meeting the demands of the family. It is essentially mapping out the courses of action to reach the goal. The need to develop a plan is derived from a felt need to resolve a problem or achieve something. The degree of satisfaction one attains will be dependent upon the completeness of the plan.

In order to develop a workable plan one must identify and clarify the demand, event, problem or goal. The inputs during this include one's values; standards and any information one has received. Planning is a series of decisions concerning the sequences of actions to be taken.

- **Making Plans**

A plan is a forecast of some future actions. It suggests the course and the method of action that are thought to be best for solution of the problem. In making plans decisions must be made as to what actions are necessary to achieve the desired objectives, why each of these actions is necessary, who is responsible for each action and when, where and how each action will take place. To determine these things, planners must search for available alternatives and then make their selection. Whereas in a family, more than one person is involved in making a plan, communication aids in coordinating activities and making plans should run smoothly. All plans should be made to fit the needs of the individual or family group; they should be flexible enough to meet necessary changes, as well as realistic in the use of available resources.

- **Kinds of Plans**

Various kinds of plans are used by home makers in arranging their daily activities but all may be classified as either long-term or short-term, having to do with either long term goals or short term goals.

Long term plans have to do with a sustained planning effort over a longer period of time. They give continuity to daily, weekly or monthly

plans. Many other plans cover shorter activities and take much less time to complete. These short term plans usually must be coordinated with long term plans.

The process of planning, deciding what to do, when to do and how to carry out the plans, basic knowledge is essential. Often the original plans have to be changed after a trial stage because some of the minor decisions would have not worked. In planning one has to essentially:

- Balance between amount of available resources and the demands made upon it.
- Ensure that the decisions made would be appropriate to the individual situations
- Make sure that plans are realistic and flexible.

● Organizing

The various plans made, call for a variety of activities and if these activities are to be carried out effectively, some form of organization is essential. Organizing consists of dividing and grouping of activities and assigning them to individuals. Organizing may be defined as the process of establishing the proper relationships among people, work, resources and channeling authority and responsibility.

In short, it refers to the division of labour, of assigning the various tasks planned to the different members of the family in relation to their resources (in the form of capacity, time, interest, skill etc.). Planning and organizing helps to use available resources more effectively. Emphasis should always be on saving effort, energy and time, besides money without compromising the quality of work. Planning and organizing prevents waste and helps to conserve money, time and energy.

● Implementing

After being drawn up and the resources being organized a plan needs to be implemented. Implementation refers to putting the plan into action, use or practice. The planner needs to observe, supervise and guide the

actions of all participating members. A plan is successful only after it has been given the right direction of action. When the plans are made; many times we find that there is inertia to get started especially if it is a big problem. In spite of having creative ideas and a good plan, implementation of the plan becomes difficult and there is tendency to give up. Here the energizing or initiating and sustaining the action would act as catalyst.

- **Controlling**

Controlling in the management process is the activity that aids in putting and keeping the plan in action. 'Controlling is concerned with making events conform to plans. This is the most challenging function in management which draws heavily on the art as well as science of management. The art of management is especially involved in the area of personal leadership, the effective understanding and motivation of the individual.

Controlling involves a careful observation of performance. Literally, it is checking work and performances to be sure that the procedure is moving in the planned direction. Controlling includes making changes when things seem to be getting off course. Such checking may concern the quality of the work, or costs in terms of either money or time, or again it may have to do with the feelings or the satisfactions of people.

Controlling calls for both leadership and joint action in the family if goals are to be attained. It also calls for flexibility in thinking and planning rather than a rigid and set pattern of action. It requires that group welfare be emphasized, not personal desires. Coordinating is another means of control. It helps to give individuals working together a feeling of security, an understanding of the total situation and of the necessity for cooperation if the best results are to be achieved.

Skillful direction and guidance are needed to help control the plan in operation. Regular checks make the plan easier to carry out. Regular appraisal of a plan in action at all stages is essential. Control helps to make a plan into a coordinated and workable whole.

l Evaluation

It is one of the most important processes of management. Its purpose is to assess what has been done, how effective the process was in relation to the goals achieved and also to see what were the factors which have affected the plan. This would form a guideline for modifying the plan or as a basis for future plans. Evaluation helps one to get away from set ideas towards one self and others to see a situation freshly. It is a step which involves a complete review of what has already taken place with an objective towards better management in the future. To be meaningful evaluation must be done in relation to goals or objectives set. It is a measure of growth and hence it has to be measured against the set standard. Goals must be specific and well defined to give clear cut guidelines for measuring the outcome.

Evaluation rightly takes place as a necessary preliminary to the next plan rather than the final. Then it becomes comfortable for a person to evaluate the performances objectively. In such case one can be always hopeful that the next plan may be improved. Evaluation sees beyond the momentary mistakes, confusions or changes needed to the excellence of accomplishment. Checking on the effectiveness or the efficiency of management requires analysis, honesty and objectivity. It requires a sound basis for judgment. In home management, the measure by which success or failure of a plan can be evaluated is the extent to which it has advanced the family's goals or specific objectives. The more definite and clear-cut purposes and goals, the more accurate the evaluation can be.

Activity – 4

Assume that you wish to arrange a farewell party for class XII students. Identify your resources and state the aspects that you will keep in mind at each stage of the management process in organising the party.

3.3 Decision Making

Decision making is inescapable in any phase of management and the quality of the decisions determines the quality of management.

Decision making occurs when there is some problem to be solved or some choice to be made. The making of decisions implies that there are some set goals towards which decisions are oriented. Decision making is the heart of management and requires time to complete it. It exists in every activity and deals with every subject. It can involve a variety of situations and problems from the very simple to the very complex.

- **Definition**

According to Nickel and Dorsey, "Decision making is the process of selecting a course of action from a number of possible alternatives in solving a problem.

3.4 Types of Decisions

Management is a mental process involving a series of decisions. This is the factor which differentiates management from mere performance of the tasks. A work is managerial in nature only when it calls for decision making.

- ***Individual Decisions*:** These are the decisions taken by self; they are also known as personal decisions. Decision are made by the person concerned because the individual will have their own preferences, choices, values and goals based on their personal standards. Individual decisions are self-made decisions, it is less time consuming and it's faster to choose the best alternative among the choices and put forth the same into action.

- ***Collective/Group Decisions*:** Collective decisions are taken collectively with the involvement of friends, family, relatives and community. As the name suggests a group of people will be involved and actively participate in the decision making process. As each member views may contradict at times, one needs to handle the situation with diplomacy without hurting anyone in a group. When conflict arises, the various levels and ways of resolving them based on facts and strengths of the decisions should be recognized. A suitable alternative, one which is fair and just and able to convinces the group with valid judgment, may be selected. This choice of alternative needs to be put forth into action.

Group decisions are not simple. It involves patience and good interpersonal communication and negotiable skills to handle the group. Different views and suggestions should be taken while considering the final choice of decision. It is time consuming and takes longer period to make a group decision.

- ***Routine Decision/Habitual*:** Routine decision does not need much thought processing because of past experience, systematic and organized way of working. This habit formation helps the individual to take routine and repetitive decisions as and when required without much effort and deliberations. It consumes less time to make a decision. This type of decision is a habitual behavior which is almost like a reflex action. These are routine actions related to daily activities. The choice is automatic because the criteria are well established. There is no conscious choice and the resultant action is spontaneous. E.g., making bed tea/coffee.

- ***Immediate decisions*:** Immediate decisions are also known as unprogrammed decisions. One cannot anticipate what will happen during different times. This type of decision making is more complex in nature. These decisions are made by individuals/group during crises and emergencies. For e.g. If Government announces that a village/town is prone to cyclone, immediately one needs to take caution and take immediate decision to move out from there to a safer destination by using helpline services. This is a complex and difficult situation one needs to act very quickly without wasting time on choices of alternative decisions due to time constraint during emergencies.

- ***Economic decisions*:** Economic decisions are made based on the availability and allotment of resources for attaining various goals. Two components are involved when the goals are multiple, related and have limited resources. One aspires for better living. Naturally the wants will also multiply and it leads to formulating many goals. These goals will be competing with each other. Each goal accomplishment needs allotment of resources. Based on the priority one must make economic decisions. In the preferential order the available resources most be utilized more

efficiently and economically and the goals accomplished on the hierarchy of preferences.

Assume one's multiple goals are

- Go for pleasure Trip
- Buy Medical Insurance for family members.
- Buy a car
- Buy household appliances

Among the above said goals, one must rank them according to the availability of resources and priority of goal defined.

3.5 Process of Decision Making

Managing family resources to attain desired goals is a series of progressive and interdependent mental activities. Decision making is called for when conditions have changed or a problem has arisen. The solution to any problem proceeds through certain steps or phases. Decision making usually involves the following steps:

- Defining and Identifying problem
- Identifying the alternative solutions
- Analyzing the alternatives
- Selecting of the best alternative
- Accepting the consequences of the decision.
- Defining and Identifying the Problem

● Defining and Identifying Problem

The first step is recognizing the fact that a problem exists that needs to be solved. Mere knowledge that the problem exists is not sufficient but one needs to identify it clearly, understand its details. The identification is made possible through symptoms. These symptoms need to be further analyzed. No problem can be solved by attacking it in isolation. Most symptoms hide the depths of a problem so one needs to analyze the

whole situation to prevent false conclusions and creation of larger problems. There is need to understand and identify the underlying factors of the problem instead of just being concerned with a symptom. This is possible only if there is a genuine desire to find the causes leading to the problem and the underlying aspect of the problem. A person's defense may be to deny the existence of any problem or to identify the problem incorrectly. Individual differences and age differences are observed to be some of the factors affecting the identification and understanding a problem.

- **Identification of Alternative Solutions**

As you recognize that a decision has to be made regarding a correctly identified problem, one begins to seek the relevant alternatives. Effective decision making occurs when you identify all the possible alternatives. This would enable you to make the best selection so that you won't regret later unless you identify possible alternatives, one cannot make a wise decision.

E.g.: Even in selecting your college, you must have considered several choices, in doing so you are essentially identifying the alternatives.

Identifying or generating alternatives varies with individuals. Factors such as awareness, intelligence, creativity and resourcefulness of an individual might be related to the ability to generate alternatives. Although it is important to have many alternatives, there should not be any confusion regarding the many varieties one can choose from. Then people tend to become ineffective decision makes resulting in no decisions or action.

- **Analysing the Alternatives**

This phase of decision making is very important and needs to be done very objectively. This is the process of mentally following through the consequences of each separate alternative systematically. This alone can facilitate effective decision making. Essentially one must list the advantages and disadvantages of each alternative. After identifying the alternatives, one begins to evaluate each one as to its possible feasibility

and its short term and long term consequences. This process utilizes a criteria one should develop to evaluate the alternatives. They are based on goals, values and standards which are yardsticks which one can evaluate and eliminate the alternatives that are not relevant or feasible.

At times one might find difficulty in foreseeing all the consequences of a particular alternative. An individual's feeling might change toward a particular alternative, or its feasibility. It definitely takes time to find and explore all the possible alternatives. But once you are able to assess each alternative in terms of the opportunity costs and benefits and the satisfaction one anticipates and can easily make the decision. The more extensive information one employs in evaluating the different alternatives, one reduces the risk factor involved in decision making.

- **Selecting an Alternative**

The fourth phase in decision making namely choosing one alternative among several ones is the crucial stage in decision making. In order to make this phase effective, accurate evaluation of the possible effects of the alternative is of utmost importance. On the basis of evaluation, one makes choice among alternatives. The choice one makes is his/her decision. In the future, consequences could be accurately foreseen. The goals of the family would become important criteria. One can eliminate a lot of alternatives which may not fit into the family context. Standards would be another set of criteria used to assess the extent to which decisions are successful in any decision making situations. Another aspect to consider is timing of the decisions. If the decision is delayed, even if it is corrected, it will lead to frustration and further deterioration of the problem.

- **Accepting Consequences of the Decision**

This is a fundamental phase of decision making which is often ignored by many. The ability to assess and accept the consequences of the decision is a great for making future decisions. This experience would indicate the final outcome of the decision making. The result of this decision could produce further evaluating criteria for future decisions whether it

is positive or negative. This would help you to refine the skills necessary to make rational decisions. The acquisition of the ability to make quick and effective decision is also an outcome which results from this step. It creates self-confidence in people to make effective decisions in the future.

Activity – 5

Plan for a class trip and decide on the venue, date, amount, number of students, transportation, etc. and evaluate your decisions

Summary

Management is an essential component of family living. It is a means by which the family identifies and deals with problems which emerge from change. It consists of a series of decisions making by the process of using family resources to achieve the family goals based on the values cherished by the families.

Today's families live in an open society interacting with the environment in all spheres of life. With the advent of industrialization, technology, education and democracy, a lot of changes are happening within the family and social system.

In this context, Home Management must be seen as valuable means for accomplishing growth and development of the family members. Effective management can find ways of reaching the objectives regardless of the limitations of our resources. Effective management recognizes the validity of the management process through which one is able to use resources more effectively, give direction to one's life and achieve the desired quality of life.

Decision making is a continuous ongoing process in solving problems of acquiring and using resources to achieve goals. The quality of the decisions determines the quality of management. The underlying factors from which the decisions stem from are values, goals, standards, past experience and the stimulus from the environment. The difference between just making decisions and effective decision making involves

recognizing and using the steps of decision making process. The making of decisions implies that there are some set goals towards which the decisions are oriented. It requires knowledge of essential information, application of the knowledge in life situation and also the willingness to know and apply. Decisions can be classified into individual decisions, group decisions, and habitual decision. In a family situations and in other group living, decisions tend to be developed by all concerned knowledge of the type of decision will aid in using the steps in the decision making process.

Glossary

Management – is an integrated process which consists of some basic functions for achieving the objectives of an organization.

Plan – A plan is a forecast of some future action.

Organizing – is the process of establishing the proper relationship among people, work, resources and channeling authority and responsibility.

Implementing – refers to putting the plan into action use or practice

Controlling – Is concerned with making events conform to plans.

Evaluation – is to assess what has been done.

Decision making – is the process of selecting a course of action from a number of possible alternatives.

Model Questions

1. Define Management.
2. What is a Plan?
3. Discuss the steps in Managerial process.
4. Define Decision Making
5. Explain the Decision Making Process.

UNIT – 4

MANAGEMENT OF TIME, ENERGY AND MONEY

Learning Objectives

Enable students to:

- Learn about the importance of time, money and energy as resources.
- Understand the management of time, money and energy.

● Time Management

Time is a most precious resource which once lost cannot be regained because, a moment wasted is a moment lost forever. Time is one resource that is available in equal amount to each and every person. Every individual has twenty four hours a day to complete the job and achieve goals. It is such a resource which neither can be borrowed, begged, lent or stolen. A basic awareness along with practice and perseverance are necessary for the proper utilization of time. It is rightly said “Time and Tide wait for none”. So every person should give importance to the value of time to get success in life. People who waste time fail to create an identity of their own.

Planning the wise use of time not only enables one to achieve more but reduces tensions and worries and also helps one to use time available for achieving a maximum benefit. One must be always conscious of time available and time needed to carry out the various jobs. Time is a useful resource not only for occupational activities but also for rest and leisure.

Time Management is

- Distributing the time more wisely and efficiently so that the right time allocated to the right activity
- Helps to make the wise and best use of time, as time is always a limited resource.
- Helps the individual to give importance to order of priorities.

- Important in every individual's life both personal and professional.

Need for Time Management

Time is one of the important resources in every one's life. Everyone has certain demands upon their own time and these demands must be met. Time should be used in an economical way in order to achieve individual and family goals which form the real objective of the time management.

Time has three dimensions namely, work, rest and leisure and there should be a proper balance amongst all of three. Balance means that there must be prescribed time for work, rest and sleep with sufficient leisure for some phases of living that will keep the individual emotionally stable and intellectually alert.

Time forms the frame works in which various activities and work takes place. Generally certain pattern develops in our activities and we tend to have parts of the day or time set aside for various activities. Management of time entails the making up of plans and their implementation. Most of the individuals follow some kind of time plan. Efficient management of time allows individual to enjoy life and be relaxed and productive. Inefficient management of time makes one tense and worried besides being unproductive. Time demands changes according to difference stages of family life cycle.

When time plans are made one can afford to find time for additional jobs. A well planned time schedule provides an individual with some free time to indulge in activities of their choice. It provides a balance between work and leisure. A tentative time plan must fulfill the following criteria.

- Maintain a balance between work and rest.
- Equal sharing of work by the members of the group.
- Distribute work and time among each member as per their capabilities and availability.
- Allot time for leisure activities.
- Allot time as per importance of task.

A time plan involves the following aspects:

- ***Types of activities*:** This involves listing of all activities that need to be carried out and then list according to importance and specific time of undertaking i.e. daily activities, weekly activities, seasonal and annual activities.

- ***Peak Loads*:** Activity at home is more concentrated in certain periods of time. These peaked periods are called peak loads. Efficient planning is essential to cope with these peak loads. The peak loads occurring daily, weekly or seasonal must be planned well to avoid fatigue.

- ***Leisure*:** Any time that is utilized for activities other than those of duty is termed as leisure. Leisure is essential to relieve fatigue and it provides a sense of relaxation and personal satisfaction. It provides good mental and physical well-being.

Time Plan

Time is one of the important tools used for accomplishing a task. Managing time involves both making plans and carrying them out efficiently. A time plan shows what one expects to do in a given period of time such as in the morning, or in the afternoon, during a whole day or a week etc. It also follows the order of sequence of the different activities and the time allotted for each of them.

A wise time plan not only enables one to achieve more but also reduces tension, worries and uncertainties. Plans must be properly implemented to be effective and to achieve maximum benefit. The biggest advantage of drawing up a time plan, means being aware of all the problems in advance, thus over coming delays.

Time allotted for occupational activities should include time for sleeping, eating, working and relaxing. The plan should indicate the time as well as time limit for achieving the goals. Before one plans, one should be able to estimate the quantity of time needed for an activity. Example one needs 7-8 hours of sleep or an hour for recreation an hour for personal care etc.

Learning to make and carry out daily time plans gradually establishes patterns that flow along automatically. Each individual with the help of family members can make an efficient and workable time plan and decide which activities to be carried out daily, weekly and seasonally based on goals. One needs to develop the habit of making time plan which allows activities to be performed within the allotted time. A time plan can be made for the full day, a week, a fortnight, a month or even a year. The plan for short periods of time may be just mental and a plan for a long period is usually in the written format.

While making a time plan the following procedure must be followed.

- Planning and organising the time
- Controlling the time plan
- Evaluation of the time plan

Planning and Organising the Time

- All the tasks to be completed in the given (allotted) period should be listed according to priority.
- The time required for all the tasks should be estimated.
- The schedule of all other family members should be taken into account and necessary adjustments made if required.

  The time plan written should be flexible practical and realistic. While making a time plan, peak loads must be given special attention. To manage the demands of peak loads periods, the following steps can be followed:

- All the family members must help is reducing the stress of peak load periods. Outside help can also be obtained if required.
- Work simplification techniques can be adopted.

Organization of work is planning, arranging and performing one's activities in such a way that they are completed in the allotted time with minimum energy expenditure.

● Controlling the Time Plans

A successful time plan should be workable and strictly followed. It should go on smoothly, it should be flexible and changed according to the needs and emergencies. For example, sudden arrival of guests, emergencies, illness etc. Skipping of one or more tasks and performing the ones which are necessary, helps to use time wisely and efficiently. The omitted tasks may be carried out during the leisure time.

● Evaluation of the Time Plans

Evaluation is a tool in time management. It is necessary for making and carrying out time plans, as well as in reviewing the results. If the task is completed on time, it proves its workability. The Time Plan which helps achieve the family and the individual goals to a certain degree of satisfaction without wasting the available resources or causing unnecessary tensions is a successful one.

The following table presents a sample of Time and Activity Plan for a student.

Time	**Activities**	**hrs./mins**
6.30 a.m.		Wake up
6.30 to 6.45 a.m.	Personal Care	00-15
6.45 to 7.15 a.m.	Prayer	00-30
7.15 to 7.45 a.m.	Breakfast	00-30
7.45 to 9.00 a.m.	Transit to college	01.15
9.00 to 9.10 a.m.	Conversation with friends	00-10
9.10 to 1.10 p.m.	Attending classes	04.00
1.30 to 2.05 p.m.	Lunch	00-55
2.05 to 3.55 p.m.	Attending classes	00-20
3.55 to 4.15 p.m.	Leisure	00-20
4.15 to 5.30 p.m.	Transit to home	01.15
5.30 to 6.00 p.m.	Personal care	00-30
6.00 to 6.30 p.m.	Tea	00-30
6.30 to 7.30 p.m.	Recreation	01.00
7.30 to 8.30 p.m.	Study time	01.00

8.30 to 9.30 p.m.	Dinner	01.00
9.30 to 10.30 p.m.	Study time	01.00
10.30 p.m.	Bed time	08.00
TOTAL		**24.00 Hrs**

- **Advantages of Time Plan**

  It helps:

  - To complete the tasks on time.
  - To achieve the goals of the individual and the family.
  - To discuss the problems in advance.
  - To face unexpected and unforeseen emergencies.

However good a time plan may be, it requires to be reviewed and evaluated from time to time, to ensure that goals of all members of the family are being achieved to the satisfaction of all. Time also needs to be budgeted like money for its best use.

Activity – 4.1

Make a detail time plan for a wedding day

4.2 Energy Management

Energy is the capacity or ability to do work. Human beings obtain energy from the food consumed. The amount of energy available for human beings to do any kind of activity varies from one individual to another and to the same individual from time to time. It also depends on the physical, mental and economical status of an individual.

The food which gives energy to our body is liberated through chemical reactions in the body.

Energy is needed by the body for:

- Performing the various physical and mental activities
- Basal metabolic process
- Growth and Development
- Maintenance of uniform body temperature

Calorie is a unit for measuring the energy. The energy is measured in terms of oxygen consumed by the body. Energy needed by an individual depends on various factors like age, sex, activity, body composition, basal metabolic rate (BMR) etc. The calorie requirement per day by a person is calculated on the basis of what his body requires while resting and performing work (energy cost). Light work like sewing, sweeping, knitting and moderate work like ironing, climbing stairs, kneading dough requires about 10% to 15% additional energy. Heavy work like washing clothes, mopping and scrubbing grinding etc. need about 15% - 20% additional energy.

For efficient management of a home, family members must have a clear idea of quality and quantity of energy requirement for various activities to be performed. They must also give importance to the order of priorities and plan accordingly. The energy consumption for each activity, helps one to plan the energy requirement more rationally for light, moderate and heavy work accordingly in the daily plan.

Need for Energy Management

To use energy efficiently, the individual needs to understand the following:

- The relation of energy to the different stages, in the family life cycle.
- The energy cost of the various household and occupational activities.
- The most fatiguing physical activities.
- The form and effects of fatigue.

Energy demands during different stages in the family life cycle

Different stages of life cycle demands different amount of energy. Sometimes, the home maker has too much of work load on her and there are certain periods when she is free. Therefore, the relation of energy expenditure of different phases of life cycle are as follows:

- ***STAGE I -*** In the first stage, the demand for energy is low since a family (nuclear) comprises of husband and wife. If the wife is employed then her energy demands will be higher and she needs to balance between her professional and domestic work.

- ***STAGE II -*** In this phase there is great increase for energy demands, because children are small. Bringing up children and all the other home activities take more time due to additional work load.

- ***STAGE III and IV*** - In these stages of life the work load is very high, as the children are in school example-nursery, primary and high schools. To meet the additional requirements of children, the demand for energy of the home maker increases both inside and outside the home. This stage of life cycle demands highest activity for both the children and the family.

- ***STAGE V*** - When children grow up and reach college level, they become less dependent resulting in lessening the work load of the home maker. Her individual responsibilities are further reduced when the children are married off and independently settled. This stage saves the sufficient amount of time and energy of the home maker to carry her work outside the home more comfortably.

- ***STAGE VI -*** At this stage of life the energy demand diminishes and the person is unable to do much work.

The Energy Cost of Household Activities

Whenever a person takes a type of a job, it requires several types of efforts - they are as follows:

- ***Mental Efforts*:** Required do any task even if it is a routine activity. For example- cleaning, cooking, dressing, and washing clothes and utensils. Although these types of jobs are performed daily, still one has to think about the way to perform them.

- ***Visual Efforts*:** Although we are not aware, every task performed involves visual efforts. For doing any task, movement of eye muscle and adjustment of vision to the objects at different distance and lighting condition take place continuously, our eyes need to direct the movement of our body parts, hands and feet.

- ***Manual Efforts*:** This type of effort is required for doing all types of household and occupational activities like cooking, mopping, washing, cleaning, dusting, ironing, carrying things, pulling, pushing and attending the office work.

- ***Torsal Efforts*:** These involve movement of the torso and hence termed torsal efforts. These include bending, leaning, raising, turning, stopping, sitting, knitting etc. These are required for doing more strenuous jobs.

- ***Pedal Efforts*:** Few tasks at home involves using one's legs, which includes pedal efforts, example-standing, walking, climbing stairs and moving. These are very necessary for home making and recreational activities. Since the whole body needs to be moved around, these activities demand heavy energy.

From above all the household activities it is clear that a person requires a combination of more than one type of efforts to perform different tasks. In order to have well balanced energy expenditure patterns, home maker needs to know the energy costs of various activities and also those which are most tiring.

The amount of energy required to perform a task is measured in terms of 'oxygen consumed by the body per minute' for the purpose of oxidation of food for release of energy. The energy value of foods and the energy exchanges in the body are expressed in terms of 'calories'. Each calorie is the amount of heat required to raise the temperature of one gram of water through 1°-C. Calorie is also termed as Kilo Calorie (KCal) is equivalent to 1000 calories. The energy requirement to perform any task is termed as its 'Energy Cost'.

According to the World Health Organization, the energy expenditure (KCal per hour) by men and women for

- Light work is 150 and 100 K Cal
- Moderately active work is 175 and 125 K Cal
- Very active work is 240 and 175 K Cal and
- Exceptionally heavy work is 300 and 225 K Cal respectively

It is necessary that one is aware of the energy consumption for every task, as this helps one to plan more rationally about energy requirements and thereby alternate light, moderate and heavy work accordingly in the daily schedule.

Activity 4.2

Observe and record the peak and low energy levels experienced during the day and analyse.

4.3 Money Management

Money is one of the important resource and a major concern of a family is how to utilize it more wisely and efficiently in order to achieve the best benefits from it. Each one has to incur some expenditure of his own. To meet this expenditure money is earned through different sources. Money consists of Coins, Notes, Currency etc.

Money is a major resource available for managing a home. It can be measured more objectively. The amount of this resource varies from person to person, for the same individual; it also varies from one period to another. The important aspect of money as a resource is that it offers almost unlimited scope for multiplication. If one is prepared to work longer and harder there is every chance of earning more money. Money can also be saved from the period of abundance to a future period of scarcity. Money is the only resource which can be also be borrowed or lent.

Income

Income comprises of money, goods, services and satisfaction derived. In every field of life income plays an integral part. The income may be what is earned by way of salary or wages by one or more members of the family. It may also be supplemented by inherited land property, rent from houses, interest from invested money or profits from business.

***Family Income*:** Varghese et al., defines Family income as money or purchasing power earned by family members during a specific period of time plus the goods and services received or created in that time. Example goods like vegetables from kitchen garden, services like teaching children, doing household chores etc.

According to Nickel and Dorsey - "Family income is that stream of money, goods and service and satisfaction that comes under the control of the family to be used by them to satisfy needs and desires and to discharge obligations".

Sources of Income

There are different sources of income to a family in the form of monthly salary, wages daily/weekly, profits from business, rent from property, interest from money invested, pensions, gifts etc.

Types of Family Income

Three major types of family income are: Money Income, Real Income and Psychic Income

Money Income

According to Gross and Crandall, money income is the purchasing power or the flow of money available over a given period of time. Money income flows into the family in the form of Currency, Coins, Notes, Bank Drafts or Cheques, in the particular currency of the Country. In India the monetary standard is the Rupee. Money income received keeps changing from time to time and also received over period of time. It is for these reasons the money income is stated to be a flow. Money constitutes

a very important non-human resource. Money is valued by individuals and families because of its purchasing power over goods and services like food, clothing, shelter, educational services etc., some of which are vital for the survival of human beings.

- **Money Performs Important Functions**
  - It is a medium of exchange.
  - It measures the value or worth of a commodity or service.
  - It serves as a yard stick to measure the standard of living of individual and families as well as a society.

Money income is usually received in the form of wages or salaries, rent, interest, dividend or profit. Wages and salaries are payments or reward for any productive services rendered physically or intellectually. Example: gardener's services (wages) or bank manager's services (salary). These are money rewards for human ability expended in production. Rent is paid for using the land or property of another person, interest is paid for using the savings of another person. Companies pay dividends and businessmen make profit with successful business. Another component of money income is transfer payment. Majority of the transfer payments are in the form of welfare payments like maternity benefit disablement benefit etc. These are also referred to as social security benefit. Pension which is paid to persons who retire from service by their employees is a transfer payment as it is paid in recognition of their past service till their death.

- **Real Income**

According to Gross and Crandall "The flow of goods and services used or available to the family for the given period". Apart from money income, families may also receive real income. This comprises the flow of goods and services which a family enjoys in a given period of time. For example a house which is provided contributes to one's enjoyment although it is not accounted in the money income. Further there may be additions to the real income in a family, not in the form of cash, but a free amenities, for instance, the family may live in free quarters, enjoy free medical care

or get free education for their children. The size of the family is also a factor to be taken into consideration in determining the real income. A person drawing Rs. 10,000 per month who has one child is better off than a person drawing Rs. 20,000 but with two or more children.

Real income consists of both producer's goods such as machinery, raw materials, factory etc., and consumer goods such as fruits, vegetables etc. Both these types of goods have want - satisfying power in them. The concept of real income is very important for a family's living.

- **Psychic Income**

According to Gross and Crandall, Psychic Income consists of the satisfaction which persons derive from the real income, satisfaction derived from all material goods and services. The third kind of income is the Psychic Income, which can also be called as enjoyment income, experienced over a given period of time, through the use or consumption of real income or with the use of money income. It is the feeling of satisfaction which a person derives out of goods or services. Since the ultimate goal of one's life is to derive satisfaction from living.

Since real income is used directly it is called direct income whereas money income, which cannot be consumed directly for deriving satisfaction but has to be used as a medium of exchange for obtaining goods and services (real income) is called indirect income.

Thus family income has been defined on the basis of those various types of income as that stream of money, goods, services and satisfaction. All these come under the control of the family to be used by them to satisfy the needs and desires and discharges its obligations. The family uses its income not only to satisfy its needs and desires but also to pay for instance taxes, obligations which it has towards the government.

- **Ways of Supplementing Family Income**
- **Small Scale Home Industries**

The income can be raised by setting up any small scale industry at

home example- stitching, knitting, book binding, paper flower making, candle making, soft toy making, making papads, pickles, jams etc. Gardening, poultry, bee keeping, selling cosmetics etc. Most of the state governments and banks have floated schemes which provide incentives in the form of loans. Their agents impart training so that after attending short courses in a particular fields, they can start their own industry and can supplement their income.

- **Proper Distribution of Time and Energy**

We all have twenty four hours a day. By the proper use of time which can be utilized for other income generating activities. To achieve this home maker can plan her time before hand and can adjust her work accordingly. She can utilize her skills/ knowledge by the production of goods or may be shared with others in the form of tuitions, classes in cooking, make pickles and jams at home and then sell them, sewing, painting, music, handicrafts, interior decoration, knitting, making stuffed toys etc. She can open a nursery school/ crèche at home or by getting a short training she can open a beauty parlour or a boutique at home.

- **Income Generating Activity**

Women sometimes make pickles and jams at home and then sell those. Using their skills, time and energy while at home, they earn money to provide some income. Some women stitch clothes on order, some knit, make stuffed toys or give tuition. Any activity which helps in bringing in some extra money is called an income generating activity.

- **Part Time Job**

Taking up part time jobs for few hours or half a day etc., help in supplementing family income. Such jobs bring lesser amount of money as compared to the regular full time jobs.

- **Savings and Investment to Earn Interest**

An individual's savings can earn interest with further investment.

Activity 4.3

List down the different ways of supplementing family Income

● Budgeting

Budgeting is the first step in the money management. A budget is a systematic spending plan for money expenditure and saving over a period of time. It's success depends on its being a realistic which is based on past experience. Budgeting is the art and science of planning your income and expenditure. It is a record of past expenditures, and estimation and planning of future expenditures and the distribution of current expenses on various items, over a certain period of time. The family budget can be planned for a week, month or year; depending on the size of income and expenditure of the family.

● Meaning

Family Budget is an arbitrary estimate of future income from various sources and expenditure of the family on different items for a given period of time.

A budget is a plan for spending and saving within a given income for a definite period- say a week, a month or a year. In other words, budgeting is a financial plan for future expenditure.

According to Bigelow "It is a tool whose value lies chiefly in the process of thinking through goals, estimating costs and making choices among alternative uses of money".

● Types of Family Budgets

There are three types of family budgets.)

● ***Surplus Budget*:** When the income is more than the expenditure and there is saving for the family it is known as surplus budget.

● ***Balanced Budget*:** When there is neither saving nor deficit, the family budget is termed a balanced budget. In such cases, though the

family can work without taking loans but some money should be kept for the emergencies. So, in this case also either the expenditure needs to be cut down a little or the income to be supplemented.

- ***Deficit Budget*:** When the expenditure exceeds the income then it becomes a deficit budget. The deficit budget is not good for the family, since it can lead to borrowing. To overcome this problem the expenditure on the luxuries or other least needed items should be cut down, for example a housewife can save by employing part time helper than the full time. Another method is to increase the family income by having kitchen garden, stitching clothes at home or if time permits homemaker can take up part time job to supplement the family income.

Out of these three types of budgets, surplus budget is considered as best budget, therefore family budget planning should be aimed for this type of budget only as this leads to savings for the rainy day.

- **Importance / Advantages of Budgeting**
  - It serves as a financial guide for the family.
  - Helps to live within one's income.
  - It helps the family in spending the money carefully so that the expenditure does not exceed the income.
  - It helps to save money for unforeseen emergencies.
  - It helps in developing goods buymanship.
  - Budgeting facilities adjusting irregular to regular expenditure.
  - It helps in distribution and proper allocation of income for expenditure on different items, according to their requirement.
  - Since all the members in a family work together for the planning of a budget, it induces a sense of co-operation among them.
- **Steps in Drawing a Budget**
  - List commodities and services

List commodities and services needed by the family members throughout the budget period. Though, these may vary from family to family but the basic needs and the expenditure on these items remains more or less the same.

- Food
- Clothing
- Housing
- Education
- Transport
- Health Care
- Entertainment
- Savings
- Miscellaneous

● Estimate the cost of desired items

After listing the items and grouping them it is very important to estimate the cost of the different items. Check the prices at different markets.

● Estimate the total expected income

Before making the budget home maker is required to know the total income of the family from all sources. Families without fixed income, can estimate approximately the total amount of expected income. Therefore, the home maker should plan the budget in such a way, so that all the essential needs of the family members are satisfied. Luxuries and other unnecessary items can be postponed for some time.

● Balance the expected income and the expenditure

It is a difficult but very essential step as without this, there will be no use of making a budget. An effective budget should be a surplus budget, otherwise it is made surplus by cutting down the expenses on unnecessary

items and also by supplementing the income of the family by one or the other way.

- **Check the budget**

  Before implementing the budget, it should be checked to determine, whether

  - the needs of all family members have been met.
  - there is allowance for emergencies, fluctuations in prices.
  - all the bills can be paid as they fall due.
  - the budget is practical and can actually be carried out.

Activity 4.4

Plan a budget for yourself with your monthly pocket money.

Summary

Time is the most precious resource in every one's life. Time once lost cannot be regained.

Time management means distributing time more wisely and efficiently so that the right time is allotted to the right activity in the order of priority. Time has three dimensions namely work, rest and leisure. There should be a proper balance among all of three to ensure its effective management.

Time plan is one of the important tools used for completing a task.

Energy is the capacity or ability to do work. The energy consumption for each activity helps one to plan the energy requirement more rational for light, moderate and heavy work in daily plan. To get economic use of energy one needs to understand the following – the relation of energy to the stages in the family life cycle, the energy cost of household activities, the most fatiguing physical activities. The energy requirement to perform any task is termed as its 'Energy Cost'.

Income is a flow of goods and services, and satisfaction over a period of time. Income is of three types: Money Income, Real Income and Psychic

Income. Some of the important functions of money are, as a medium of exchange, measures the value or worth of a commodity or service, serves as a yardstick to measure the standard of living of individuals, families, as well as a society.

A budget is a financial plan for future expenditure. There are three types of family budgets-surplus, balanced and deficit budget. A good budget is realistic, simple, flexible and suited to the goals and resources of the family.

Glossary

Budget - A budget is a financial plan / guide for money expenditure.

Surplus - More

Deficit - Lack

Miscellaneous - Other expenditures

Peak loads - Peak loads are activities concentrated in certain periods of time.

Leisure - Free time that can be used for any activity other than work.

Fatigue - Tiredness caused due to physiological or psychological factors.

Time plan - A tool used for doing work efficiently.

Energy - Energy is the capacity or ability to do work

Energy Cost - The energy requirement to perform any task

Calorie - Calorie is the unit of heat used for measuring energy

Model Questions

1. Discuss time as a resource?
2. What are the factors which influence time?
3. What is meant by leisure?

4. What are peak load periods?
5. What is a time plan?
6. What are the advantages of time plan?
7. What is Energy? How can energy be managed
8. How do we get energy?
9. What is the function of energy in our body?
10. What is a calorie?
11. How is a calorie measured?
12. How is energy related to the different stages in the family life cycle?
13. What is the energy cost of household activities?
14. What are the types of efforts required by a person to perform any task?
15. What is an income?
16. Define the family income?
17. What are the different sources of income?
18. What are the types of incomes, write with examples?
19. What are the important functions of money?
20. What are the various ways of supplementing family income? As a student of science how do you supplement the income of your family?
21. Define a budget?
22. What are the different types of family budgets? explain them.
23. Write the importance of budgeting?
24. Enlist the steps in drawing a budget?

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UNIT – 5
CONCEPT OF FOOD AND NUTRITION

Learning Objectives

Enable students to:

- Become familiar with terminologies related to food and nutrition
- Understand the functions of food
- Develop an awareness regarding factors influencing food habits

5.1 Introduction

Food is a basic need for all living beings. Just as we cannot live without air and water, we cannot live without food. Food gives us energy to carry out our day-to-day activities and keeps all the systems in our body functioning well. Since food has so many functions to perform to keep us in good health, a study of the composition of various foods and the functions performed by these components is essential, if one has to enjoy good health. Food, nutrition and health are intimately connected aspects of our life.

5.2 Terms Related to Food and Nutrition

- **Health:** The word 'health' refers to the condition of the body. Good health implies physical, mental and emotional fitness and freedom from disease. The World Health Organisation (WHO) defines health as "a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity".

- ***Food*:** Food is an edible substance consisting of nourishing and nutritive components which sustains life, generates energy, maintains health, growth and reproduction.

- ***Food Science*:** Food science is a systematic study of the nature of food materials and the scientific principles underlying their modification, preservation and spoilage. All foods are chemical compounds that undergo

physical as well as chemical changes during processing, preparation, packing and storing. Food science is closely related to food chemistry, food microbiology, and food technology. To understand this, one should have the basic concept of science.

- ***Nutrition*:** Nutrition has been defined as food at work in the body. It means nutrition is the scientific study of food and its relation to health. Nutrition is a combination of processes by which all parts of the body receive and utilize the nutrients necessary for the performance of their functions and for the growth and renewal of all the components. Thus, nutrition is the result of the kinds of foods supplied to the body and how the body uses the food supplied.

- ***Nutrients*:** Nutrients are the components of food that supply nourishment to the body. They are needed by the body in adequate amounts in order to grow, reproduce and lead a normal, healthy life. Nutrients include Carbohydrates, Proteins, Fats, Minerals, Vitamins, Water and fiber.

- ***Nutrition Science*:** Nutrition is the science of foods, the nutrients and other substances therein, their action, interaction and balance in relationship to health and disease; the processes by which the organism ingests, digests, absorbs, transports and utilises nutrients and disposes of their end products. It is also defined as the area of knowledge regarding the role of food in the maintenance of health.

- ***Nutritional Status*:** Nutritional status is the condition of the body as it relates to consumption and utilization of food. The nutritional status of a person may be good, fair or poor. Adequate, Optimum and good nutrition are expressions used to indicate that the supply of the essential nutrients is correct in amount and proportion.

- ***Good Nutritional Status*:** Good nutritional status refers to the intake of a well-balanced diet, which supplies all essential nutrients to meet the body's requirements. Such a person may be said to be receiving optimum nutrition. The characteristics of good nutritional status are a well-developed

body, with normal weight for height, healthy skin, clear eyes, smooth and glossy hair, good appetite and good nurtured personality.

- ***Poor Nutritional Status***: Poor nutritional status is evidenced by undersized poorly developed body, abnormal weight, pale skin, rough and lustreless hair, poor appetite, lack of vigour and endurance for work and susceptibility to infections. Poor nutritional status may be result of poor food selection, irregularities in meal time, work, sleep and elimination etc.

- ***Malnutrition*:** Malnutrition means an undesirable kind of nutrition leading to ill-health. It results from a lack or excess or imbalance of nutrients in the diet. It includes both under nutrition or deficiency and over nutrition or excessive consumption.

- ***Under Nutrition*:** Under nutrition is a state of an insufficient supply of essential nutrients. An undernourished person is underweight. For example, insufficient intake of calories for prolonged duration or starvation results in protein energy malnutrition.

Activity

Illustrate using pictures a child who is:a. under weightb. over weightc. obese

- ***Over Nutrition*:** Over nutrition refers to an excessive intake of one or more nutrients, which creates a stress in the body function. For example, an excessive intake of calories results in overweight which can lead to obesity.

- ***RDA (Recommended Dietary Allowances)*:** RDA is defined as the nutrient present in the diet which satisfies the daily requirement of nearly all individuals in a population. The Indian Council for Medical Research (ICMR) has prepared Recommended Dietary Allowances for Indians. These recommendations are revised and updated at regular intervals based on suggestions from experts. This guide tells us the amounts of different nutrients we should consume daily.

● Food Composition Table

Most food contains more than one nutrient. The nutrient contents of foods have been determined by analysing these in the laboratory. The food composition tables give the concentration of nutrients in 100 g of the edible portion of the food. Foods are grouped in the food value tables, on the basis of the plant part from which the food is derived, for example, seeds, roots, leaves, fruits, etc. Animal foods are grouped on the basis of species and the product used. An Indian Food Value table is published as the Nutritive Value of Indian Foods by the Indian Council of Medical Research (ICMR).

5.3 Classification of Nutrients

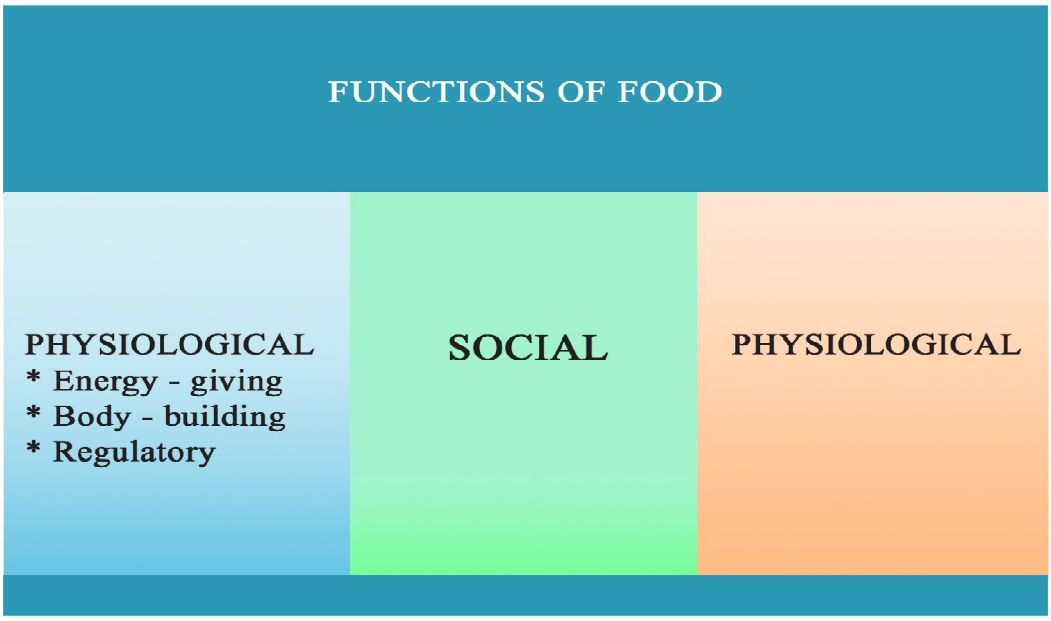
Based on the requirements of the body, nutrients are divided into two major groups- the macronutrients and the micronutrients. Major portion of the food we eat is composed of proteins, carbohydrates, fats and water. These are the macronutrients. Vitamins and minerals are required in minute amounts and are also present in food in very small quantities. These are classified as micronutrients.

The requirement for macronutrients is in grams (g), while the requirement for micronutrient is in milligrams (mg) and micrograms (ìg). Both macronutrients and micronutrients are equally important for good health, and one cannot enjoy good health without including all nutrients in the diet.

5.4 Functions of Food

Food occupies the first position among basic needs of human beings and is needed for the well-being of the individuals. Food provides the body with energy required for all human activities. Food is essential for growth, renewal of body tissues and for production of various substances which are needed for optimum functioning of the body. Since time immemorial, food has played a significant role in the economic, social, religious activities. Food has been a major source of joy for ages. The celebration of feasts, festivals and fairs are always accompanied by variety of foods and delicacies,

rich with dazzling colours, aromas and flavours. Each festival is known for its own special food. Special foods are an inseparable part of these celebrations (for example feasts, festivals, wedding ceremonies, social and religious occasions). Sweets are distributed to convey good news, be it a birth or betrothal in the family, an anniversary, success in an examination, landing the first/new job, promotion and the like. Region specific foods evolved through ages have their distinctive charm and



continue to surprise the food lovers even today. Intake of right kinds and amounts of food depending on individual needs ensures good nutrition and health. Food has physiological, social and psychological functions.

Activity

Collect and illustrate with pictures

a. Energy giving foods

b. Body building foods

c. Protective foods

Physiological Functions of Food

The physiological functions performed by food are:

- Energy – yielding
- Body – building
- Protective
- Regulatory

The basic function of food is to provide energy. The body needs energy to perform various types of activities such as sitting, standing, walking, running, performing all household, professional and recreational activities. Involuntary activities performed within the body also require energy. Energy is also needed to digest the food eaten into usable nutrients. The energy needed for various functions like to renew, grow, keep warm, fight infections and others is supplied by the oxidation of the foods consumed. Carbohydrates, fats and proteins are the energy-yielding substances. Carbohydrates (least expensive source) and fats are the main source of energy to the body.

Body building is an important physiological function of food. A newborn baby weighing 2.7 – 3.2 Kg can grow to its potential adult size of 50 – 60 Kg if the right kinds and amounts of food are provided. Our body is made up of millions of microscopic units called cells. When growth takes place, new cells are added to the existing ones and the existing ones also increase in size. Over a period of time, cells get worn out and die. These cells have to be replaced and this process is called repair. For body building, growth and repair, proteins are necessary.

The other important physiological functions performed by foods are the protective and regulatory functions. Protective refers to the role in preventing or fighting infections and to improve our body resistance to diseases. In case a person develops an infection or any other type of illness, the nutrients in food facilitate rapid recovery. The next physiological function of food is to help in the regulation of basic body processes. This includes regulation of various processes in the body, such as:

- Respiration
- Beating of the heart
- Maintenance of the body temperature at 98.4oF or 37oC.
- Muscle contraction
- Clotting of blood
- Removal of waste products from the body.
- Vitamins, minerals, proteins and water contribute to protective and regulatory functions.

Social Functions of Food

Most social events in our life are associated with food. Food is a symbol of hospitality and friendship throughout the world. Food and eating have social significance. It has been a part of every community's social, cultural and religious life. Food plays an important role in bringing people together. Region specific, elaborate and special foods are prepared, served and exchanged during festivals. Food is an integral part of festivity anywhere in the world. Special foods are distributed as benediction (God's blessings) during religious occasions at homes and at places of worship. Distribution of sweets, accompanies the good news that a family wishes to convey in their social circle. Special meals are served at occasions such as birthday's, naming ceremonies, marriages, anniversaries and any other social gathering Food has been used as an expression of love, friendship, social acceptance and respect for a person or people. Snacks and beverages served at meetings (formal or informal) and get-togethers create a relaxed atmosphere and help in connecting people. When people move to another region or country, they gradually adapt their traditional diets to the new geographic, economic and cultural environment. An individual who has good food habits throughout life is likely to be in good health and enjoy the benefits of a healthy life.

Psychological Functions of Food

Food is closely associated with emotions. Food satisfies certain emotional needs such as sense of security, love, care and attention. An

infant feels secure and comfortable, when the mother feeds the baby. A growing child gains confidence and a feeling of belonging when the child knows that there is food at home and a caring person to feed and take care. A child may accept or reject food to draw attention of his parents and family members. Familiar foods make us feel secure and comfortable, especially when one has to eat away from home. During periods of scarcity and natural calamities, people feel reasonably secure when they have enough food stored up to satisfy their hunger and to take care of them. Sharing of food is a token of friendship and acceptance. Most people try out new foods. With time and repeated experience the new foods become familiar and new tastes are developed.

5.5 Food Habits

Food is an integral part of human life. Food for consumption and better acceptance should have a proper appearance, colour, juiciness, texture, odour and taste. Food habits are acquired or learned food preferences. Food habits are influenced by economic, geographic, social, cultural and other factors. Food habits do not remain the same always. They change with - age; according to the need to adapt to a new environment; to new attitudes and to new values. The pattern of diet followed during growing years helps the person to achieve the maximum genetic potential for their physical and mental development. In case of adults, food habits help in delaying or preventing the onset of diseases like obesity, hypertension, diabetes mellitus and deficiency diseases. Food habits determine the nutritional status of a person. Teaching children the meaning and importance of good nutrition helps them develop good eating habits in their early years. These good eating habits will help them to lead a healthy life.

● Factors Affecting Food Habits

Food habits are shaped from an early age and are influenced by various factors. The factors affecting food habits are:

- Economic influence
- Geographic influence

- Social influence
- Influences of family on child's food habits
- Social influences outside the family on child's food habits
- Influence of television viewing on the food habits
- Cultural influence
- Food preferences and food habits
- Knowledge about nutrition

- **Economic Factors**

People enjoy eating food. Income influences the variety, choice and also the amount of food that may be purchased from each of the food groups. People select, buy, prepare and consume food to sustain life. The price of a food is not necessarily an indicator of its nutritional value.

- **Geographic Factors**

Monotonous food habits and ignorance about locally available food is a major reason for widespread malnutrition. Man depends on environment for his food. The type and amount of resources available in a given region determines the food pattern of a society. Foods that are commonly and easily grown within a specific region become a part of their regular meals. However modern technology, new agricultural practices and advanced transportation methods have greatly increased the year- round availability of many foods, anywhere at any time.

- **Social Influence**

Food intake and food habits are influenced by the societal norms where we live. Effects of social environment on the food habits of children can be due to:

Influences of family on child's food habits Family food habits greatly influences child's eating pattern. Parents influence the food and eating habits of their children by following healthy food preferences and habits. Studies among school children, indicate that regular habit of eating

breakfast has a beneficial influence on attention, concentration, memory and school achievement.

Social influences outside the family on child's food habits**The majority** of children spend most of the day at "school" or in "after school activities". During their interaction with peers and friends, they may influence each other with regard to food habits.

Influence of television viewing on the food habits: Viewing television during mealtimes is not advisable. Misleading food advertisements may lead to unhealthy food preferences. Excessive use of Television, Computer, Internet also limits a person's physical activity level.

Activity

Illustrate using pictures Social activities or Festivals showing exchange and distribution of foods.

- **Cultural Influence**

Food is an integral part of man's culture. It has many different meanings and symbolisms at various stages of life. Menus, method of eating and food preparation methods vary depending on culture of a particular society.

- **Food preferences and food habits**

It is essential that healthy food preferences are encouraged and promoted from early childhood, in order to establish healthy food habits later in life. Obesity and poor eating habits are closely linked. "Faulty food habits" leads to various diseases like obesity, diabetes, heart diseases etc.

- **Knowledge about nutrition**

Nutrition education can have a significant effect in promoting healthy eating habits. Eating too much becomes a habit for many people. This may be due to ignorance about healthy foods and nutrition. When people become aware about nutrition and healthy eating, they develop good food

habits. Schools need to educate parents and children on how to live a healthy lifestyle that includes proper nutrition. Healthy eating is essential for students to achieve their full academic potential, mental growth, and lifelong health and well-being. When children do not receive proper nutrition, they are unable to reach their full potential.

Summary

Food is the prime basic need for existence. Food is necessary for optimal human growth and maintenance of health. Most foods fulfil more than one function as they are complex mixtures of a number of substances. Food gives us energy, builds and maintains our body, and regulates the innumerable functions which take place in our body. Apart from the physiological function, food adds pleasure to our life and helps fulfil our emotional and social needs. Food is much more than a substance supplying nutrients for health. It helps to bring people together and also serves as a means to express emotions and feelings. Economic conditions, geographic factors, social setting, culture of a group, individual food preferences, knowledge about nutrition and external influences, determines the food habits of people.

Glossary

- Appetite: Refers to a perceived desire for food; state of hunger.
- Calorie: The unit of measuring energy.
- Deficiency: A state or condition caused due to inadequate dietary intake of one or more nutrients in the diet.
- Delicacies: Special dishes usually prepared for certain occasions.
- Diet: Refers to the foods you eat and drink during the course of a day.
- Edible portion: suitable for eating portion
- Eating pattern: The number of meals and the type of foods served.

- Growth: Changes such as increase in size and number of cells
- Hunger: Compelling need or desire for food; the painful sensation with contractions of the stomach or state of weakness caused by need for food.
- Menu: List of food items (dishes) included in a particular meal.
- Obesity: The term is applied to person whose weight is 20 percent or more above desirable body weight, having excessive amount of fat tissue.
- Oxidation: The process of chemical combination of a substance with oxygen.
- Tissue: A number of similar cells in the body together form a tissue.

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Model Questions

1. List three “functions of food”
2. Mention the physiological functions performed by food
3. “The body needs energy”-Give two reasons
4. Write a short note on “body building” and “regulatory” functions of food
5. Food is closely associated with emotions – Explain this statement by giving examples
6. List down factors which affect the food habits of an individual

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UNIT – 6
BASICS OF NUTRITION

Learning Objectives

Enable the students to

- Understand the role of Nutrients in the body.
- Identify the food sources of nutrients.
- Relate the function of each nutrient to a state of deficiency or excess.

6.1 Introduction

Food is the prime necessity of life. The food we eat contains nutrients which nourish the body. Food is required for growth, development and to lead an active, healthy life. A diet should be planned based on sound nutritional principles. Information is needed about the importance of various nutritional constituents which are present in food stuffs for planning a good diet. Food contains Carbohydrates, Fats and Proteins in different quantities.

6.2 Carbohydrates

In Indian diet, about 70-80% of energy required by the body is supplied by Carbohydrates. There are practical reasons for the universal use of carbohydrates in diets. The yield of cereals, the primary source of carbohydrates are higher in per unit area. Therefore they are widely available and are a good and affordable source of energy. They are easily packed and have a long shelf life in dry storage. Carbohydrate rich foods are easy to prepare.

- **Composition**

Carbohydrates are synthesized by green plants using solar energy, water from the soil and carbon dioxide from the air. Carbohydrates contain carbon, hydrogen and oxygen. General formula of carbohydrate is $Cn(H_2O)n$ where n= no. of molecules.

- **Classification**

Carbohydrates are classified as:

- **Monosaccharide (Single sugar unit)**

Monosaccharide's are the simplest form of carbohydrates. Mono means single. Monosaccharide's contain 2 to 6 carbon atoms and are termed as biose, triose, tetrose, pentose, hexose depending upon the number of carbon atoms. Examples of monosaccharide's are:

Glucose (dextrose): which is available in fruits, vegetable, honey

Fructose (levulose): which is present in many fruits and honey

Galactose: which is available only on hydrolysis of lactose

- **Disaccharides**

These contain two saccharide groups per molecule. Disaccharides are:

Sucrose (Glucose + Fructose): which are present in Sugar cane, beet sugar

Maltose (Glucose + Glucose): Which are present in sprouted and malted grains, acid hydrolysis of starch

Lactose (Glucose + Galactose): Milk is the only source.

- **Polysaccharide**

These are composed of many molecules of monosaccharide's linked together in a chain. The important Polysaccharides in human nutrition are:

Starch: It is available in Cereals, Pulses, roots, tubers, vegetables and unripe fruits

Glycogen: It is stored in liver and muscle. It is involved in hormonal control of blood sugar. Glycogen is the storage form of carbohydrates in the body.

Cellulose: It is present in cell wall of vegetables, fruits, cereals, nuts, wheat bran etc. Pectin is found in the ripe fruits and have the capacity to absorb water and to form gels, a useful property for making fruit jellies.

Activity

List the different types of fruits and vegetables rich in carbohydrates.

- **Sources of Carbohydrates**
- **Plant Sources**

Cereal Grains: Rice, Wheat, bajra, corn, barley, jowar, ragi contain large amount of starch. In addition they also contain some amount of proteins, minerals, vitamins.

Vegetables: Roots, Tubers and seeds contain large amount of carbohydrates. Starchy legumes, beans, peas, yam, tapioca and potatoes contain large amounts of carbohydrates. Green leafy vegetables contain low levels. Sugars present in fresh vegetables change to starch on storage. Onions do not contain starch.

Fruits: Dry fruits contain large amount of carbohydrates. Starch is present in some raw / unripe fruits. It is slowly converted to simple sugar. For ex: Starch in raw banana gets converted to sugar on ripening. Fruits also contain some cellulose and pectin. Nuts contain 10 – 20% Carbohydrates.

Sugars: The ordinary house hold sugar, ground sugar (powdered) corn syrup and honey are the concentrated source of sugar but do not supply any other nutrient in addition to calories. Jaggery contains some minerals in addition to sugars.

- **Animal Sources**

Animal sources do not supply appreciable amount of carbohydrates, except milk which supplies lactose. Glycogen or animal starch is stored in the animal's liver, but it rapidly degrades. Small amount of glycogen may be found in meat, fish and poultry.

Activity

Illustrate with pictures four sources of cereals

- **Functions of Carbohydrates**
- **Source of Energy**

Carbohydrates supply energy for immediate use by the body. One gram of Carbohydrate when oxidized provides approximately four kilo calories (Kcal). It is the cheapest source of energy.

- **Protein sparing action**

When carbohydrates and fats supplied to an individual to meet the demands for energy, proteins are spared for the growth and repairs which is known as 'Protein sparing action'. When carbohydrates are not adequate to meet the needs of an individual, proteins are used for energy.

- **Regulation of Fat Metabolism**

Some carbohydrates are required so that oxidation of Fats can proceed normally. When carbohydrates are severely restricted fats are metabolized faster but it is not oxidized completely.

- **Conversion of Carbohydrates into Fats**

After fulfilling the energy demands and filling the stores in the liver and muscles, extra ingested carbohydrates are converted into fats and stored in adipose tissues. These stores of fat could be used for giving energy in emergencies.

- **Role of Gastrointestinal Function**

Lactose is concerned with the growth of bacteria in the small intestine. It also facilitates the absorption of calcium. Some bacteria are useful in the synthesis of certain B-Complex vitamins. Pectin and cellulose help in the stimulation of gastrointestinal tract. It gives bulk to the intestinal tract by absorbing water.

- **Central Nervous System**

Glucose acts as a source of energy for the brain. Brain tissue in glucose deficiency experience semi-permanent or permanent change in

the cells in a very short time. Low blood sugar for a long duration can cause permanent damages in the brain.

- **Normal Function of Heart**

The efficiency of heart as a pump depends upon carbohydrates for energy. The carbohydrates are supplied from the blood sugar and glycogen stored in heart muscles. The reserve store can be utilized in any emergency. Anginal pain is experienced when heart's energy is diminished, due to low blood and oxygen supply, along with low levels of stored glycogen levels in its tissues.

- **Muscle Contraction**

Energy is required for movement of muscles. Carbohydrates are the cheapest fuel for it. Only a certain amount of Glycogen reserves of muscles are utilized for being converted into energy.

- **To add taste, flavor and variety to the diet**

Some of the carbohydrates being sweet make food tasty. When carbohydrates are cooked they produce flavor that enhances the appetite.

- **Daily Requirement of Carbohydrates**

A minimum of 100 gm. carbohydrates are needed in the diet to ensure the efficient oxidation of fats. Most diets supply more than this amount. If the carbohydrates consumed in excess of the body's need, the excess is converted into fat and is stored as reserve. No daily allowance has been fixed for carbohydrates by ICMR. As it is the cheapest source of food energy, it supplies up to 80% of the calories in the low cost diets in India. Carbohydrates should provide 60-70% of the total calories in the diet and the remaining calorie requirement is met by fats 20% and proteins10%.

- **Deficiency of Carbohydrates**

Generally there is no deficiency of carbohydrates in the diet, because carbohydrates are found in different forms in the diet. The deficiency occurs when an individual is fasting. Carbohydrates sources are rapidly exhausted as the body contains reserves of less than 500 gms. If there is deficiency then the effects are as follows:

- **Lack of energy**

If carbohydrates are deficient in diet, the individual will not be able to do physical work and will be tired soon.

- **Weight loss**

When there is deficiency of carbohydrates in the diet, energy is derived from proteins and stored body fat, leading to wasting of muscles and weight loss.

- **Ketosis**

When there is inadequate supply of carbohydrates, energy is derived from stored body fat which is not completely oxidized to carbon dioxide and water, there by forming ketone bodies. The accumulation of Ketone bodies increases the acidity and reduces the alkalinity of the blood. This condition is called Ketosis.

- **Proteins used as energy**

When there is deficiency of carbohydrates, proteins are used as energy source depriving of their own important function of building and maintenance of cells and tissues of the body. Severe deficiency of carbohydrate leads to malnutrition also.

- **Indigestion**

In humans food cellulose referred as fiber, provide a source of roughage in the intestinal tract which helps normal peristaltic action of the intestine, absorbs moistures and provides bulk to stimulate normal evacuation of the large intestine. Lack of roughage in the diet causes indigestion and constipation.

- **Deficiency of B-Complex Vitamins**

Carbohydrates serve as a source of energy for the micro-organism that synthesis some B-Complex vitamins in the intestinal tract.

- **Excess in the Diet**
- **Obesity**

When the energy intake exceeds expenditure the excess is deposited as fat. Over a period of time, overweight, obesity can occur. Obesity is

known to be a predisposing factor for a number of health problems. It increases the risk of diabetes, hyper tension and cardio-vascular diseases.

- **Dental Caries**

If sugar remains in contact with the teeth, it tends to lead to tooth decay. If it is not checked it may lead to dental caries.

6.3 Proteins

The term protein meaning “to take first place’ was introduces by the Dutch Chemist Mulder in 1838. He defined protein as a nitrogen containing constitution of food and felt life was impossible without it. Next to water, Protein is the most abundant component of the body. About 50% of protein is present in muscle, 20% in bones 10% in skin and the remaining is present in other parts of the body. Amino acids are basic units and building blocks of proteins. Protein molecules are made up of amino acids in various proportions and arrangements. There are (22) twenty two amino acids widely distributed in proteins. The body can synthesis only some of these amino acids. But some amino acids cannot be synthesized by the body and these have to be supplied through the diet. They are called as essential amino acids.

- **Essential amino acids**

These amino acids which cannot be synthesized in sufficient amounts by the body and must be provided by the diet and are called as essential amino acids. The human adult requires eight (8) essential amino acids growing children require ten (10) essential amino acids. Examples: Methionine, Leucine, Isoleucine, Tryptophan, Lysine, Valine,

- **Non-Essential amino acids**

These are called as non-essential amino acids because the body can synthesize it in adequate amounts if nitrogen is present in the diet. Example: Glycine, Serine, Tyrosine

- **Composition**

Proteins are very large organic compounds. Proteins contain carbon, hydrogen and oxygen. In addition proteins contain about 16% nitrogen which is their unique feature.

- **Classification**

Proteins can be classified on the basis of nutritional qualities. They are as under:

Complete Protein: These contain all the essential amino acids in sufficient amounts. These help in growth and development and repair of body tissues. It has good quality protein obtained from animal source like egg, fish, meat and milk.

Partially Complete Proteins: These are those proteins which are deficient in some of the essential amino acids. These can repair the worn out cells but cannot help in growth and development of the body. These are available in cereals and legumes and nuts.

Incomplete Proteins: These are those proteins which are deficient is all of the essential amino acids. These are incapable of repairing and building tissues. Eg: Zein in Corn.

- **Sources**
- **Animal Sources**

These are complete proteins such as milk, meat, egg, fish and poultry which are good protein foods in both quality and quantity. Milk is valuable source of protein, though it does not contain a large quantity of protein the quality is excellent.

- **Plant Sources**

Good source of plant proteins are legumes, pulses, nuts and oilseeds. But their quality is low as compared to the animal sources, but combining two plant sources or combining an animal and vegetable source in one meal increases the nutritional value of the meal tremendously. All vegetable and fruits are a poor source of protein

- **Functions of Protein**
- **For growth and development**

The most important function of protein is to supply amino acids to

cells for continuous replacement of cells throughout the life. From conception to growth at various levels, foetus, infant, child and during pregnancy and lactation period protein is very essential.

- **For repair of tissues**

In our body tissues are not in a static position. Degradation and re-synthesis of protein and other nitrogenous compounds always take place in our cells. Tissue are broken down and new substances are continuously synthesized in our body. Muscles and other tissues, bones, cartilage also contain fairly high percentage of proteins. Our hair, nails and skin also contain protein. All body fluids except bile and urine have protein in them.

- **To supply energy**

Protein is the last source that the body utilizes for energy. From proteins like carbohydrates yield approximately 4 calories/gm. But the process of obtaining energy form proteins is not advisable as deamination of amino acids leads tremendous load on the kidney. Utilization of protein for energy is a waste which weakens the body in all respects, retards growth and reduces weight.

- **Formation of enzymes and hormones**

Proteins supply raw materials for the body to synthesize enzymes. Hormones like insulin is protein in nature. Digestive juices contain enzymes which are protein.

- **Formation of antibodies**

The resistance of the body against diseases is maintained by antibodies which are protein in nature.

- **Formation of blood and breast milk**

Proteins, perform highly specialized regulatory function in the body. Hemoglobin which is the main constituent of the red blood cells, carries oxygen to the tissues. In lactating mothers, proteins are required for the production of milk.

● Synthesis of Vitamins

Synthesis of vitamins in the body depends on amino acids which have specified and specialized functions in the body. For ex: Tryptophan an amino acid, is precursor of niacin.

Daily Requirement of Proteins: BY ICMR 2010

Group	Particulars	Body Weight	Protein
Man	SedentaryWork Moderate WorkHeavy Work	60kg	60gms/day
Woman	Sedentary Work Moderate Work Heavy Work Pregnant Woman Lactation· 0-6 months 6-12	55kg 55kg 55kg 55 kg	55gms/day 78gms/day 74gms/day 78gms/day 68gms/day
Infants	0-6mths 6-12mths	5.4kg 8.6kg	1.16gms/kg/day 1.69gms/kg/day
Children	1-3 yrs 4-6 yrs 7-9 yrs	12.9kg 18kg 25.1kg	16.7gms/kg/day 20.1gms/kg/day 29.5gms/kg/day
Boys	10-12 yrs 13-15 yrs 16-18 yrs	34.3kg 47.8kg 55.4kg	39.9gms/day 54.3gms/day 61.6gms/day
Girls	10-12 yrs 13-15 yrs 16-18 yrs	35kg 46.6kg 52.1kg	40.4gms/day 51.9gms/day 55.5gms/day

(5) Deficiency of Proteins

The protein deficiency is found in children between the age group of

1 – 3 years. The reason is due to exclusive breast feeding in the first year of a child's life. As the child grows his requirement also increases and quantity of breast milk is not sufficient. When daily requirement of protein is not met it starts showing signs of protein deficiency called "Kwashiorkor".

The Protein deficiency in adults may show the symptoms in the form of:

- Loss of weight
- Reduced Subcutaneous fat
- Anaemia
- Susceptibility to infection
- Frequent loose stools
- General Weakness
- Inability to sustain hard work
- Delay in healing wounds
- Oedema

- **Protein Energy Malnutrition (PEM)**

Protein Energy Malnutrition is the name given to various degrees of nutritional disorders caused by inadequate quantity of protein and energy in the diet. This is one of the most prevalent diseases in India. Such deficiency occurs mainly in children below five years of age, when they are

Fig 10.15: Nutritional marasmus in a 2 year-old child. Not the remarkable wasting of both muscles and subscuttaneous adeposity. The child had been only on a diluted formula. The parents were waiting for "annaprasana" ceremony to initiate solids,

weaned from mother's milk and the diet which is substituted does not supply sufficient protein and energy or protein. These diseases are called as Kwashiorkor and Marasmus.

Activity

Collect and paste the pictures of a child with Kwashiorkar and a Marasmic child.

- **Kwashiorkor:**

This Disease typically arises when after prolonged breast feeding the child is weaned on a traditional low protein diet. It generally occurs in the age group of children aged 1-3 years and is precipitated by an infection or more commonly by a series of infections. If the customary diet is limited in protein and calories, it leads to kwashiorkor.

Signs:

- Growth: The child's weight is visually well below standard for the age.
- Muscles and Fat: The muscles are wasted. This is noticed around

the chest and upper arm. The wasting around hips and legs is frequently noticed by oedema.

- Mental Changes: The child becomes apatheic and miserable.
- Hair: Hair becomes fine, straight and often show pigmentary changes.
- Skin: Changes in skin are usually noticed particularly in serious cases. In such cases the skin looks scarred, the legs, buttocks are also affected generally any part of the body may be affected.
- Liver maybe enlarged due to accumulation of fat – fatty liver.
- Gastro Intestinal System: Vomiting and diarrhoea are present, diarrhoea is always with passage of stools containing undigested food. Diarrhoea may be due to impaired secretion of digestive juices.
- Anaemia: The degree of anaemia and it's nature are largely determined by associated infection's and dietary deficiencies.
- Associated Vitamin Deficiency: Vitamin 'A' deficiency with xerophthalmia and keratomalacia occurs in serious cases of protein energy malnutrition.
- Oedema: Oedema is excessive accumulation of fluid in the intercellular spaces of the tissues.

- **Marasmus**

Nutritional marasmus is principally due to the consumption of diets markedly deficient in both proteins and calories. In some developing countries marasmus is of greater clinical importance than kwashiorkor. It affects infants under 1 year of age in contrast to kwashiorkor which mainly occurs between 1-4 years of age.

Signs:

- Retardation of growth and reduction in weight
- Wasting of subcutaneous fat and muscles which gives the infant old man's face with wrinkles.

- There is watery diarrhoea or semi-solid, bulky acid stools.
- In Contrast to kwashiorkor oedema is absent and characteristic changes are seen in the hair and skin
- Liver is not fatty.
- Dehydration.
- Associated vitamin deficiencies.
- Abdomen may be distended with gas but liver is not fatty.

Marasmic Kwashiorkor is the disease which shows mixed signs and symptoms of both kwashiorkor and marasmus.

6.4 Fats (Lipids)

Fat is an important component in the diet and serves a number of functions in the body. Fat is a concentrated source of energy and it supplies more than twice the energy supplied either by carbohydrates or by proteins. It also gives Palatability to the diet and retards stomach emptying time. Presence of fat in the diet is important for the absorption of fat soluble vitamins.

- **Composition**

Lipids are organic compounds which are made of carbon, hydrogen and oxygen. Besides these essential components, they contain other elements like phosphorus and nitrogen.

The main constituents of all fats are fatty acids. They consist of chains of Carbon atoms with a methyl (CH3) group at one end, a carboxyl (COOH) group at the other end. Fatty acids are “Saturated” or “Unsaturated”. A fatty acid is one in which each of the carbon atom in the chain has two

hydrogen atoms attached to it is known as saturated fatty acids. An unsaturated fatty acid is one which contains one or more double bonds of hydrogen.

Food Fats are a source of two groups of essential nutrients. They are Essential Fatty Acids (EFA) and Non-Essential Fatty Acids. (NEFA)

Essential Fatty Acids (EFA) : EFA are not synthesized in the human body, these are available only through diet and are required for important function in the body such as growth in the young, maintenance of normal healthy skin etc. Ex: lenoleic, lenolenic acid.

Non-Essential Fatty Acids (NEFA): These can be synthesized by the body and need not be supplied through diet. Palmitic acid, oleic acid and butyric are some of the non-essential fatty acids.

- **Cholesterol**

Cholesterol is a word we come across very often in advertisement of fats and oils, in relation to heart disease, vascular disorders and high blood pressure. Cholesterol is one of the sterols, is found in different concentrations in all animal tissues and blood and has several important functions in the body.

It is present in animal foods. It is synthesized in the body by the liver. The body normally synthesized about 2gm of cholesterol daily. The normal blood level of cholesterol is 150 to 200 mg / 100 ml at blood. The level of cholesterol increases in the body by the dietary intake of cholesterol rich foods like egg yolk, organ meats, shell fish and dairy fat. Therefore it is necessary to restrict their intake to prevent atherosclerotic conditions.

- **Sources of Fats**
- **Plants Sources**

All oils obtained from edible nuts and oilseeds such as Sun flower, groundnut, sesame (Til), Soya bean, Corn, Coconut, Palm, Walnut, Cashew, Pistachio, almond and other nuts are rich sources of visible fats.

Hydrogenated Vanaspati, and margarine are also rich source of fats. Cereals, pulses, fruits and vegetables are poor source of fat. If cereals and legumes are consumed in large quantities they contribute to the invisible fat in the diet.

- **Animal Sources**

Whole milk, pork, poultry, eggs, mayonnaise, fish, dairy products, butter, ghee etc are rich source of fats.

Activity

Illustrate using pictures of plant and animal sources of fat.

- **Functions of Fat**

Following are the functions of fat

- **To Supply energy**

Fats are the most important source of energy among all food stuffs. It gives double the amount of energy as compared to carbohydrate and proteins. 1 gram of fat yields approximately 9 kilo calories. Fat is a concentrated source of energy and by increasing fat content in the diet the energy intake can also be increased specially in children, pregnant and lactating mothers.

- **Source of essential fatty acids**

There are certain fatty acids which the body cannot produce. They are to be taken through the diet. Fats supply these essential fatty acids required by the body.

- **Source of Fat soluble Vitamins**

Fat soluble vitamins ‘A’, ‘D’, ‘E’, ‘K’ need fat for being soluble and for absorption in the body.

- **To protect vital organs of the body**

Fat is stored in the body in adipose tissues, they are the reserves of energy and acts as a cushion for the vital organs of the body like heart,

brain and kidneys also have a padding of fat around them, which protects them from injury and acts a shock absorber.

- **Helps in regulating body temperature**

There is a thin layer of fat beneath our skin which helps in regulating and maintaining the normal body temperature in winters and summers.

- **To add Flavour and taste to diet**

Fats present in the diet provide a characteristic flavour to the food. The taste of cooked food is also increased by adding ghee. Fried food has a special place in our diet.

- **Gives Satiety**

Fats improve palatability of diet and provide feeling of fullness i.e satiety. Fats take more time in digestion of food and delays gastric emptying time.

- **For healthy skin**

The deficiency of essential fatty acids leads to lustreless and dry skin which is known a 'phrynoderma'.

- **Fat supplies energy during emergencies**

Like carbohydrates fats are also source of energy. The energy needs are fulfilled when carbohydrates and fats are present in the required amounts. The stored fat provides energy, when there is need for energy during fasting and starvation.

ICMR Recommended Dietary Allowance of Visible Fat – 2010

Groups	Visible Fat gm/day
Man	
Sedentary Work	25
Moderate Work	30
Heavy work	40
Woman	
Sedentary Work	20

Moderate Work	25
Heavy work	30
Pregnant woman	30
Lactation	
0-6 Months	30
6-12 Months	30
Infants	
0-6 months	
6-12 months	19
Children	
1-3 years	27
4-6 years	25
7-9 years	30
Boys	
10-12 years	35
13-15 years	45
16-17 years	50
Girls	
10-12 years	35
13-15 years	40
16-17 years	35

- **Deficiency of Fats**

Effects of deficiency of fats are not visible at early stages because we get fats from different food stuffs. But if there is prolonged deficiency of fats it shows the following effects on the body.

- **Loss of Body weight**

Fats are the concentrated source of energy. When the diet is deficient in fats the fat stores are depleted and prolonged deficiency leads to loss of weight.

- **Deficiency of fat soluble vitamins**

The fat soluble vitamins i.e A, D, E, K need fat to be absorbed in the body as they are fat soluble in nature. Their deficiency affects the skin, vision, bones etc.

- **Dry Skin**

Deficiency of fats leads to dry and lustreless skin. There are skin eruptions and eczema. This condition is known as phrynoderma.

- **Lack of essential fatty acids**

Essential fatty acid deficiency, affects the body cells adversely. The mucous membranes of digestive system are affected leading to poor digestion of food.

- **Excessive Intake of Fats**

If the fats are taken in excess, these cause many harmful effects on the body which are as under

- **Obesity**

Excessive amount of fats cause gain in weight i.e. obesity. The excess amount is deposited under the skin and abdomen leading to obesity which in turn lessens the physical activity, further increasing the weight.

- **Cardiac (heart) Problem**

Excessive intake of fat in diet increases the level of cholesterol in blood. Excess cholesterol in blood gradually gets deposited under the lining of blood vessels, resulting in a condition known as atherosclerosis in which the blood vessels are narrowed and hardened. The coronary arteries supplying blood to the heart are affected and coronary heart disease results.

- **Possibility of stones**

Fats interfere with the absorption of calcium by combining with calcium to form insoluble calcium soap. This soap cannot be absorbed through the intestinal wall. With the increase of cholesterol there is possibility of forming gall stones.

- **Slow digestion**

  Fats slows down the digestion and absorption of food products.

6.5 Energy

Energy is a basic requirement of man for the maintenance of life, growth and physical output. Our body needs air (Oxygen), water and food. Food supplies the energy components (Carbohydrates, Fats, Proteins) as also nutrients (Vitamins and Minerals) which ensure their use in the body.

Energy is the capacity to do work. Just as a machine needs fuel to keep it operating, the body needs food to provide the energy to perform its various tasks. The energy of carbohydrates, Fats and proteins is made available to the body when these compounds are oxidized in the energy releasing reaction of respiration.

Activity

Illustrate with pictures, two high energy (calorie) snack foods.

- **Energy Value of Food**

All forms of energy are inter convertible. The energy value of food is expressed in “Kilo calories”. One Kilo Calorie is defined in terms of the amount of heat energy required to raise the temperature of 1 Kg of Water by 10C from 14.50C at normal atmosphere pressure.

The unit of energy which has been used in nutrition is the Kilo calorie. But, recently the International Union of Science and International Union of Nutritional Science (IUNS) have adapted ‘Joule’ as a unit of energy in place of Kcal (Kilo Calorie).

The energy value of food is measured with the help of calorimeter. In the laboratories by the use of special equipment called the ‘Bomb Calorimeter’ the energy value of Food measured. In this equipment, the heat given off by a food in direct combustion or burning is measured under controlled conditions.

Energy value of a food can also be measured indirectly by measuring the oxygen used in burning a known amount of food.

The average calorific values of nutrients determined by Bomb calorimeter are given below:

- Carbohydrates : 4.10 Kcal / gm
- Fats : 9.45 Kcal /gm
- Proteins : 5.65 Kcal / gm

The energy available from food in the body called the physiological fuel value. It is less than its fuel value given above because.

- Some partially oxidized products are excreted.
- Some food is excreted in undigested form.

So the physiological energy value i.e., the energy available to the body was calculated as

- Carbohydrates : 4 Kcal / gm
- Fats : 9 Kcal / gm
- Proteins : 4 Kcal / gm

● Components of Energy requirements

The human body's total energy needs can be subdivided into three separate categories.

- Basal metabolic rate.
- Physical activity.
- Thermic effect of food (Specific Dynamic Action).

Generally basal metabolism represents a person's largest expenditure of energy, followed by physical activity and the thermic effects of foods.

- **Basal Metabolic Rate (BMR)**

The energy metabolism of a subject at complete physical and mental rest and having normal body temperature and in the post absorptive state (ie 12 hours after the last meal) is known as basal metabolism.

Factors Affecting Basal Metabolic Rate (B.M.R)

B.M.R. is not same for all individuals and many factor affect the BMR. These are as under

- **Body Composition:** The BMR is directly related to the lean body mass. Persons with well-developed muscles will have a higher BMR than obese persons whose higher body weight is due to adipose tissue.
- **Gender:** Females have slightly lower BMR than males.
- **Age:** The BMR is highest during the first two years of life. It declines gradually throughout childhood and accelerates slightly in adolescence. Thereafter it decline continues throughout life with an average of about 2 percent per decade after the age of 21 years.
- **Body size and surface area:** BMR is directly proportional to surface area. Basal metabolism is most closely related to the body surface or area and less directly related to either weight or height of an individual.
- **Sleep:** The BMR in sleep is about 5 percent lower
- **Endocrine Glands:** Hypothyroidism decreases BMR upto 30% and hyperthyroidism may cause an increase in BMR upto 100% depending on the severity of the condition.
- **Pregnancy:** BMR increases by about 5% during first and second trimesters. During the last trimester the BMR increases by 12%.
- **Nutritional Status:** Prolonged under nutrition or starvation causes a reduction of about 10-20%.
- **Environmental Temperature**: In persons living in tropical climates, the BMR is about 10% less than those living in temperate zones.
- **Smoking:** Research indicates that habitual smokers when stop smoking have a tendency to gain weight. This may be caused by the fact that the nicotine taken in increases BMR by 10%

- **Energy Requirements for Various Physical Activity**

Physical activity includes both, the cost and quantum of activity as well as the type of activity namely

- Essential: economic or occupational
- Discretionary Activities: house hold tasks, social activities and activities aimed at maintenance of physical fitness.

- **Thermic Effect of Food**

The third category of energy requirement to be taken into account in estimating total energy needs is the energy needed to provide for thermic effect of food. It is also known as “Specific Dynamic Action” (SDA). The energy corresponding to the thermic effect of food includes the energy cost of digestion, absorption, metabolism and storage of nutrients within the body. In this as a result of the stimulation of metabolism increased heat production occurs from 1 – 3 hours after a meal.

6.6 Vitamins

The term ‘vitamin’ was coined from the words ‘vital amine’ as early scientists felt these chemicals which are vital for life, were amines. Vitamins were discovered one at a time from 1900 to 1950. Some as a cure for classic diseases such as beri-beri, pellagra and scurvy, while others were discovered after research on various body functions.

Fig: The Vitamin Wheel with food sources

Vitamins like carbohydrates, proteins and fats are organic compounds.

Unlike these nutrients, vitamins are required in minute quantities called as micronutrients. Vitamins have no caloric value but are constituents of enzymes which function as catalysts in metabolic reactions. Vitamins help to convert fats and carbohydrates into energy and assist in forming bone tissue.

- **Definition**

Vitamins is the term used for a group of potent organic compounds other than proteins, carbohydrates and fats which occur in minute quantities in food and which are essential for some specific body functions such as regulation, growth, maintenance and protection.

- **Functions of Vitamins**
  - Regulation and protection
  - Help in physical growth.
  - Vitamins help in the digestion, absorption and metabolism of carbohydrates, fats and protein. Thus the body gets energy and physical development takes place.
  - For health and activity.
  - Help in digestion
  - Help in maintaining mental equilibrium, (balance)
  - Protection from various diseases.
- **Effects of Vitamin Deficiency**
  - Following symptoms appear if there is deficiency of vitamins:
  - Loss of appetite.
  - Weakness, fatigue, irritation, restlessness.
  - Insomnia and lowered resistance against diseases.
  - Diseases of bones and teeth.
- **Classification**

Vitamins are grouped according to their solubility in either fat or water as fat soluble and water soluble vitamins.

- Fat-Soluble Vitamins: The fat-soluble vitamins are vitamin A, D, E and K. They require fat for their absorption and can be stored in the body. If their intake is poor, but body stores are ample deficiency symptoms will not be seen immediately.
- Water-Soluble Vitamins: The water-soluble vitamins are B-complex vitamins and vitamin C. Being water-soluble they are easily absorbed and the excess consumed is excreted in urine. They are not stored in the body.

Classification of vitamins

FAT SOLUBLE VITAMINS	WATER SOLULE VITAMINS
1. Vitamin A ı Retinol ı Carotene (precursor)	I. B-Complex vitamins 1. Thiamine (Vitamin B-1)
2. Vitamin D	2. Riboflavin(Vitamin B-2)
ı D-2: Calciferol ı D3: 7-dehydro Cholestrol / cholecalciferol	3. Niacin (Vitamin B-3) Nicotonic acid
3. Vitamin E· ı Tocopherol	4. Pyridoxine (Vitamin B-6)
4. Vitamin K Quinones	5. Cyanocobalamin (Vitamin B-12) 6. Folic Acid 7. Pantothenic acid 8. Biotin 9. Inositol 10. Choline

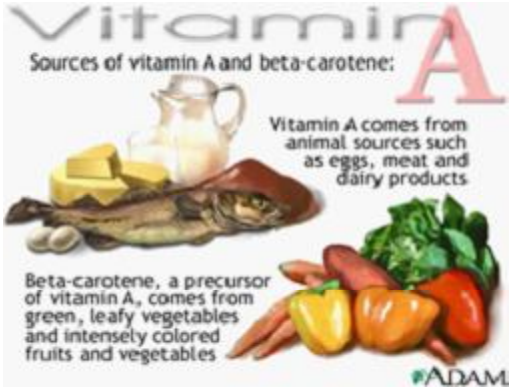
Vitamin A

Vitamin A is the generic name given to a group of compounds having vitamin A activity. These compounds are retinol, retinal and retinoic acid. They are found only in the fatty phases of foods of animal origin. Plant foods contain yellow, orange and red coloured pigments called carotene

which give colour to vegetables and fruits. Carotene pigments are converted to vitamin A in the body. i.e., carotene is a pro-vitamin or precursor of vitamin A.

It is soluble in fat, insoluble in water, and relatively stable to heat, acids and alkalis. It is easily oxidized and rapidly destroyed by UV rays.

● Food sources



Animal foods contain vitamin A but its precursors, carotenoid pigments occur extensively in vegetable kingdom. Fish liver oils are the richest sources, butter, cream, pure ghee are good sources while milk and milk products are fair sources.

In vegetable kingdom, green leafy vegetables, yellow vegetables and fruits are good sources of carotene.

- Green leafy vegetables - spinach, fenugreek, amaranth
- Yellow vegetables - carrot, pumpkin
- Yellow fruits - Apricot, peach, papaya, mango

Activity

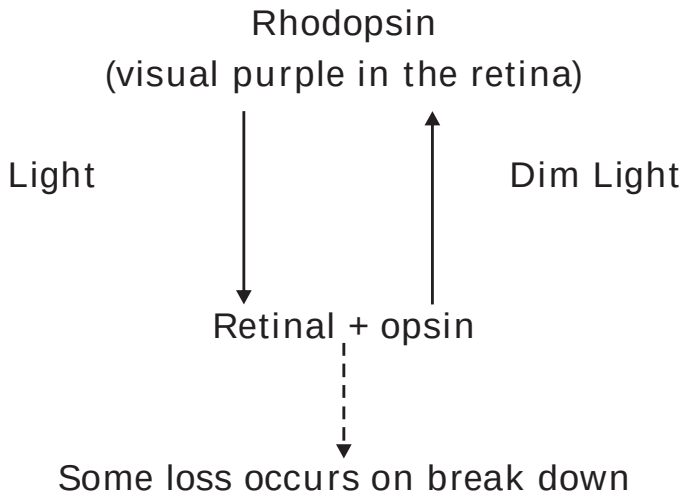
Collect the pictures of yellow and orange colored Vitamin A rich fruits and vegetables.

● Functions

Vitamin A performs the following functions:

● Vitamin A maintains normal vision in dim light. Rhodopsin or 'visual purple' is present in the retina of the eye. It is required for vision in dim light. It is formed when vitamin A combines with protein opsin.

In bright light rhodopsin absorbs light and breaks down into protein opsin and retinal. Every time rhodopsin breaks down, some retinal is lost. In dim light or darkness, retinal and opsin recombine rapidly to from rhodopsin, provided there is an adequate supply of vitamin A



- Epithelial tissues: It helps in synthesis and maintenance of healthy epithelium- outer most lining of skin and inner most lining of mucous membranes of respiratory gastro- intestinal and genito-urinary tract. Epithelial glands secrete mucous that lubricates the lining of the eyes, respiratory and gastrointestinal tract etc.

- Normal skeletal and tooth development: Vitamin-A is required for normal bone and tooth development and proper growth.
- It helps the body to fight against infections by keeping mucous membranes in a healthy condition which act as a barrier to infection.
- Vitamin A is important for different senses.

- **Requirement**

  An adult requires 600mg of retinal or 2400mg of â-carotene / day

- **Deficiency**

  If the body has sufficient stores, deficiency does not develop at once.

- **Night blindness**

It is one of the earliest signs of vitamin A deficiency. In this condition, an individual is unable to see in dim light area. This happens because there is insufficient vitamin A to bring about quick formation of rhodopsin.

Changes in the eyes are:

- Secretion of tears decreases.
- Eye ball becomes dry and lusterless.
- Bitot's spots (pigmented spots) are seen on conjunctiva.
- Photophobia or sensitivity to bright light is observed.
- Xeropthalmia- Cornea becomes dry and in flammed. If not treated it leads to Keratomalacia.
- Keratomalacia or softening of the cornea and permanent blindness results.

Fig: Temporal Bitot's spot due to deficiency of vitamin A.

- **Bone Development**

Growth failure and stunted bones are seen in children.

- **Respiratory tract and alimentary canal**

Mucous membrane of nose, throat trachea, and bronchi becomes rough and dry resulting bacterial infection.

- **Follicular Keratosis**

In this condition the hair follicles are blocked with horny plugs of

keratin, rendering the skin surface rough and dry like the skin of toad.

- **Skin problems**
- **Epithelial changes**

The epithelium becomes dry, scaly and rough, goose pimples are seen. on upper forearms and thighs.

- **Excess of Vitamin A**

High doses of vitamin A is not recommended as excess is stored in the liver. This excessive accumulation of vitamin A in the body is toxic. Symptoms of toxicity are nausea, vomiting abdominal pain, loss of hair, thickening of long bones and joint pain. Vitamin A deficiency is one of the public health problem prevalent in India and other developing countries. Prevalence is high among preschool children between 3 – 6 Years.

- **Vitamin D**

Vitamin D is also referred as 'sunshine' vitamin. It is a fat-soluble vitamin. The two important forms are vitamin D2 and vitamin D3. Vitamin D3 is produced when 7-Dehydrocholesterol in the skin is exposed to the UV rays in the sun. Vitamin D differs from other fat-soluble vitamins, because it is synthesized in the body and we do not depend on our diet for it. Being fat soluble it requires fat for its absorption.

- **Food Sources**

Fig: Sources of Vitamin D-milk, cheese, fish and also sunlight.

Sunlight is the cheapest source of vitamin D. It converts 7-Dehydrocholesterol in the skin to cholecalciferol. The richest sources are fish liver oils. Vitamin D is also present in smaller quantities in dairy products such as butter and eggs. Milk has a very low content of Vitamin D. The other sources includes fatty fish, meat, poultry and egg.

- **Functions**
  - Absorption of calcium: Vitamin D promotes the absorption of calcium and phosphorus from small intestine.
  - Maintenance of calcium and phosphorus level: Vitamin D maintains the proper concentration of calcium and phosphorus in blood by reabsorption of phosphorus from the urinary tubules.
  - Bone formation: It promotes mineralization of bones through its action on. Calcium and phosphorus.
  - It promotes growth in general: This is probably dependent on the role of the vitamin in growth of long bones.

Vitamin D maintains normal functioning of parathyroid hormone (PTH).

Activity

Illustrate with pictures deficiency of Vitamin D

- ***Requirement***

The daily requirement of vitamin D for infants, children, pregnant and nursing women have been estimated to be 400IU (10mg) and for older children and adults about 200 IU (5mg)

- **Deficiency**

Vitamin D deficiency leads to lowered absorption of calcium, low serum levels of calcium and reduced bone mineralization. Bones cannot withstand the weight of the body and leads to deformities.

- **Rickets:** Rickets is seen in infants and children. Bones are soft and yield to pressure. Joints are enlarged and there is delayed closing

of the skull bones. Symptoms of rickets include enlarged skull, pigeon chest, poor muscle development, pot belly, and bowed legs or knocked knees. Due to poor calcification, the teeth erupt late and deformities of pelvic bones, enlargement of wrist appear.

Fig: Rickets- Bowed legs in children caused due to deficiency of Vitamin D

- **Osteomalacia:** Osteomalacia or adult rickets is more common in women who consume a diet deficient in calcium, phosphorus and vitamin D and have had several pregnancies. The softening of bones leads to a deformed spine, rheumatic pain in the legs and lower back a waddling gait, and spontaneous fractures. Visible symptoms includes general weakness and difficulty while walking especially while climbing stairs.

- **Dental caries:** Delayed eruption and malformation of teeth due to vitamin D deficiency leads to dental caries.

- **Excess of Vitamin D**

For the treatment of rickets and osteomalacia, about 1000 to 500 (IU) of vitamin D should be administered orally for about a month, followed by 800 (IU) daily for 6 months. These diseases can be prevented by supplement the diet daily with 400 (IU) of vitamin D.

Advice on diet and general hygiene is needed. An adequate intake of calcium is essential. The best source is milk and least 500ml should be taken daily. An egg daily and butter or fortified margarine to increase to dietary in take of vitamin D are recommended. Children should enjoy playing in the sun.

Other Fat-Soluble Vitamins

#	Name of the Vitamins	Functions Requirement	Food sources	Daily	Deficiency
1	Vitamin E (Tocopherol) 	Essential for reproduction Prevents abortion and muscular dystrophy	Vegetable oils wheat germ, rice germ. Ground nut Germs of cereals and pulses, Green leafy vegetables nuts and legumes. Animal foods are poor sources	8 to 10mg / day	Haemolysis of RBC's is seen in premature infants Haemolytic anemia and haemorrages.
2	Vitamin K 	Essential for clotting of blood. Formation of prothrombin and other clotting proteins	Green leafy vegetables, cabbage, cauliflower, soya been, pork liver	60 to 80 mg/day	Prolonged clotting time haemorragic disease in new born infants.

Water Soluble Vitamins

- **B-Complex Vitamins**

Scientists discovered eleven water soluble B-complex vitamins of which eight are considered essential for humans.

They differ from each other in their structure, distribution in foods, stability and symptoms that result from their deficiency. They are:

1. Thiamine (Vitamin B1)
2. Riboflavin (Vitamin B2)
3. Niacin (Vitamin B3)
4. Pyridoxine (Vitamin B6)
5. Pantothenic acid
6. Biotin
7. Folic acid
8. Cyanocobalamin (Vitamin B12)

They are all water soluble. These eight vitamins are grouped together because their functions are closely related. The remaining three B-Complex vitamins, namely para-aminobenzoic acid (PABA), choline and inositol play an active role in cell metabolism but the diet and intestinal synthesis can make good requirement.

Activity

Collect the pictures of food sources of Thiamine (Vitamin B1)

(1) Thiamine (Vitamin B1)

Thiamine (Vitamin-B1) also called anti-neurotic or anti Beri-beri vitamin, is widely known for its role in preventing the deficiency disease BeriBeri.

- **Food sources**

  Dried yeast, rice polishings and wheat germ.

  Whole cereals, Legumes, oilseeds and nuts.

  Milled cereals, vegetables, fruits, milk, meat and fish.

- **Functions**

  Thiamine performs the following functions:

  - as a co-enzyme, i.e. thiamine pyrophosphate (TPP) which is required in the breakdown of glucose to yield energy.
  - helps to maintain a healthy nervous system.
  - required for normal appetite and digestion.
  - necessary for growth, metabolism and heart functioning.

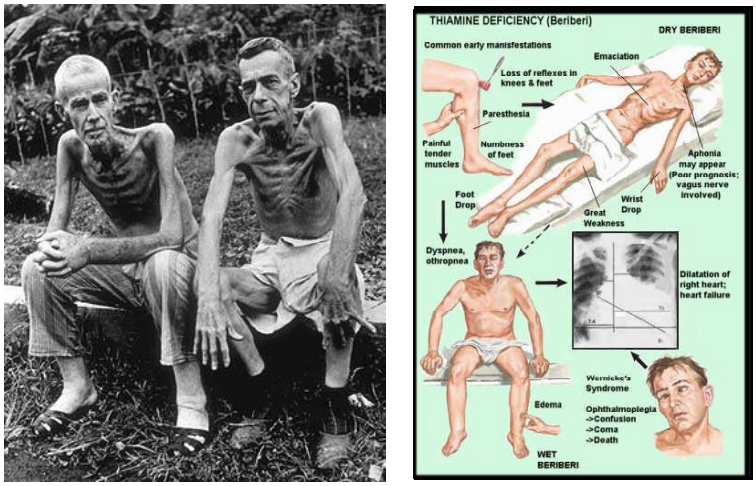
- **Requirement**

Daily requirement of Thiamine is 0.5 mg/1,000 kcal. Thus an adult who needs 3,000 calories would require 1.5mg of vitamin B1 per day.

- **Deficiency**

The symptoms of deficiency occur because the tissue cells are unable to receive sufficient energy from glucose. Therefore they cannot carry out their normal functions. The gastrointestinal, nervous and cardio-vascular systems are specially affected.

Fig: Beri-Beri – Dry and Wet



Early symptoms of deficiency include fatigue, irritability, depression, poor appetite, tingling and numbness of the legs. A severe deficiency causes Beri-beri. Beri-beri is of two types.

- Dry Beri-beri
- Wet Beri-beri

- **Symptoms of Dry Beri-Beri**
  - Loss of appetite.
  - Tingling numbness of legs and hands.
  - Polyneuritis or inflammation of the nerves
  - Paralysis of legs and hands
  - Muscle weakness.
  - Dropping feet

- **Symptoms of Wet Beri-Beri**
  - Oedema of legs and abdomen due to accumulation of fluid.
  - Enlargement of the heart, increase in rate heart beat rate, Palpitation and breathlessness and heart failure.

- A person may suffer from either type of Beri-beri. Beri-beri is also known as 'rice eaters' disease, because it is seen in people whose staple food is polished rice. Parboiling of rice, avoiding excessive milling and polishing of cereal grains can increase the thiamine content. Traditional family cooking practices need to be encouraged. Bread and other staple cereal foods can be fortified with the vitamin. Consumption of refined and processed foods should be discouraged.

Effect of cooking and processing

Vitamins B1 is easily destroyed by cooking food in neutral or alkaline medium, losses are greater when food is cooked in high temperature, overcooked and cooking water is discarded.

Activity

List and Collect the Pictures of Riboflavin rich foods

Riboflavin (Vitamin B2)

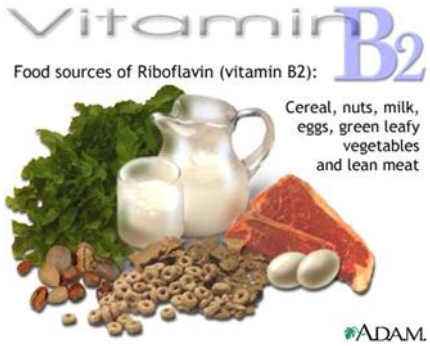
Riboflavin derives its name from yellow colour (Flavus-yellow) and is found in many substances. As it was discovered that molecule contained in a group resembling to sugar ribose, the name 'Riboflavin' was given.

Food Sources

Liver, Dried yeast, skim milk powder, whole milk powder.

Milk, egg, meat, fish, whole cereals, legumes and dhals, oilseeds and nuts, green leafy vegetables.

Milled cereals and cereal products (raw milled rice, white flour), roots and tubers and other vegetables.



- **Functions**
  - Fundamental constituent of living tissue.
  - Role in utilization of food.
  - Maintenance of healthy skin and oral mucosa.
  - Required for normal functioning of eyes.
  - As a co-enzyme, just like vitamin B1, it is a vital factor in carbohydrate and protein metabolism,.
  - Riboflavin is necessary for normal growth.
  - It is also concerned in the oxidation of fats.
- **Requirement**

  The daily allowances of riboflavin recommended by the ICMR are 1-8mg/day.
- **Deficiency**

  Due to deficiency of riboflavin the organs mentioned below are mostly affected.
  - Swelling of lips with cheilosis.
  - Cracks in the skin at the corners of the lip. i.e., angular stomatitis.
  - Redness and swelling of the tongue or glossitis.
  - Eyes look blood shot, eye fatigue, itching, burning, watering and sensitivity to bright light i.e., photophobia.

- **Nicotinic Acid (Niacin) - Vitamin B3**

Niacin formerly known as nicotinic acid, was originally obtained by the oxidation of nicotine. Niacin is unique among the 'B-vitamins' because the body can produce small amounts of it. Tryptophan, an essential amino acid can be converted to niacin.

Food sources of Niacin (vitamin B3) include dairy, poultry, fish, lean meat, nuts and eggs

- **Food Sources**

Dried yeast, liver, rice polishing, groundnut.

Whole cereals, legumes, meat, fish.

Milled cereals, maize, milk, egg, roots and tubers and other vegetables,

- **Functions**
  - Like vitamin B1, and vitamin B2, niacin is also required as co-enzyme that brings about breakdown of glucose, amino acids and fatty acids to yield energy.
  - For a healthy skin, normal functioning of gastrointestinal tract and maintenance of the nervous system.

- **Requirement**

The daily allowance of nicotinic acid for adults recommended by the ICMR is 6.6mg/1000 Kcal.

- **Deficiency**

Pellagra is characterized by three D's – Diarrheoa, Dermatitis, Dementia. In the beginning, there is tiredness, head ache, loss of appetite and weight, poor health, muscular pains and a sore and swollen tongue.

Diarrhoea- There is a pain in the stomach which is followed by loose motions. In acute stage, ulcers are formed on the underside of the tongue, secretion of gastric and pancreatic juices also decreases. If deficiency increases liver also gets damaged.

Dermatitis - In dermatitis there are skin lesions. The lesions are found on exposed parts like neck, back of hands, forearms and feet etc., They are red, swollen and tender in the beginning, later the skin becomes rough, scaly and ulcerated.

Dementia - Due to dementia, central nervous system is affected. There is depression, fear, confusion, dizziness. Tremors can also be seen in acute cases, loss of ability of muscular co-ordination and paralysis causing death.

Activity

Collect the pictures of Niacin (Vitamin B3) deficiency symptoms

Other Vitamins

Apart from the vitamins already discussed, there are other which are required for human nutrition. The importance of some of these to man has not been completely established. Nevertheless they must be present in the diet to make it really complete. The following Table gives a brief account of these vitamins.

Table-2

Name of vitamin	Functions	Important Sources
Vitamin B_6 (Pyridoxone)	Essential for fatty acid and amino acids metabolism	Rice polishings, whole cereals germ of cereals, Liver, nuts, oilseeds, pulses, egg yolk, milk, curds, lettuce and spinach.
Pantothenic acid	Growth, maintenance of normal skin and hair, oxidation of carbohydrates and fat	Cereals, pulses. Nuts, oilseeds, liver, beet, pork, kidney and eggs.
Biotin	Deficiency causes skin changes, lassitude, loss of appetite and anemia	Liver, Kidney, chicken, Milk. Peas and spinach.
Inositol	Prevents accumulation of fats in the Liver	Present in small amounts in all foods.
Choline	Prevents accumulation of fats in the liver, necessary for the formation of acetylcholine and phospholipids	Cereals, Pulses, Nuts and oilseeds. Pork, liver, eggs and milk

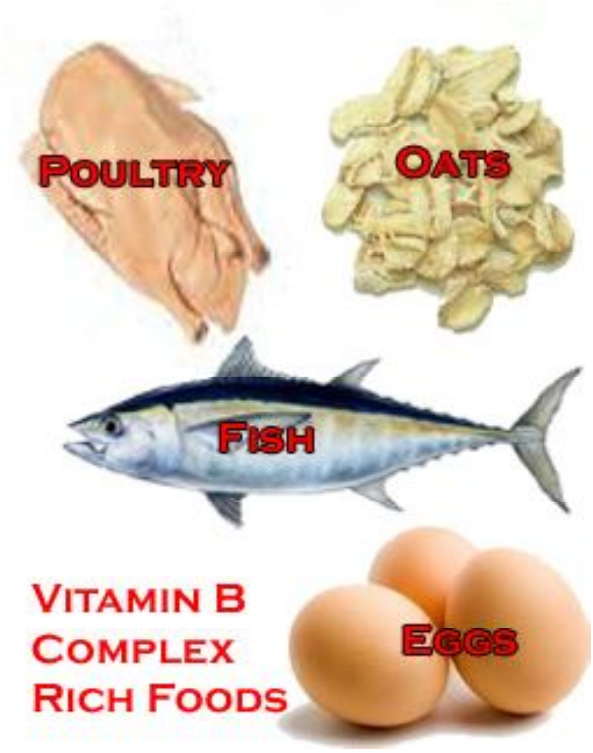


Fig: Foods rich in B-Complex as a whole

- **Vitamin C (Ascorbic Acid)**

Vitamin C is also known as the fresh fruit and vegetable vitamin. It was discovered as an acid in lime juice, which prevented scurvy among British sailors on long voyages at sea. It was named ascorbic acid because of its anti scorbutic or anti scurvy properties.

- **Food Sources**

Fruits- Amla (Indian Gooseberry) and Guava. Lime Juice, Oranges, Pineapple, Mango-ripe, Papaya-ripe, Cashew fruit, Tomato-ripe, Green leafy vegetables like Amaranth leaves, Brussels sprouts, cabbage, coriander leaves, Drumstick leaves, Ipomoea leaves, spinach, and Radish leaves.

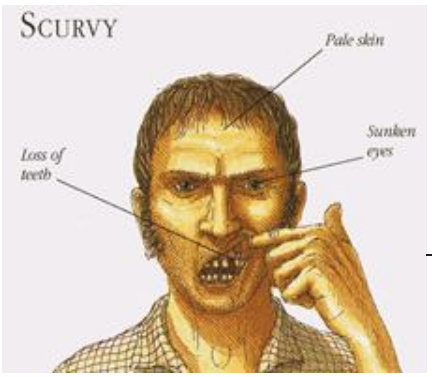
Apple, Banana (Plantain ripe), Jack fruit

Vitamin C is highly soluble in water and most easily destroyed as compared to all other vitamins. It is readily oxidized and destroyed by heat and in presence of alkali. It is lost when food is dehydrated.

- **Functions**
  - Formation of collagen which is the inter cellular cementing substance that keeps cells in bone and muscle tissues together.
  - Ascorbic acid reduces the ferric iron to ferrous iron and thus helps in the absorption of iron.
  - As an antioxidant, like Vitamin-E, it prevents the oxidation process.
  - Healing of wounds and fractures.
  - Increasing resistance to infections and fevers.
- **Requirement**

The daily allowances of ascorbic acid as recommended by the ICMR is 40-60mg.

- **Deficiency**



Deficiency of Vitamin-C results in defective formation of the inter cellular cementing substances. Vitamin-C deficiency in the diet for several months cause the disease Known as scurvy.

- **Symptoms of Scurvy:**
  - Poor wound healing because collagen is not synthesized
  - Haemorrhages in joints, causes swelling and pain in joints
  - Swollen blue-red spongy and bleeding Gums
  - Skin bruises by slightest injury.

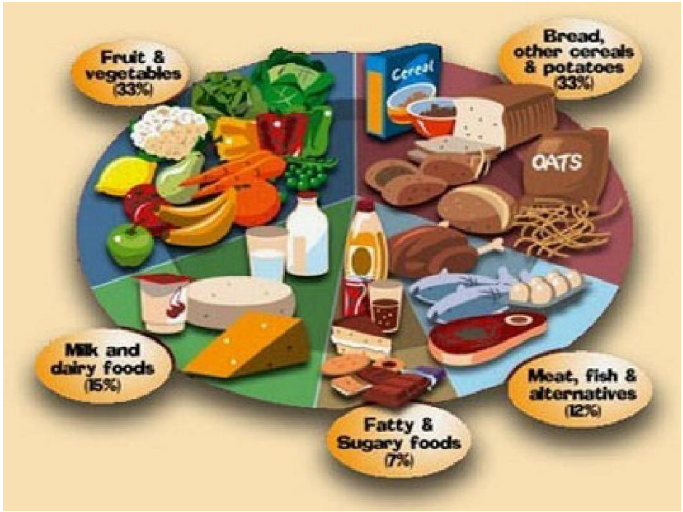
The symptoms of scurvy are general weakness, swelling, infections and spongy bleeding of gums, loose teeth and haemorrhages in various tissues.

- **Excess of Vitamin – C**

Excess of vitamin-C causes stone formation in the kidney and urinary tract due to conversion of some of ascorbic acid into oxalic acid.

6.7 Minerals

Minerals are the inorganic elements required by the body in varying amounts to carryout various body functions. When plant and animal tissues are ignited, they remain largely as ash. Mineral elements are inorganic substances found in body, tissue and fluids. They occur in foods as salts e.g., sodium chloride, calcium phosphate and ferrous sulfate. They constitute 4% of our body weight.



Unlike carbohydrates, fats, and proteins they do not furnish energy. They have many functions in our body such as tissue building, regulation of body fluids and other functions, Like vitamins, they are required in small quantities and are vital to the body. They should be supplied daily as they are excreted through kidney, the bowel and the skin.

Minerals are present in the body as:

- Components of organic compounds e,g. haemoglobin contains iron and thyroxine contains iodine.
- As inorganic compounds e.g., calcium phosphate in the bones.
- As free iron in every cell in the body and in all body fluids.

Sodium is the main electrolyte in the extra cellular fluid and potassium is the main electrolyte in the intracellular fluid.

The mineral elements are not destroyed by heat, oxidation, acid or alkali, since they are soluble in water some loss occurs due to leaching when cooking water is discarded.

Classification

Minerals may be classified into three groups.

- **Major minerals or macro minerals:** Seven minerals are required in large amounts of over 100mg/day eg, calcium, phosphorus, sodium, chlorine, potassium, magnesium and sulphur

II **Minor Minerals**: These are required in small quantities

III **Trace elements**: A few micrograms to a few milligram are required per day, e.g., Iodine, fluorine, zinc and molybdenum.

Calcium

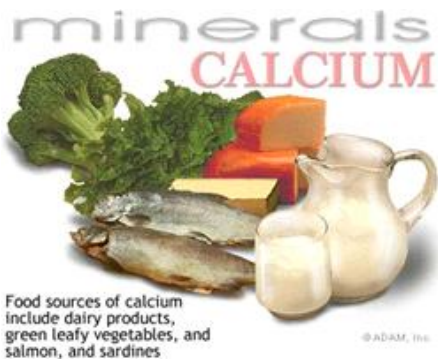
The adult body contains 1.2kg of calcium of which 99% is present in bones and teeth. The bones provide.

- A rigid frame work for the body.
- Reserves of calcium

The remaining 1% is distributed in extra cellular and intracellular fluids.

- **Food Sources**

Milk, skim milk powder, ragi, sesame seeds (gingelly seeds), small fish. Cheese, khoa, drumstick leaves, curds, cabbage, nuts and oil seeds



Activity

Plan and stick the picture of calcium rich dish

- **Functions**
  - Calcium acts as a catalyst in clotting of blood.
  - It increases permeability of cell membranes thus helping in absorption.
  - Calcium regulates contraction and relaxation of muscles including the heart beat
  - It activates a number of enzymes such as pancreatic lipase and acts as a co-factor
  - It is essential for normal heart rhythm and nerve irritability
  - Calcium is required for the formation of bones and teeth, their growth and maintenance.
  - It helps in the absorption of vitamin B12 in the ileum.

- **Requirement**

The daily allowance of calcium for adults recommended by the ICMR is 600mg during pregnancy and lactation 1200 mg/day.

- **Deficiency**

A severe deficiency of calcium leads to rickets in children; osteomalacia and osteoporosis in adults. Absorption and metabolism of calcium is closely related to Vitamin-D

- **Rickets:** Rickets is seen in infants and children. Bones are soft and yield to pressure. Joints are enlarged and there is delayed closing of the skull bones. Symptoms of rickets include enlarged skull, pigeon chest, poor muscle development, pot belly, and bowed legs or knocked knees. Due to poor calcification, the teeth erupt late and deformities of pelvic bones, enlargement of wrist appear.

- **Osteomalacia:** Osteomalacia or adult rickets is more common in women who consume a diet deficient in calcium, phosphorus and vitamin D and have had several pregnancies. The softening of bones leads to a deformed spine, rheumatic pain in the legs and lower back a waddling gait, and spontaneous fractures. Visible symptoms includes general weakness and difficulty while walking especially while climbing stairs.

- **Osteoporosis:** In osteoporosis, the bones become porous because of bone mineral loss. This causes compression of the vertebrae, that results height reduction, pain in the back and hip, and increased susceptibility to fractures. It is seen in post menopausal women and can be controlled by weight bearing exercises, calcium supplements and hormone therapy.

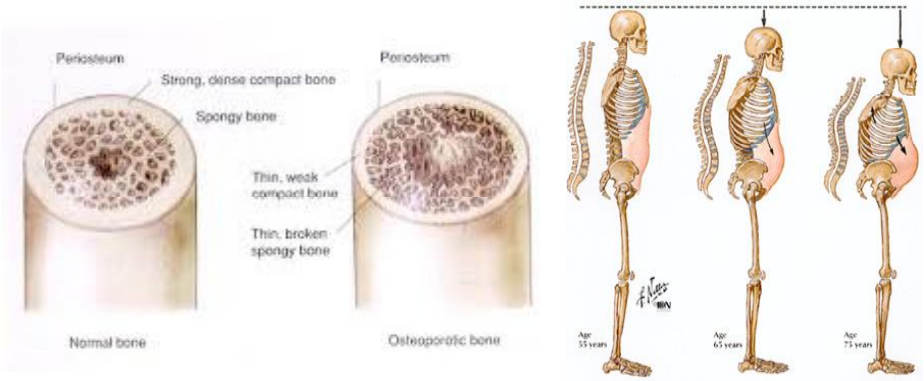


Fig: Osteoporosis-compression of vertebrae resulting height reduction

- **Tetany**

A decrease in serum calcium levels gives rise to condition called tetany. The symptoms of tetany are severe. Intermittent spasms of hand and feet muscles, accompanied by muscular pain.twitching of facial muscles are seen.

Excess of Calcium

When the level of calcium goes high in the serum and soft tissues, individual complains of vomiting, gastrointestinal bleeding and high blood pressure. A patient suffering from peptic ulcers having excessive alkali therapy with large amount of milk also leads to hyper calcaemia.

- **Phosphorus**

Phosphorus comprise 1% of total body weight, It occurs along with calcium in human nutrition and also has many other functions in the body.

- **Food Sources**

Milk, eggs, meat, fish. Cereals, pluses, nuts and oilseeds cheese. Vegetables.

- **Functions**

  - Building bones and teeth along with calcium and magnesium.
  - DNA and RNA the nucleic acids needed for genetic coding contains phosphorus.
  - As phospholipids, they regulate the absorption and transport of fats.
  - Adenosine triphosphate (ATP) and adenosine diphosphate (ADP) are necessary for storing and releasing energy according to body needs.
  - Phosphorus is a part of enzyme needed for the metabolism of carbohydrates, fats and proteins.
  - Phosphorus is important part of cell constituent.

- **Requirement**

The daily allowances of phosphorus for adults recommended by the ICMR is 1.5 gms.

- **Deficiency**

Phosphorus deficiency is rare since a diet that contains adequate protein and calcium will be rich in phosphorus. Deficiency symptoms are similar to calcium deficiency. Deficiency of phosphorus causes poor mineralization of bones. Poor growth, rickets in children, osteomalacia in adults.

Activity

Plan and stick pictures of Iron rich snack

- **Iron**

Those elements which are required in traces are known as trace elements. Iron is a trace element and its presence in the body is very significant. The human body contains 3-5gms of iron of which 70% is in the circulating hemoglobin. Normal hemoglobin levels for females are 11.5-14.5gms and for males 12.5 to 16.5gms.

- **Food Sources**

Liver, meat, Egg yolk, fish, green leafy vegetables, Cereals, legumes, and Jaggery. Raw sugar, Apricots, Beetroot.

- **Functions**
  - Iron is an essential component for the formation of hemoglobin.
  - Necessary for carrying o2 to the lungs where o2¬ is released and co2 is picked up to be exhaled by hemoglobin in the red blood cells.
  - It is an essential part of several oxidation enzymes.
  - It helps in specific brain functions such as a good attention span and cognitive development.
  - It facilitates the complete oxidation of carbohydrates proteins and fats with in the cells and release of energy for performing physical work..

- **Requirement**

Iron requirements suggested by ICMR is 20mg/day for man and 30mg/day for women.

- **Deficiency**

Anemia due to iron deficiency is very common in the vulnerable age group in all developing countries. Hemoglobin levels may be as low 5-9gm/100ml blood.

- **Symptoms of Anemia**
  - Weakness, fatigue, and headache.
  - Loss of appetite.
  - Burning sensation in the stomach.
  - Insomnia.
  - Paleness of eyes and nails.
  - Shortness of breath and dizziness
  - Brittle finger nails, spoon shaped nails.
  - Oedema of ankles
  - Liver and spleen become enlarged.

Iron deficiency causes microcytic and hypochromic anemia. Red blood cells appear pale and smaller in size. Iron deficiency may also be seen if excessive blood loss occurs or because of faulty absorption intestinal disease or parasites especially hook worm and round worm infestations.

Iron deficiency anemia can be prevented through:

- Dietary Improvement.
- Supplementation
- Fortification
- Education

Fig: Brittle,spoon shaped finger na s

Fig: Pale eyes –another symptom of Anemia

- **Excess of Iron**

Hemochromatosis is a rare disease in which excessive amounts of iron are absorbed from the intestinal tract. The absorbed iron is deposited in various organs leading to cirrhosis of liver, diabetes mellitus and grey discolouration of skin etc.

Siderosis is a disorder of presence of excess of iron in the body. This may occur due to excessive destruction of red cells in haemolytic conditions and failure to regulate absorption.

Activity

List and collect the pictures of iodine fortified foods available in market.

Iodine

Iodine is a constituent of thyroxine, the active principle of the thyroid gland. The thyroid gland weighing about 25gm in a normal adult, contains only about 10mg of iodine. The adult body as a whole contains about 50mg of iodine.

Food Sources

Iodine is present only in small amounts in common foods, the quantity of iodine present depends on the iodine content of the soil. The soil of mountainous region usually contains less iodine than the soil of the plains. Common salt prepared from sea water and sea fish are good sources of iodine.

Fig: Food source of iodine

Functions

Iodine is one of the essential micronutrient required for normal growth and development of the human brain and body.

The thyroid hormone regulates the rate of oxidation within the cells. Thyroid hormones regulate the conversion of carotene into active vitamin A. Thyroxine is also known to be essential for reproduction.

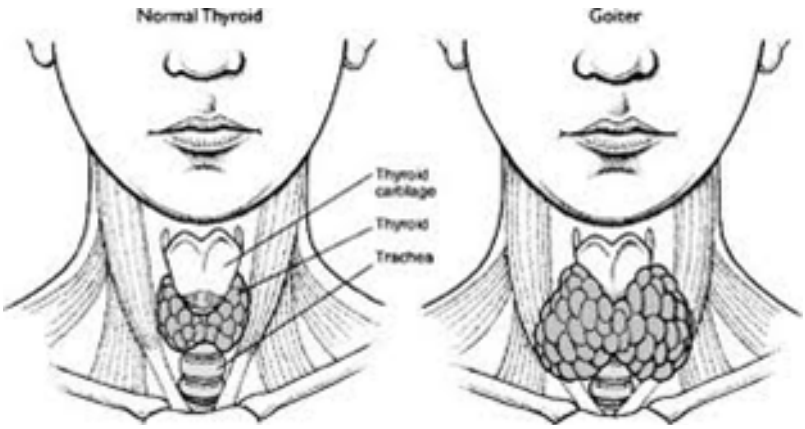
- **Requirement**

Iodine requirements for adults are about 0.15 to 0.2mg and for infants and children 0.05 to 0.10mg daily.

- **Deficiency**

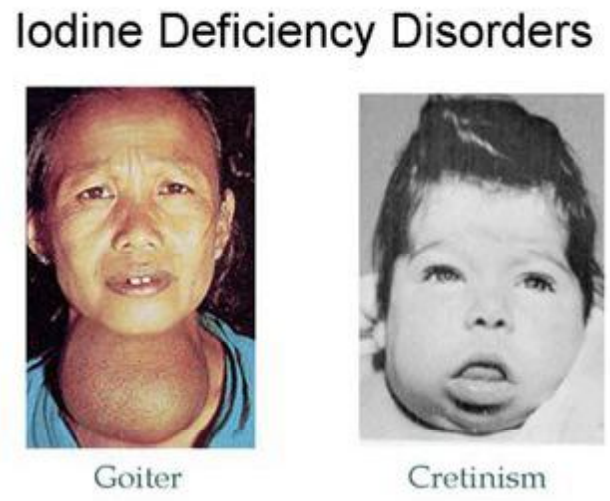
Deficiency of iodine results in goitre.

Goitre: Goitre is an enlargement of the thyroid gland due to the deficiency of iodine. The secretion of thyroxine hormone is also reduced, so the gland cells try to produce iodine in large quantity which leads to multiplication of cells which results in the enlargement of the gland that forms goitre. Prevelence of goitre is more in the hilly regions where soil lacks iodine.



Cretinism: Cretinism is caused in children when there is deficiency of thyroxine hormone (iodine). cretinism in children (stunted growth) critinism is characterized by a low basal metabolism rate (BMR), flabby and weak muscles, dry skin, mental retardation and lowered skeletal development.

Myxedema: Iodine deficiency in adults results in Myxedema. Face becomes thick and looks puffy, facial expression is poor and person becomes inactive. As given in fig: below



Goitrogens: Goitrogens are substances in food known to interfere in the metabolism of thyroxine and can produce goiter. They are present in the redskin of peanuts and in vegetables such as cabbage and cauliflower, turnips, mustard, almonds, peaches and soyabeans and bamboo shoots.

(5) Other Minerals

Sl.No	Mineral	Functions Requirement	Daily	Sources	Deficiency symptoms
1	Magnesium about 60% is found along with calcium and phosphorus in the bones and teeth	It is present mainly in the intra cellular fluid and helps in maintaining fluid balance along with sodium, potassium and calcium.It helps in transmission of nerve impulses, muscle contractions and regulation of the heart beat.It acts as a co-factor in many metabolic reactions.	Plasma level 1.5-1.8m Eg/L daily intake 250-300mg	Milk, Cheese, fish, meat whole grains, pluses and nuts.	Deficiency of magnesium is uncommon symptoms of deficiency are similar to tetany
2	SodiumOr common salt Adult body contains 100gm of sodium most of which is present in the extracellular fluid of the body.	Electrolyte in extra cellular fluid.Water balanceAcid-base balance Digestion-as part of gastric juice.	1-3.5gm/day	Common salt, Milk, egg white, meat, poultry, green leafy vegetables. Bengal gram dal beet root and knolkhol	Seen in severe vomiting or diarrhea resulting in alkalosis
3	ZincAbout 90% of the body's Zinc is in muscle and bone.	Zinc is a constituent of the enzyme, carbonic anhydrase.It is a constituent of insulin.	Blood level - 650-680mg/ 100ml and plasma level - 120-140/100ml; Daily requirement 15-20mg	Oysters, sea foods, liver, wheat germ, yeast, meat, poultry, eggs and diary products and nuts.	Anemia Growth Retardation Delayed genital maturation Impaired glucose tolerance

4	Potassium	Maintenance of intracellular fluid balance.Acid-base balance Transmission of nerve impulses. Storage of cell protein and glycogen.	Normal serum level 3.6m RDA about 4gm	Meat, fish, Chicken, cereals, green leafy vegetables, fruits like apricot peaches, bananas, orange, pinapple	AcidosisAdrenal tumorsMuscular Weakness Cardiac arrhythmias Mental apathy Paralysis Bone fragilityAdernal hypertrophy
5	Copper	Essential for hemoglobin synthesis Activation of enzymes.Role in bone formation Maintenance of myelin sheath of nerves.Formation of iron metabolism.	2.5mg	Liver, oyster, meat, fish nuts, legumes, whole grain cereals	Retarded hemoglobin production.Loss of weight.Microcytic hypo chromic anemia Hair turn grey.Atrophy of myocardium

Fig: Copper rich foods, Pista and Beans are rich in Zinc

Fig: Copper rich foods, Pista and Beans are rich in Zinc

6.8 Water

Water in the most essential constituent of our body. It accounts for 55-70% of our total body weight. Men have a higher proportion of water in their body as compared to women.

- The total body fluid is distributed among two major compartments.
- The extra cellular fluid or water present outsid‘e the cell in the interstitial spaces and blood plasma
- The intracellular fluid or the water present inside the cells
- Sodium is the principal electrolyte predominant in the intracellular spaces. The normal concentration of ions in the intracellular and extracellular fluids needs to be maintained at all times.

Activity

List any five fruits and vegetables which are high in water content

Sources of water to the body

Apart from the water we drink during the day to relieve thirst between and during meals, there are there major sources of water

Beverages and liquid foods: Hot and cold beverages such as tea, coffee milk shakes, fruit juices and soups are largely made up of water. Both stimulating beverages and refreshing beverages are important sources of water and nutrients.

Water content of solid foods: Another important source of water is fruits, vegetables and the water used for cooking food, solid foods contain varying percentages of water.

Metabolic water: It is synthesized in the body as a result of oxidation of fat, proteins and carbohydrate adding to about 300-350 ml/day

Functions

- Water quenches thirst and is the most refreshing and cooling of all liquids.
- It i's a structural component of all cells. In the bone, water is tightly bound but in most tissues, a constant interchange takes place between the body compartments of water.
- Water is the medium in which all the chemical reactions take place.
- It is an essential component of all body fluids, bile, digestive juices and urine
- It acts as a lubricant and helps food to be swallowed and digested food to pass through the gastro intestinal tract
- It acts as a solvent for the products of digestion and helps in transporting these products to different tissues.
- It helps in excreting waste products of metabolic reactions.
- Water is essential to maintain the turgidity of cells
- Water regulates body temperature by taking up and distributing heat produced in cells when metabolic reactions take place.

- **Requirement**

A minimum of six to eight glasses of water is recommended to enable the body to perform optimally and keep one active and refreshed throughout the day. It should be consumed at regular intervals so that the body is always well hydrated. This quantity is independent of other fluids consumed.

- **Deficiency of Water**

Excessive loss of water could take place due to diarrhea, vomiting, fever excessive perspiration strenuous exercise and uncontrolled diabetes mellitus. It can result in dehydration. Dehydration can be classified as

Mild	<5%	Fluid loss
Moderate	5-15%	Fluid loss
Severe	15-20%	Fluid loss

A 20% loss of fluid from the body can be fatal.

A dehydrated person feel thirsty, has a dry mouth sunken and dry eyes, and may feel restless, irritable or even lethargic or unconscious in severe cases. The skin when pinched does not go back quickly. A dehydrated person is usually managed by oral Rehydration Therapy (ORT) The WHO recommends oral Rehydration salts (ORS) that are to be dissolved in 1 litre of water. This is to be sipped till hydration returns to normal.

- **Excess of Water**

Oedema is the retention of salt and water in the interstitial fluid giving rise to swelling of the skin. A pit or depression is formed when pressure is applied with the finger to the swollen skin. Oedema is seen in the hypertension, Cardiovascular and kidney disorders. Salt restriction in the diet is essential.

6.9 Fibre

Dietary fiber is defined as the component of plant material in the diet that cannot be digested by human enzymes. It includes all

undigestable polysaccharides, cellulose, hemicelluloses, lignin, pectins, gums etc.

- **Classification**

Dietary fibers are classified as soluble and insoluble fibres. Soluble fibres which are viscous and fermentable, include pectins, gums and mucilages. Insoluble fibres are non-viscous, slowly fermentable, include cellulose, hemicelluloses and lignin.

- **Food sources**

Foods such as whole grains cereals, fruits and vegetables especially with the edible peel and seeds, are rich sources of fibre.

- **Functions**

  - Fibre can absorb and hold water there by increasing faecal bulk.
  - Insoluble fibre prevents constipation by stimulating peristalsis in the large intestine.
  - The contraction of muscular wall of the digestive tract is stimulated by fibre.
  - Fibre increases water absorption, forming a larger, softer stool that rapidly passes through the colon.
  - Soluble fibre binds bile acids and cholesterol and is beneficial to people suffering from coronary heart disease.
  - Fibre reduces triglyceride and cholesterol levels in blood.
  - Fibre is beneficial to people on weight reduction regime.
  - It provides satiety value to the meal as it needs more chewing and at the same time does not add to the calorific value of the meal.
  - It helps in lowering blood sugar levels in diabetic individuals by slowing down carbohydrate absorption and lowers the insulin requirement.
  - Regular intake of fibre may prevent cancers of the colon and rectum.

Activity

Draw 6 pictures of foods that are rich in fibre.

Requirement

In a normal adult diet, an intake of about 40 grams of fiber per day is recommended which can be easily supplied through whole grain cereals, fruits and vegetables.

Deficiency

Low intake of regular diet could cause excessive straining and increased hardness of stool. Hemorrhoids and diverticulosis are more prevalent among population with low fibre intake.

Excess of Fibre

A high-fiber diet produces abdominal distension and pain, flatulence and diarrheoa; and, with a highphytate content, it decreases the absorption of calcium, zinc and iron. This may predispose the individual to osteomalacia and iron-deficiency anemia. Decreased zinc absorption in children produces stunted growth and retarded sexual development.

Summary

The chemical constituents present in food are called nutrients. Nutrients are broadly classified into macro and micro nutrients. Carbohydrates, proteins and fats are macro nutrients. Vitamins and minerals are micronutrients.The requirement for macronutrients is in grams while the requirements for micronutrients is in milligrams and micrograms. Each nutrient has a definite function and if there is a deficiency of any one nutrient, the body suffers from its specific deficiency. Both macronutrients and micronutrients are equally important for good health and one cannot enjoy good health without including all nutrients in the diet. Energy is the capacity to do work. Carbohydrates, proteins and fats are the only nutrients which provide energy. Human body needs energy for maintaining basal metabolic rate, physical activity and thermic effect of food.

Glossary

Anemia: A condition in which number of RBC's or hemoglobin content of blood is reduced.

Anti oxidant: A substance naturally present or added to a product to prevent it break down by oxygen

BMR: Energy needs of body at rest is called BMR

Carotene: Reddish orange colour pigment in yellow/orange/red fruits and vegetables.

Cheilosis: Swollen, cracked and red lips

Co-enzyme: A substance that must be present along with an enzyme for a specific reaction to occur

Collagen: Intercellular cementing substances which is protein matrix of cartilage, connective tissue and bone.

Glossitis: Inflammation of the tongue.

Neuritis: Inflammation of the nerves.

Oedema: Retention of fluid in extracellular spaces, sodium, the electrolyte in the extracellular fluid is also retained along with water resulting in swelling.

Photophobia: Abnormal sensitivity to light

Precursor: Another term used to describe provitamin.

Parboiling: Steaming of rice in the husk before milling.

Rhodopsin or visual purple: A light sensitive pigment in the rods of the retina needed for vision in dim light or for dark adaptations.

Insulin: A hormone secreted by the pancreas, which regulates carbohydrate metabolism.

Lignin: A substance which is not a carbohydrate but present along with carbohydrates in the cell walls of plants and forms part of dietary fibre.

Coronary heart disease: A disease resulting in a reduction or stoppage of blood supply to part of the heart muscles due to narrowing or blockages in a blood vessel.

Atherosclerosis: A condition of narrowing of the lumen of the arteries due to deposition of cholesterol and other material and hardening of arterial walls.

Electrolyte: A chemical element or compound that dissociates in to ions when in solution.

Homeostasis: A state of equilibrium in the body between body parts and functions.

Interstitial fluid: Fluid present in the spaces or interstices between the cells and tissues in an organ.

Niger seeds: Also called black gingelly seeds.

Model Questions

1. Describe the important functions performed by carbohydrates.
2. Classify carbohydrates of importance in human nutrition and give one rich food source for each category.
3. List ten rich sources of carbohydrate and fibre in your daily diet.
4. List ten preparations rich in fibre from the menu card of typical Indian restaurant.
5. What are the beneficial effects of fibre in the diet of an adult man sedentary worker? How much fibre should be consumed daily?
6. What are the negative effects of excessive carbohydrates consumption? How many calories should carbohydrates provide in our diet?
7. Classify proteins on the basis of their quality.
8. Define the following terms.
   i. Essential amino acids.
   ii. Biological value.
9. List and briefly explain the functions performed by proteins.
10. List the symptoms of protein deficiency in children
11. Differentiate between
    i. Fats and oils.
    iii. Visible and hidden fats
12. List five important functions of fat in the body.
13. Explain the following.
    i. Consequences of excessive consumption of fat
    ii. Cholesterol
14. Suggest five simple measures to reduce the fat intake in your daily diet.
15. Why is water an essential nutrient? Discuss the functions of water.
16. What are the major sources of water to our body? Explain giving suitable examples.

17. List the various conditions which lead to excessive loss of body water.
18. Explain briefly.
    i. Oedema
    ii. ORS
19. Define vitamins and classify them.
20. Differentiate between water soluble and fat- soluble vitamins.
21. Explain the following briefly.
    i. Role of vitamin A in vision.
    ii. B-complex vitamin and energy metabolism.
22. List fiber rich sources of each of the following vitamins.
    Corotene
    Niacin
    Ascorbic Acid
23. What are the symptoms of the following deficiency diseases.
    Beri-Beri
    Pellagra
    Scurry.
24. List the seven major minerals?
25. Classify mineral elements giving two example for each.
26. Define the following terms
    i. Trace elements
    ii. Goitrogens
27. What are the symptoms of the following deficiency diseases.
    i. Osteoporosis
    ii. Anemia
    iii. Cretinism
    iv. Goitre
28. List five rich sources of each of the following minerals.

i. Calcium
ii. Iron
iii. Iodine

29. List and briefly explain the functions performed by calcium
30. What are the effects of excessive vitamin A consumption?
31. What are the steps taken to prevent vitamin A and vitamin D deficiency.
32. Define Energy.
33. Define Basal Metabolism.
34. Explain the factors affecting Basal Metabolism.
35. Name the measuring instrument of energy?
36. Define thermic effect of food.

UNIT – 7
PRINCIPLES AND METHODS OF PREPARATION OF FOOD

Learning Objectives

Enable students to:

- Understand the principles of cooking and become familiar with the various methods of cooking.
- Create awareness about the effect of cooking on the nutritive value
- Learn the methods of enhancing the nutritive value of foods

7.1 Introduction

The concept of subjecting food to the action of heat is termed as cooking. Food preparation is an important aspect of food acceptance. Preparation of nutritious and tasty food is both a science and an art. One has to understand various methods of cooking and their effect on the different components of food to retain nutrients during cooking

7.2 Selection of Foods

To prepare good quality food it is very important to select right quality of various ingredients used in preparation of any dish. There are two aspects of quality

- Physical Quality: Hygienic, free from foreign matter, free from infestation, bad odour, lumps etc and being whole and not broken. All food items have to pass this test to be selected for cooking
- Processing Quality: This refers to the suitability of the quality of the ingredient for its use in the preparation of the dish. Some of the points to be remembered are listed below.

- Aging improves the cooking quality of rice. So older rice cooks better than new rice. Thin long grain rice is suitable for making pulao, biryani etc as it does not clump after cooking. Idli, dosaetc can be made using short and medium grain rice.
- Semolina (Rawa or suji) is available as fine, medium and large grains. Fine grain semolina can be used for preparing halwa, medium and large grain can be used for upma, shira, porridge etc.
- Dals containing broken ones cost less and can be used in making vada,idli, dhokla, pakodaetc
- One should make sure that the nuts have even colour as unnatural spots on nuts is a sign of deterioration
- A good quality egg is clean with unbroken shell, has small air cell (less than 0.3 cm) with yolk in the centre.

Activity 1

An Egg is kept in front of you. How can you say that it is of good quality or not

- The selection of a particular type of fat or oil depends on the food to be prepared, food budget and regional preferences. Ghee is usually used where flavour is preferred e.g. in preparation of sweets. The type of cooking oil used varies from region to region. In North India Mustard oil is used, in Kerala coconut oil is used, In Gujarat ground nut oil is used. A good quality oil should have its characteristic aroma, natural colour, clarity and be free from adulteration. Hydrogenated fats such as vanaspathi are used as a substitute for ghee. The smoking point of hydrogenated fats is higher than that of refined oils and are used for frying of bland foods. Oils selected for deep fat frying should have high smoke point. (smoke point is the temperature at which fat or oil gives off a bluish haze or smoke)

Activity 2

Make a sample of shira using ghee and another sample of shira using oil. Note the difference between the two samples. Which one you prefer and why

- Although the standards of selection for each fruit and vegetable varies, in general it is desirable to select fresh fruits and vegetables which are of uniform size, bright colour, firm, suitable degree of ripeness with no visible bruises or signs of decay or defects. Roots and tubers should be firm, free from sprouts and without green discolouration. Each fruit and vegetable has highest nutrient content, flavour and lowest price during its peak season. So it is advisable to use seasonal fruits and vegetables

7.3 Preliminary Preparation of Food

Before actual cooking, some tasks have to be done. All these tasks are collectively called preliminary preparations or preparations. These include cleaning, peeling, stringing, cutting, grating, sieving, soaking, processing, coating, blanching, grinding, drying, filtering, germination, fortification etc. Each task has a definite purpose and a procedure to be followed to achieve desired results.

● Cleaning

All food stuffs have to be cleaned to prepare hygienic food. Food stuffs do contain dirt, mud, small stones, seeds, pesticides, worms, insects, rotten parts, infested parts etcAll these have to be discarded. Some foods such as fruits, vegetables, cereals, dalsetc are washed using water to remove dirt, pesticides, worms etc. Repeated washing may result in loss of water soluble nutrients

● Peeling and Stringing

This is done to remove inedible portion of food. Eg peeling of potato, stringing of beans etc. To reduce the loss of nutrients it is advisable to boil and blanch with skin and then remove the skin wherever possible. Peeling of roots and tubers which comes in contact with soil such as carrot, radish,

potato etc helps in further removing the soil that might have been there even after washing.

- **Cutting and Grating**

Dividing the food into smaller pieces known as cutting is an important aspect of preparation. There are different ways in which it is done. Some of the common terminologies and their meanings are given below.

Terminology	Meaning
Cut	Dividing into pieces with knife, slicer, chopper, or grinder
Chop	Cutting into no specified shape
Mince	Chopping into very fine pieces
Dice	Cutting into small uniform cubes
Slice	Cutting into small uniform pieces usually across the grain
Grate	Cutting finely with a grater

Activity 3

Take a piece of carrot, dice, slice and grate it.

When food is cut into very fine pieces, loss of nutrients increases. So it is advisable to cut foods into bigger pieces wherever possible.

- **Sieving**

Coarse fibre, worms, stones etc can be removed by sieving. Cereal flours, food grains are sieved. Bran which contains fibre, proteins, and B complex vitamins is lost during sieving.

- **Soaking**

Food grains such as rice; pulses etc are immersed in water or salted water. Soaking reduces cooking time; food becomes soft, reduces pungency

as in case onions and helps in wet grinding. The water used for soaking should not be discarded as it contains water soluble nutrients.

- **Processing**

The various processes and their meaning are given below:

Process	Meaning
Mix	To combine various ingredients to make a uniform whole
Blend	Two or more ingredients are thoroughly mixed so that they lose their individual identity
Bind	Making two or more ingredient to cohere as a homogenous product
Beat	To move the beater (instrument) back and forth to achieve smooth texture
Whip	To beat with a rapid lifting motion to incorporate air
Fold	Light mixing by gently turning one over the other
Mash	Crush the food into a smooth mix
Stuff	Filling a food stuff E.g. Stuffing mashed potato in parathas

- **Coating**

A layer of crumbs, flour or other fine substances are used for covering food. This adds colour, flavour, acts as binding agent and produces crunchy texture.

- **Blanching**

Putting the food into boiling water and then immersing in cold water. It helps in preservation of food and facilitates peeling for further processing.. Usually tomatoes and potatoes are blanched.

- **Marinating**

The process of soaking the food in a marinade is known as marinating. Marinade consists of a liquid made for this purpose. Usually oil, flavour builders and acid are used in making a marinade. The main purpose of marinating is to add flavour, to tenderize food or both. Meat, fruits and vegetables are usually marinated.

- **Grinding**

Grinding can be wet (as in case of chutneys, idli batter or dry as in case of masala powder, coffee powder. Grinding helps in proper blending of flavours.

- **Drying**

It removes moisture from foods Eg. mango powder, fryums, papads etc.

- **Filtering**

It is done to remove unwanted particles. Coffee, tea, clear soups, fruit juice are filtered.

7.4 Principles of Cooking

The principles to be followed while cooking any food item are listed below:

- Cooking should be done in such a way that the flavour or aroma of the food is retained. The aroma of the food stimulates the secretion of digestive juices thereby helps in digestion of food.
- The nutritive value of the food should be preserved as much as possible by using proper methods of cooking. Knowledge of the effect of heat on different nutrients is necessary for this.
- Sieving flour results in loss of B complex vitamins as bran which is removed during sieving is rich in B complex vitamin.
- Use of soda during cooking results in loss of B complex vitamin.
- Food should be cooked in shortest possible duration to minimise

loss of heat sensitive nutrients

- It is advisable to wash vegetables before peeling, and cutting.
- Do not peel and cut the vegetables long before cooking.
- Cut vegetables into large pieces rather than small pieces
- Cook in minimum amount of water or use the excess water used for cooking
- For fruits, wherever possible do not remove the skin as in case of apples.

- **Reasons for cooking food**

  - The digestibility of food should increase. Cooked food is easy to chew and swallow. Heat softens the food e.g.: Starchy foods such as cereals absorb water, swell and soften.
  - To make the food safe by killing the microorganisms by application of heat. E.g. Boiling milk helps in killing pathogenic microorganisms present in food.

Activity 4

Keep a glass of raw milk and a glass of boiled milk. Observe the time taken for spoilage by each sample.

  - To improve the taste and palatability of food
  - To provide variety. The same raw foods can be cooked into a variety of dishes.

7.5 Methods of Cooking

There are a number of different methods of cooking. Based on the media used for heat transfer, the methods of cooking have been broadly classified as follows:

Sl. No.	Medium	Methods of cooking
1	Air	Roasting, Baking, Broiling, Grilling
2	Water	Boiling, Simmering, Stewing
3	Steam	Steaming, Pressure Cooking
4	Oil	Deep fat frying and shallow fat frying
5	Combination	Combination of any of the above methods
6	Unconventional	Solar, microwave etc

- **Air**

This is also known as cooking by dry heat. Some of the methods which use heated air as medium are:

- **Roasting and Toasting**

Here foods are cooked using dry heat without covering it. Eg roasting of groundnuts, cashew nuts, pistaetc on a hot tawa. Dry chapatti, roti, nanetc are also prepared using this method

- **Baking**

Baking is a method of cooking in which hot dry air surrounds food from all sides. Oven or hot sand bath is used for this. Egg Preparation of bread, biscuit, cakes etc. Baking improves the texture and flavour. Baking requires skill and separate equipment.

- **Broiling/Grilling**

Here food is exposed to direct heat. Eg Grilled sandwich

- **Water**

This is the most common method of cooking. It includes boiling, simmering, stewing

- **Boiling**

Food is immersed in water and the water is brought to boil (100

degree C). Soups, dals and curries are prepared by boiling. It is one of the simplest methods of cooking and special skill and equipment are not needed for this. In this method there is extensive loss of heat labile nutrients, particularly if excess water is used for boiling. Loss of nutrients can be minimized by boiling food along with skin, covering the utensil with lid.

- **Simmering**

Simmering is done by immersing the food in a liquid that is maintained just below boiling point (85 to 90 degree centigrade). Here the bubbles form slowly and collapse below the surface. E.g. Preparation of kheer, poaching of egg.

- **Stewing**

The temperature of stewing is same as that of simmering but very small quantity of liquid is used for cooking. Preparation of vegetables, meats, apple stew

- **Steaming**

Here food is cooked in water vapour. Water is kept at the bottom of the pan which when heated produces steam.

There are 2 methods of steaming:

Direct method: Here steam is applied directly to food which is placed in a perforated rack over boiling water in a pan. Which is covered tightly with a lid.Eg.Idly, Dhokla, modak.

Indirect method: Here the food is packed in a vessel with a lid. The vessel is then immersed in another vessel of boiling water (double boiler). Eg.Puddings, Caramel Custard.

Steamed foods are light, fluffy and easy to digest. Steaming requires special equipment. The loss of nutrients is less. The food does not lose its shape as the food grains do not shrink due to evaporation of water.

- **Pressure Cooking**

This method is similar to steaming but the steam is under pressure. Here temperature of about 121 degree C and a pressure of 15 psi (103 kPa) above atmospheric pressure is reached and the time needed for cooking is reduced considerably thereby saving the fuel. Pressure cooking is done in a pressure cooker. Rice, dal, potatoes, roots and tubers etc are cooked in a pressure cooker. These different food items can be cooked simultaneously. Loss of nutrients is less but skill and knowledge of using the equipment are required.

- **Oil**
- **Shallow Fat Frying**

Shallow fat frying involves cooking of food in a slightly greased pan. Chapati, parota, dosa etc. are prepared by this method. Shallow fat fried food will be crisp outside and soft and tender inside.

- **Deep Fat Frying**

Food is cooked by immersing the food in heated oil. Here a high temperature of 180-220 degree C is reached. So cooking is done very fast. Deep frying has to be done below smoke point as fats start decomposing above smoke point. Frying gives special flavour and texture to the foods. Fried foods are usually crunchy and crisp. Fried foods are difficult to digest. Eg.Purie, Baji, Pakoda, Samosa, Chips are deep fat fried foods. Fried foods are expensive. Attention is required while cooking and care should be taken to avoid accidents. The food may become oily or soggy due to excess absorption of oil during frying.

- **Sautéing**

It involves use of little fat. The food is tossed occasionally to cook evenly. E.g. vegetables, noodles, mushrooms etc are cooked by this method. It is one of the healthy ways of cooking as nutrients can be retained by this method.

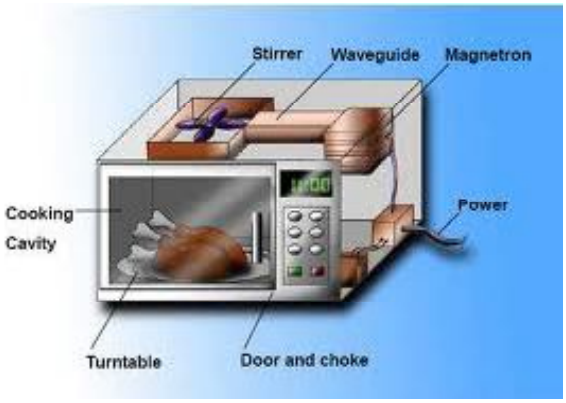
- **Unconventional Methods**
- **Solar Cooking**

Source: rksolar.com

This is an eco-friendly method in which solar energy is used for cooking food. A solar cooker is needed for this. A solar cooker consists of a big metal box inside of which is painted black. The box has a glass cover and a flap with a mirror embedded in it. The flap is adjusted in such a way that the sunrays that fall on the mirror are reflected on the box. Here the fuel is free. The loss of nutrients is less. The chances of food getting burnt are less. Solar cooker keeps the food warm for a long time. The disadvantage is that it takes lot of time for cooking and is affected by the vagaries of weather.

- **Microwave Cooking**

A microwave oven is needed for this. It is a quick and economical method of cooking as it uses very less fuel compared to other conventional methods of cooking. It is used for cooking, reheating, thawing and dehydration. Retention of nutrients is good compared to other methods. The microwaves are generated by the magnetron in the microwave oven. These microwaves bombard the food and cause molecular friction which heats up the food. The containers (plastic/ glass) which are permeable to microwaves can be used for cooking. Some scientists believe that microwave cooking results in molecular damage of the food and therefore such foods are not good for health.



Source usahitman.com

Activity 5

Collect one food sample for each method of cooking

7.6 Effect of Cooking on Nutritive Value

Food is composed of two components-Nutrients and non- nutrients. Nutrients include carbohydrates, proteins, fats, vitamins, minerals, water and non-nutritive components include pigments, flavour components, enzymes etc. The nutrient components undergo the following changes during cooking.

- **Carbohydrates :** One of the common carbohydrates widely found in cereals, millets, dale, roots and tubers etc is starch. It is sparingly soluble in cold water. When heated with water, the starch granules absorb water, swell and there is change in texture, colour and viscosity of the mixture. This is termed as gelatinization. Because of this property starch is used as a thickener in soups, puddings etc. In general the digestibility of carbohydrates is improved by cooking.

Activity 6

Soak a cup of raw rice in water (double the volume of rice) Continue heating till a thick liquid is formed. Record the changes with time and temperature.

- **Proteins:** Heat denatures proteins. Most of the proteins except milk proteins get coagulated by heat. (Milk proteins are coagulated by acid). Coagulation of proteins takes place between 65 and 90 degree C. Cooking results in softening of proteins.

- **Lipids:** If fat used for deep frying is heated beyond boiling point, it smokes (Smoke point). Deep frying has to be done below smoke point. If fat is heated for a long time, it browns and thickens and flavour changes. Such heated oil should not be reused.

Activity 7

A sample of raw egg and a boiled egg are kept in front of you. Make a list of differences between the two.

- **Vitamins:** Thiamine (B1) and Ascorbic acid (Vitamin C) are usually affected by cooking. Repeated washing of rice or dal prior to cooking or cooking in excess water and discarding the same results in loss of thiamine (10-25%). Vitamin C is water soluble, gets oxidized easily and is affected by heat. Washing vegetables after cutting, exposing the cut vegetables to air results in 30-35% loss of vitamin C.

- **Minerals:** Normal cooking procedures do not result in loss of minerals. If excess water used for cooking is discarded then water soluble minerals may be lost.

7.7 Methods of Enhancing Nutritive Value

Methods of enhancing nutritive value are as follows:

- Germination
- Fermentation
- Parboiling
- Malting
- Fortification

- **Germination / Sprouting**

Germination is a process in which seeds (Whole cereal or whole pulse) are soaked in water for 6-8 hours and the seed absorbs water and swells. The excess water is drained and the seeds are wrapped in a muslin cloth and are allowed to sprout or germinate for 12 hours or more

- **Effect of germination**
  - Germination improves the nutritive value. The effect of germination on nutrients is listed below
  - Vitamin C content increases manifold after 48 hours of germination
  - Riboflavin, niacin, choline and biotin content increase but folic acid content decreases
  - Some of the starch will be converted into sugars
  - Most of the toxic factors and anti-nutritional factors will be either reduced / eliminated by germination

- **Fermentation**

It is an anaerobic respiration in which CO2 is produced by microorganisms which results in increase in volume and change in texture of food. Yeast is commonly used to bring about fermentation. Idli, dosa, bread, curd, beer, wine are examples for fermented foods. The following changes are brought about by fermentation

The proteins and starches are partially broken down. Thereby fermentation increases digestibility and palatability of food.

Fermentation improves the availability of essential amino acids, B complex Vitamins such as Thiamine, Riboflamin, Niacin, B12

- **Parboiling**

Parboiling is partial boiling. It is used for paddy. Paddy is soaked in water and steamed or boiled. Parboiling gives a hard texture and smooth surface which drastically minimizes the breaking of rice during milling,

reduces loss of nutrients during cooking, makes it hard for insects to attack. B complex vitamins present in the husk are absorbed by the grain and therefore parboiled rice contains more B complex vitamins than milled raw rice. Parboiled rice is thicker, more brownish in colour than raw rice. Parboiled rice is consumed in coastal areas of Karnataka, parts of Tamil Nadu and Kerala

- **Malting**

Malting is as process in which germinated cereal grains are dried. Cereals such as barley, ragi, wheat are usually used for malting. During malting complex carbohydrates and proteins are broken down into simpler forms and are easy to digest. Malted grain is used to make health drinks, infant foods, beer, whisky etc.

- **Fortification**

According to WHO/FAO fortification is a practice of deliberately increasing the content of an essential micronutrient in a food irrespective of whether the nutrients were originally in the food or not, so as to improve the nutritional quality of food supply and to provide a public health benefit with minimal risk to health. The term enrichment is often used synonymously with fortification; there is a slight difference between the two. Enrichment refers to addition of micronutrients to a food which are lost during processing. Iodized salt, Vitamin D added to margarine, vegetable oil, dairy products, Calcium added to rice, Golden rice (Bio-fortification in which rice is genetically modified to produce â carotene) are examples for fortified foods

Activity 8

Collect a sample of germinated green gram, idli, ragi malt, iodized salt, soya milk, synthetic vitamin and mineral supplements like tonic bottle, B Complex capsules, iron and calcium tablets.

Summary

It is a challenge to prepare nutritious, healthy and tasty food. For

this one has to have the knowledge of how to select suitable ingredients and an understanding of the principles and methods of cooking. There are different methods of cooking such as roasting, baking, broiling, grilling, boiling, simmering, stewing, steaming, pressure cooking, shallow and deep fat frying, solar and microwave cooking. Heating alters the nutritive value of cooked food. So it is very important to cook food in such a way as to retain nutrients as much as possible. There are some methods of improving the nutritive value of foods such as germination, fermentation, fortification, enrichment, substitution.

Glossary

Roasting: It is a method of cooking in which foods are cooked using dry heat without covering it

Baking: Baking is a method of cooking in which hot dry air surrounds food from all sides. Oven or hot sand bath is used for this

Broiling: It is a method of cooking in which foods are exposed to direct heat

Simmering: Simmering is a method of cooking in which food is immersed in a liquid that is maintained just below boiling point (85 to 90 degree centigrade).

Stewing: The temperature of stewing is same as that of simmering but very small quantity of liquid is used for cooking

Smoke point: Smoke point is the temperature at which fat or oil gives off a bluish haze or smoke.

Germination: Germination is a process in which seeds (Whole cereal or whole pulse) are soaked in water for 6-8 hours and the seed absorbs water and swells. The excess water is drained and the seeds are wrapped in a muslin cloth and are allowed to sprout or germinate for 12 hours or more

Fermentation: It is an anaerobic respiration in which CO2 is produced by microorganisms using carbohydrate as a substrate

Fortification: It is a practice of deliberately increasing the content of an essential micronutrient in a food irrespective of whether the

nutrients were originally in the food or not, so as to improve the nutritional quality of food supply and to provide a public health benefit with minimal risk to health

Model Questions

1. How do you select a good quality egg?
2. What is cooking? Mention the any two principles of cooking.
3. What do you mean by smoke point? Why deep frying has to be done below smoke point?
4. Write a short note on mutual supplementation of cereals and pulses.
5. How will you select the various food ingredients for cooking?
6. Explain in detail the preliminary preparations of food.
7. What are the principles of cooking? Add a note on the various methods of cooking.
8. Describe the effect of cooking on various nutritive components of food.
9. Explain any five methods of enhancing nutritive value of foods.

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UNIT – 8

HUMAN GROWTH AND DEVELOPMENT

Learning Objectives

Enable the students to:

- Understand Growth and Development
- Know the laws of developmental direction and different domains of development
- Know the stages of human life span

8.1 Introduction

Human Development is the study of real lives. It is the study of human beings from conception through old age. The development of fertilized ovum into a human being is fascinating. This development from a single celled zygote to complex structure of cells, the human being involves change. This change continues throughout life span. A newborn baby undergoes various stages of development to reach old age. Human Development is the scientific study of those changes that occur during the life span. In other words it is the study from womb to tomb. The study of Human Development helps to understand the changes in growth and development throughout the life span. It also enables to know the norms of development and also the allied fields of growth and development.

- **Definitions**

According to Laura. E Berk, "Human Development is an interdisciplinary field devoted to understanding all the changes that human beings experience throughout the life span".

According to Papalia and Olds, "Human Development is the scientific study of processes of change and stability throughout the human life span".

8.2 Concept of Growth and Development

Human beings are never static; development takes place throughout the life span. Change constantly takes place in various domains. This change is more obvious in childhood but occurs throughout lifespan. It generally occurs in two forms-Growth and Development.

- **Growth**

The qualitative change that can be measured is referred to as Growth. It is the physical increase in the size of the body (fig.1). Ex: increase in weight, height and size of the organ. Growth is one aspect of the larger processes of development. Physical growth slows down considerably after certain period.

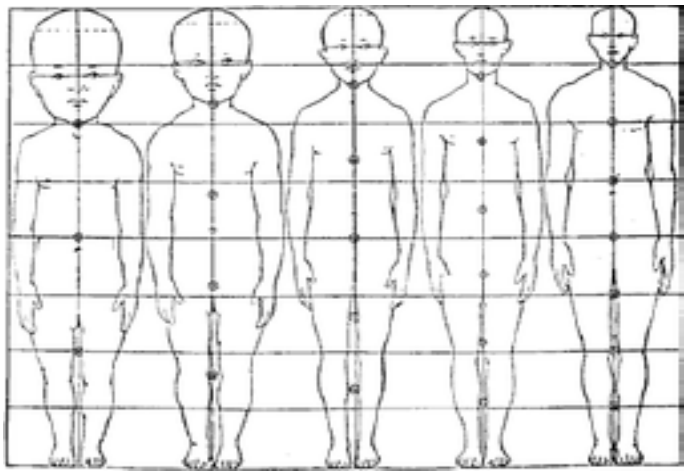

Fig.1: Change in body proportion

- **Development**

It is the quantitative as well as qualitative change which includes not only the structure but also the function. Development is the orderly and relatively enduring change in physical and neurological structure, thought processes and behavior that every organism goes through from the beginning of life to the end. Development continues even when physical changes are not visible.

Activity

Record the heights and weights of infants in the age group of 0-2 years and plot the graph. Observe the changes for increase in height and weight.

Table 1: Difference between growth and development

Growth	Development
● Growth is the concrete change in size and structure	● Development includes growth but abstract changes are also referred as development
● Growth is a kind of development	● Development includes growth
● Physical growth may be a pre requisite for motor or cognitive growth	● Development may take place without any pre requisite physical growth
● Growth is only physical in nature	● Development may be physical, mental, social etc.
● Growth is more oblivious through the increase in size and weight	● Development is perceived through behavior also.

8.3 Stages of Human life span

The human life span has been divided into different sub stages as it is a vast period to study. Different cultures divide the period into various sub stages according to their norms. The Indian culture divides the life span as Brahmacharya, Gruhastashrama, Vanprasta and Sanyasa. The common division of lifespan for the purpose of studying the changes is given in table-2. Though these stages are divided on the basis of chronological age; each stage slightly overlaps the other in the end. There are characteristic changes, developmental mile stones and developmental tasks in the growth and development of each stage. Each individual will

undergo a successful completion of these stages at different rates and slightly at different ages. Each stage has developmental behavioral patterns and problems that must be solved before the individual moves on to the next. Failure to do so might lead to immaturity and poor adjustment in the next stage.

Table.2: Stages of human life span

Stages		Duration
Pre-natal stage		Conception till birth
Infancy	Neonate	Birth to two weeks
	Infancy	Two weeks to two years
Childhood	Early childhood	Two to six years
	Late childhood	Six to 10/11 years
Adolescence		10/11to 18 years
Adulthood	Early adulthood	18-40 years
	Middle age	40-60 years
	Old age	60 years and above

Activity

Prepare a chart / poster on different stages of human life span

- **Pre natal stage**

It is the time from conception to birth. It involves tremendous growth- the growth of single cell to full term fetus which takes place in the uterus of the mother. The duration is approximately nine months.

- **Infancy**

This is the developmental period from birth to 18 or 24 months. It is a time of extreme dependence upon adults. During this period, language,

symbolic thought, sensory motor coordination, and social learning are at the beginning stage.

- **Early childhood**

This is the developmental period from the end of infancy to age 5 or 6. This period is also called as the “preschool years.” During this time, young children learn to become more self-sufficient and to care for themselves, develop school readiness skills such as reading, writing and spend many hours in play with peers.

- **Late childhood**

During this period, the fundamental skills of reading, writing, and arithmetic are mastered. It is the developmental period from about 6 to 10 years of age, and also called as school years. The child is formally exposed to the larger world and its culture. Achievement becomes a more central theme of the child’s world, and self-control increases.

- **Adolescence**

This is the developmental period of transition from childhood to adulthood. This period spans from 10/12 to 18 years of age. Adolescence begins with rapid physical changes—dramatic gains in height and weight, changes in body contour, and the development of secondary sexual characteristics mark the period. At this stage the desire for independence and identity are prominent. Thought is more logical, abstract, and idealistic. More time is spent outside the family and the peers gain the prominent place in an individual’s life.

- **Adulthood**

Adulthood is further divided into young adulthood, middle age and old age. This is the developmental period that begins inthe late teens or early twenties. Young adulthood is a time of establishing personal and economic independence, career development, and, for many, selecting a mate, learning to live with someone in an intimate way, starting a family, and rearing children. Middle age is a time of expanding personal and social involvement and responsibility. This is a time of assisting the next

generation in becoming competent, mature individuals; and of reaching and maintaining satisfaction in a career. Late adulthood is a time of life review, retirement, and adjustment to new social roles involving decreasing strength and health. It is the longest span of any period of development, and the number of people in this age group has been increasing as a result of improved health care facilities and better lifestyle practices.

8.4 Domains of Human Development

The growth and development takes place in an individual from the beginning of life in various domains-physical and motor, cognitive, language, emotional and social.

- **Physical and motor development**

Physical development refers to the physical changes in the size, structure and proportion of the parts of the body, ex: height, weight, development of various organs etc. Motor development is the control over body movements. This requires coordination of various parts of the body. These developments will help an individual to acquire various skills, ex: the coordination of eye and hand will help in writing, eating etc.

- **Cognitive development**

This is the emergence of thought processes. The skills developed in this domain are perception, memory, problem solving, imagination, creativity etc. The ability to think improves qualitatively throughout the life span.

- **Language development**

The changes that takes place in the way an individual communicates with the world is referred as language development. It includes learning of new words, comprehension etc.

- **Emotional development**

Development of various emotions, learning the ways of expression of those emotions is referred as emotional development.

Social development

This refers to the skills in which an individual interacts with self and the society in a meaningful way. This includes the social skills such as cooperation, waiting for the turns, etc.

Activity

Observe an infant during play and identify the skills for all the developmental domains. Report on the inter relationship between domains by stating suitable examples.

Interrelationship between the developmental domains

Although the development takes place independently in each domain, it is interdependent sometimes. Development in physical skills makes the individual mobile. As a result, the individual moves around and thus the social horizon gets broadened. This also enables a person to acquire various cognitive skills as there is an exposure to the new environment and stimulation. Language development helps an individual to communicate better and therefore better ways of expression of emotions are possible. This in turn helps a person to develop new social relationships. Hence the development in various domains is interdependent, and not on its own.

Laws of developmental direction

Physical and motor development follows a predictable pattern. It follows two laws of direction-Cephalocaudal and Proximodistal (Fig. 2).

- Cephalocaudal Law - This is an organized pattern of physical growth and motor control that proceeds from head region to the leg region.
- Proximodistal Law - This is an organized pattern of physical growth and motor control that proceeds from centre of the body to outwards.

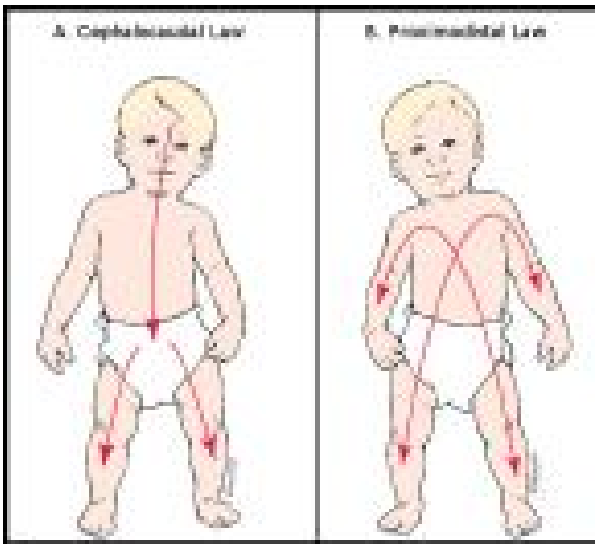

Fig. 2: Laws of developmental direction

8.5 Factors Influencing Growth and Development

Development is the product of maturation and learning. The factors which influence growth and development are heredity and environment.

Activity

Conduct a buzz session on factors influencing growth and development and present the same.

- **Heredity**

The inborn traits and characteristics which are transmitted from parent to children are known as hereditary traits. Genes carry the hereditary material from one generation to the other. Some of the examples are colour of the skin and eyes, height, body structure. These traits cannot be altered by any other external influences.

- **Environment**

The external conditions that influence development are considered as environmental factors. The environmental factors are, cultural practices,

nutrition, socioeconomic conditions psychological factors, parental attitudes, availability of opportunities, quality of care, gender discrimination etc. Sometimes these factors exert a powerful influence on the growth and development of an individual.

Summary

Human development is the scientific study of the human beings from conception to old age. Human beings undergo constant change throughout life span. This change takes place in two forms –growth and development. Growth is the quantitative change whereas development is both qualitative and quantitative. Growth and development take place in all domains namely physical, motor, cognitive, language, emotional and social. These changes that take place in different domains are interdependent. Development in physical and motor domains follows a predictable pattern according to cephalocaudal and proximodistal laws. Heredity and environmental factors influence growth and development.

The human life span is divided into various sub stages based on chronological age. The different sub stages are; pre-natal, neonate, infancy, early childhood, late childhood, adolescence, young adulthood, middle age and old age. An individual will go through all the stages, on completion of the previous stage. Each of these stages has definite characteristics which are specific to that particular stage.

Glossary

Human Development: It is the study of human beings from conception through old age.

Growth: The qualitative change that can be measured. It is the physical increase in the size of the body proportion.

Development: It is the quantitative a well as qualitative change which includes not only the structure but also the function.

Domains of Development: physical and motor, cognitive, language, emotional and social.

Cephalocaudal Law: This is an organized pattern of physical growth and motor control that proceeds from head region to the leg region.

Proximodistal Law: This is an organized pattern of physical growth and motor control that proceeds from centre of the body to outwards.

Cognitive development: The thought processes and intelligence of an individual.

Model Questions

1. Define Human Development.
2. Define growth
3. Define development.
4. Give the stages of human lifespan
5. List the developmental domains
6. What is physical development?
7. What is motor development?
8. What is meant by cognitive development?
9. Give the meaning of language development
10. What is meant by emotional development?
11. Give the meaning of social development?
12. Give the interrelationship between the developmental domains
13. What is cephalocaudal law?
14. What is proximodistal law?
15. List the factors which influence growth and development.

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UNIT – 9

BIOLOGICAL BEGINNINGS OF LIFE

Learning Objectives

Enable the students to:

- Understand the beginnings of life.
- Know about menstruation and pregnancy.
- Understand the stages of pre-natal development.

9.1 Introduction

Human being is the one of the complicated creations of nature. The development of human being from a zygote to a well-developed adult is a long and interesting journey. It is a fascinating process. This process involves reproduction and development. This journey begins with fertilization process. The individual's life begins with the union of sperm and ovum to form a zygote. The zygote then divides further and fetus is formed. There are various factors which influence the growth and development both before and after the birth.

9.2 Reproduction

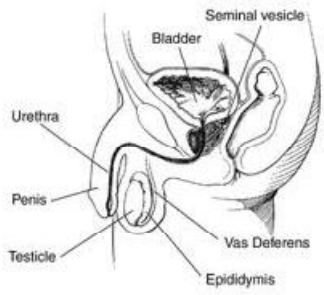
The function of reproduction is one of the essential characteristics of life. The important function of the reproductive system is to carry out the function of propagation. Reproduction is initiated bythe union of sex cells (gametes) sperm and ovum, formed by the testis and ovaries respectively. The cell formed by the union of sperm and ovum is called as zygote.

Male Reproductive System

Male reproductive system consists of a pair of testis which produces spermatozoa and hormones. The other organs are vas deferens, seminal vesicles, prostate glands, urethra and penis.

Functions of Male Reproductive Organs

- **Testicles:** produce and store millions of tiny sperm cells and produce hormones, including testosterone.
- **The Vas Deferens:** transports the sperm-containing fluid called semen.
- **The Epididymis:** is a set of coiled tubes (one for each testicle) that connects to the vas deferens
- **Scrotum:** This bag of skin helps to hold the testicles and also regulates the temperature of testicles, which need to be kept cooler than body temperature to produce sperm.
- **Accessory Glands:** Seminal vesicles-provide fluids that lubricate the duct system and nourish the sperm.
- **The Prostate Gland:** Produces some of the parts of semen.
- **The Urethra:** carries the semen to the outside of the body through the penis.
- **Penis**: Organ for sexual intercourse and the semen which contains sperm is ejaculated through penis.



Male Reproductive System

Female Reproductive System

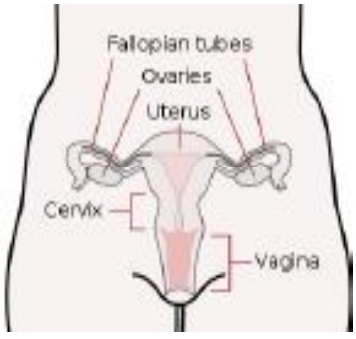
The female reproductive system consists of a pair of ovaries which produce ovum and hormones. The other organs which help in reproduction process in female are uterus, fallopian tubes, cervix, vagina and vulva. Mammary glands are also included because of their associated development and functions.

Activity

Classify the following as male and female reproductive organsOvary, Uterus, Scrotum, Vulva, Testis, Vas deferens, fallopiantube, cervix, penis.

Functions of Female Reproductive Organs

- **Ovaries:** the main function is the formation of female gametes (Ovum)and secretion of female hormones – Estrogen and Progesterone.
- **Uterus:** nourishes the developing fetus throughout the duration of pregnancy. At the end of pregnancy, the muscular walls of the uterus contract to expel the fetus.
- **Fallopian Tubes:** these serve as ducts to convey the ovum from the ovary to the uterus. Fertilization of on ovum by a sperm takes place in the fallopian tube.
- **Cervix:** the opening of the uterus which helps in child birth.
- **Vagina:** the external opening of the female reproductive system. Menstrual flow and child birth takes place through vagina.



Diagrammatic representation of Female Reproductive System

9.3 Menstruation

Menstruation is the cyclical bleeding from uterus of adult female at intervals of one lunar month (28 days) on an overage. It occurs during the reproductive period i.e., from puberty to menopause.

Each ovary contains many sacs like structures called GraffianFollicles,that contain immature egg cells. At the onset of puberty due to the release of FSH (Follicle Stimulating Hormone) from the pituitary gland, several graffian follicles are activated each month, only one will evolve as mature ovum. This process of maturation of ovum takes place in alternative ovaries every month.

Simultaneously, Estrogen is being produced by the ovary. Estrogen signals the uterus to prepare for a pregnancy by filling its lining with blood and nutrients for the nourishment of the fertilized egg. Another hormone called Luteinizing Hormone (LH) is released into the blood stream from the pituitary gland. The production of LH causes the rupture of the follicle and release of the mature ovum, which is drawn into the fallopian tube by the fimbriae. This process of release of the mature ovum is called as Ovulation. This usually occurs midway in the 28 days menstrual cycle (14-16 days).

Each month the endometrium (uterus lining) thickens and gets filled up with blood cells. This is the preparation for receiving the fertilized egg in the event of fertilization. The effect of LH continues to bring about closure of the ruptured graffian follicle which is now called the ‘Corpus Leutum’. Progesterone, another hormone further prepares the uterus for implantation of a fertilized egg and continues to maintain the uterus during pregnancy if fertilization occurs.

If the ovum is not fertilized and there is no pregnancy, the lining of the uterus is not required; it is shed and bleeding results. This monthly bleeding is known as Menstruation. It can be divided into three phases.

The Phases of Menstruation

- Proliferative or Estrogen phase.
- Secretary or Progesterone phase
- Menstrual or Bleeding phase

Proliferative or Estrogen Phase

The level of estrogen in the blood increases and as a result the lining of the uterus starts getting thicker. The graffian follicle gets activated and one graffian follicle matures and releases an ovum. This takes place approximately between 14-16 days of a menstrual cycle. The proliferative phase is also called as follicular phase and lasts for about 1-14 days.

Secretary or Progesterone Phase

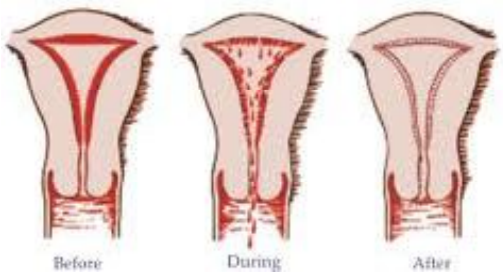
The level of progesterone increases in blood and as a result the lining of the uterus gets thicker and thicker. The graffian follicle which releases the ovum forms a structure called Corpus Leutum, which secretes the hormone progesterone. This phase lasts for 15-25 days.

Menstrual or Bleeding Phase

When the ovum does not get fertilized, the level of estrogen and progesterone decrease in the blood and as a result the lining of the uterus gets detached from the wall of the uterus and comes out of the vagina in the form of bleeding or menstruation. This phase may last from 3-5 days.

Activity

Prepare an audio visual aid on phases of menstruation.

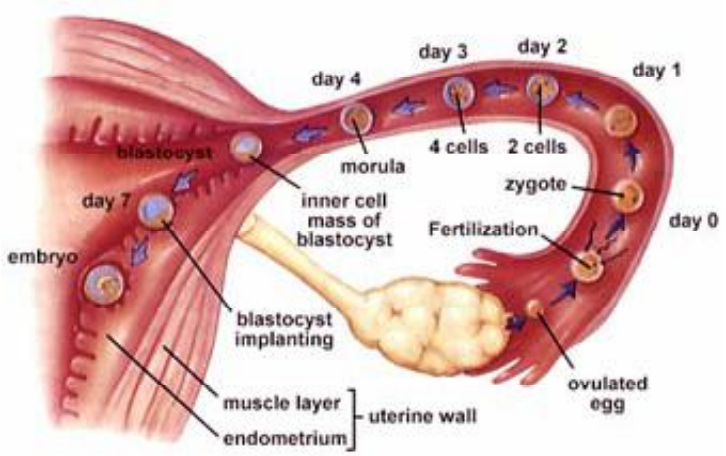


Diagrammatic representation of Menstruation.

9.4 Fertilization

Life begins at the moment of fertilization (conception) the time when female reproductive cell (ovum) is fertilized by male reproductive cell (sperm). The fertilization takes place in either one of the fallopian tubes. The new fertilized cell is called as Zygote. The zygote reaches the uterus and attaches to the uterus wall. This process is called as Implantation. The implanted zygote will develop as a foetus.

The fertilization is one of the most important moments of one's life. Three important aspects are determined at the moment of fertilization. They are: heredity endowment, sex of the individual and number of off springs.



Fertilization and implantation

- **Heredity**

The factor that determines the parental characteristics in the off spring is termed as "Heredity". The gametes – sperm and ovum have chromosomes which contain genes. These carry information necessary for creating new individual. The genes will decide the important characteristics of the individual.

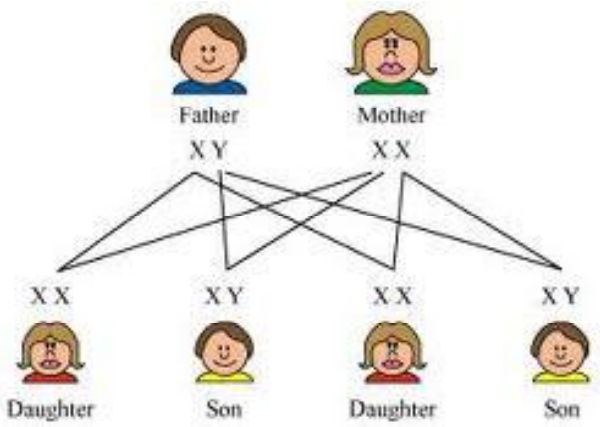
- **Sex Determination**

All human being have 46 chromosomes 23 of these obtained from

the ovum and the other 23 from sperm cell. Together they make up a pair of 23 chromosomes. Of the 23 pairs, one pair consists of the sex chromosomes. The sex chromosomes include 'XX' chromosomes in the mother and "XY" chromosomes in the father. The male baby receives 'X' chromosome from the mother and a 'Y' chromosome from the father. Female baby receives 'X' chromosomes from both mother and father.

- **Number of off springs**

The number of off springs depends on the cell division and multiple fertilizations. This could be singleton, twin, triplets etc.



Determination of sex

9.5 Pregnancy

If the released ovum is fertilized it continues as pregnancy. The duration of pregnancy is also known as Gestation Period. The Gestation Period is 280 days. (9 months or 10 lunar months or 38-40 weeks). This period is divided as first, second and third trimesters. Each trimester is of three months duration. This stage brings about various physiological changes in a woman's body. The increased hormonal activity causes a slight discomfort. There are individual variations in experiencing of these discomforts. Some of them are the signs and symptoms of pregnancy. A few of them might trouble the mother and the fetus as discomforts or complications.

Signs and Symptoms of Pregnancy

- **Amenorrhea:** Stopping of menstruation is the first indication of pregnancy.
- **Morning Sickness**: A feeling of wanting to vomit which is called as Nausea. This usually happens in the early morning. It is common in the early months of pregnancy.
- **Changes in the breast:** Fullness or tenderness of the breasts may be noticed.
- **Quickening:** Quickening is the mother's sensation of the movements of the fetus. It is felt from the fifth month of pregnancy.
- **Enlargement of the uterus**: The uterus enlarges during pregnancy owing to the increasing size of the growing fetus.
- **Enlargement of the abdomen:** The abdomen begins to show enlargement at the 16th week of pregnancy when the uterine wall comes into contact with the abdomen wall.
- **Increased frequency of urination:** There is a feeling of frequent urination. It increases as the pregnancy advances.
- **Vaginal discharge:** Vaginal secretion increases during pregnancy. A white discharge which does not cause local irritation is another symptom of pregnancy.
- **Pigmentation:** During the pregnancy the skin of the nipples turn brown due to increase in the amount of brown pigment. The small lubricating glands around the nipple increases in size and small projection from the surface of the skin are noticeable.
- **Fatigue**: A pregnant woman feels tired and wants to relax for longer periods than usual, as body requires more rest.
- **Change in taste:** It is a common symptom. For eg : If a woman had previously a liking for tea, it may taste horrible now change in taste is not as same as cravings.

Some pregnant women become crazy to eat certain foods, which become a source of amusement, like strong likings (cravings) for inedible articles such as chalk soil etc., This is called as 'PICA'.

Activity

Interview a pregnant women and report on the knowledge of signs and symptoms / discomforts / complications / care / nutritional needs.

Care during Pregnancy

Pregnancy is a time of great fulfillment and happiness. It is also a time of physical and psychological care which plays an important role to keep the health in good condition. The care given to the pregnant mother is called as ante-natal care which includes both physical and psychological care. It is important to take care of pregnant mother as it helps in the following ways.

- Helps to make pregnancy a safer and comfortable one for the mother.
- Helps to avoid certain health risks during pregnancy.
- Ensures a safe delivery.

Physical Care

- **Physical examination and exercise:** Most of the pregnant women gain 9-12.5 kgs during pregnancy. Routine checkups should be conducted by the doctor. These include weight monitoring, blood and urine examination, blood pressure and ultrasound scan if necessary. All these tests help to avoid many complications. Pregnant women should be active and continue to do their household duties and duties at work place unless the doctor advices bed rest due to complications. Walking is the best form of exercise. Breathing and relaxation exercises could also be practiced.
- **Sleep and Rest:** Adequate amount of sleep is necessary for the pregnant women. During sleep, waste products are eliminated from tissues. It is a time of repair and refreshment of the body

and mind. Eight to ten hours of sleep during the night and a short nap in the afternoon is recommended.

- **Care of Breasts:** Comfortable innerwear is advisable. Care should be taken to keep nipples clean.

- **Drugs, Smoking and Alcohol:** All types of drugs should be avoided during pregnancy except those that have been specially prescribed by the doctor. Smoking and excessive use of alcohol should be avoided as they have a bad effect on the developing foetus.

- **Clothing:** Clothing should be made out of soft textured fabrics. Tight – fitted clothing should be avoided. Clean cotton innerwear should be used to prevent infections. Comfortable shoes or flat slippers could be used.

- **Care of the Skin:** Light massage with a special cream or vegetable oil is of help in keeping the skin soft and elastic. A daily warm bath keeps the pregnant woman fresh and relaxed.

Psychological Care

A pregnant woman should be emotionally stable in all circumstances. She should not react immediately to minor problems. Women are anxious about the baby's sex, arrival of the baby, general health, complexion etc. Such thoughts must be avoided and positive feelings must be generated towards the unborn baby.

Nutrition During Pregnancy

Adequate nutrition during pregnancy is extremely important for both maternal and foetal health. There is no need to 'eat for two' as it can lead to excessive weight gain. Pregnant women should eat variety of foods to maintain proper balance of nutrients. ICMR [Indian Council for Medical Research] recommends additional allowances of some of the nutrients during pregnancy period.

Additional energy during pregnancy is required to support the growth of the foetus, placenta and maternal tissues as well as to meet the increased

basal metabolic rate [BMR]. The protein intake must be increased in pregnancy due to its specific contributions to foetal growth. Vitamins such as Thiamin, Riboflavin and Niacin are based upon the energy intake.

Among the minerals, iron and calcium are of great importance because most of the pregnant women are anemic and foetus also gets less iron. During pregnancy, iron is needed for the manufacture of hemoglobin in both maternal and foetal blood cells, expansion of blood volume and foetal growth. Red blood cell formation increases during this period and that requires folic acid. Hence iron and folic acid tablets are given to prevent anemia and to build up iron stores in the baby's liver. These stores last until baby starts taking other foods than milk. Pregnant women must be supplied with sufficient amount of calcium and vitamin 'D' for her own needs and to promote adequate mineralization of the foetal skeleton and teeth. Thus a pregnant woman needs a well-balanced, nutrient rich diet.

9.6 Stages of Pre-Natal Development

As soon as the ovum is fertilized by a sperm, development begins to accomplish such a tremendous task in a short period(Fig 8). Nature has developed a perfect mechanism that specifies the time of delivery of the child. The development of the foetus in the womb of the mother for ten lunar months (28 days / month) is known as Pre-natal development. The prenatal period is divided into three stages. They are as follows:

Period of ovum (0-2 weeks): During this stage the fertilized egg is not attached to the uterus. It floats freely and receives only little nourishment from the yolk to maintain its life before it gets implanted to the uterine wall and gets new source of nourishment. Implantation occurs about ten days after fertilization. Ovum starts receiving its nourishment through the bloodstream of the mother. There is a rapid cell division in this stage and the cluster of cells is called as an embryo.

Period of embryo (2 weeks – 2nd lunar month): There is a quick growth as compared to the total duration of the period. The embryo divides into

two layers, i.e., outer and inner layer. From the outer layer the accessory apparatus such as placenta, umbilical cord and amniotic sac will be formed. These accessory organs will help in the foetal development (Table-1). Placenta develops from the place of implantation. Umbilical cord develops from placenta and is attached at the other end to the abdominal wall of the embryo. Amniotic sac contains amniotic fluid.

The inner layer forms three layers, namely ectoderm, mesoderm and endoderm, Ectoderm helps to form skin, nails, teeth, sense organs etc., Mesoderm is responsible for the formation of muscles, circulatory and excretory organs. Endoderm, the innermost layer helps to form the lining of the lungs, digestive tract, liver, salivary glands, endocrine glands etc.

Table 1: Functions of accessory organs

Placenta	l It supplies the nutrients to the growing embryo. l It also transfers waste products from the embryo to mother. l It secretes hormones which are important for continuation of the state of pregnancy. These hormones keep the uterus in a relaxed state. They also contribute to breast development and inhibit further ovary activity so that ovulation and further pregnancies are not possible.
Umbilical Cord	l It transports the nutrients from mother's blood to the embryo. l Sends the waste products of the foetus back through placenta into mother's blood stream and these are excreted through excretory organs of the mother. l It also supplies oxygen to the foetus and brings back carbon dioxide from the foetus.
Amniotic Sac	l This protects the foetus from shocks or accidents till the time of birth. l It helps to lubricate the birth passage during delivery.

Period of Foetus (end of 2nd lunar month till birth): The foetal activity like kicking begins at the 3rd month. The embryo resembles human being but not proportionate. Tooth buds appear, ears are formed, fingers and nails appear and jaw and nose develops fully. Foetus now begins to move in the amniotic sac. Heart beat can be felt at the 4th month. External sex organs are also formed in the fourth month. From 6th month, the foetus grows rapidly. Soft body hair appears which is called as Lanugo. The foetus is completely covered with a white, oily greasy layer called as VernixCaseosa. Fat deposition also takes place. By 7th month the foetus reaches the age of viability (i.e. if it is to be born pre maturely at this time there are chances for its survival). The nervous, circulatory and other bodily systems are sufficiently well structured to stand a chance of being able to function adequately in the extra- uterine environment.

The 8th and 9th month till birth is marked by further development The fetal movements include blinking, sucking, turning head, fist griping and a variety of movements of hands and feet. The foetus also prepares itself for birth and independent living. The foetus positions itself in the last few weeks which remains unchanged up to birth.

Fig 8: Stages of pre-natal development

Activity

Create a resource file on stages of pre natal development / factors influencing the prenatal growth and development.

Factors influencing Pre-natal growth and development

The growth and development during the pre-natal period is influenced by various factors such as maternal malnutrition, use of illegal drugs, use of tobacco and alcohol, infections, chromosomal abnormalities, unfavorable attitudes towards the baby, maternal age etc.

The position of the foetus in a pregnant women's uterus is of a particular importance as this depends on the type of delivery. The foetus takes a particular position in last few weeks which changes little during the remainder of the pregnancy.

Position of the Foetus

Inside the uterus the foetus has its head bent on the chest and the legs bent up with the knees touching the abdomen. The arms are folded and tied close to the body. The head is considered one pole and buttocks (breech) is the second 'pole'. The longitudinal axis of the baby passes from head to the breech. The three common positions or lies are 'longitudinal', 'the transverse' and the 'oblique' lie. The lie of the foetus is described with reference to the longitudinal axis of the foetus. The positions of the foetus in the uterus are as given below:

- **Longitudinal position:** This is the most common position. The baby lies in the head down position i.e., the head is near the cervix of the mother. This presentation is also known as cephalic presentation.
- **Oblique position:** In this position the baby's longitudinal axis is at an oblique angle to the uterus.
- **Transverse lie:** In this type of presentation the longitudinal axis of the baby is at right angles to the longitudinal axis of the uterus.
- **Breech presentation:** The baby's buttocks are presented first.

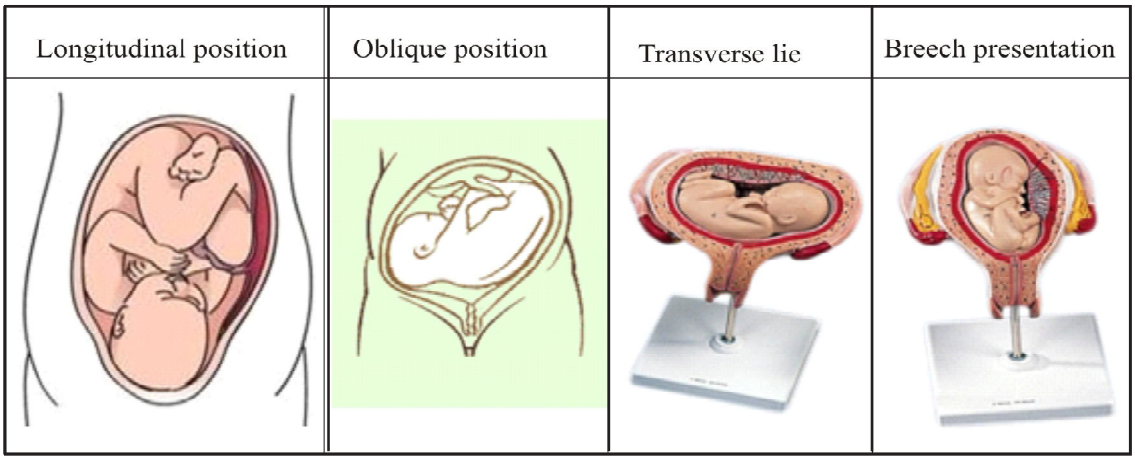


Fig 6: Diagrammatic representation of position of the foetus.

9.7 Child Birth Process

Child birth begins with a long series of involuntary contractions of the uterus, often called 'labour pains'. Child birth process is divided into three stages (Fig 7). They are as follows

- **The first stage (dilation of cervix)**

This stage usually lasts for about 12-24 hours during which the uterine contractions move the foetus down towards the cervix which expands to a diameter of 10cms. When the cervix is fully dilated the amniotic sac breaks down and lubricates the vagina which is the birth canal. In women who have first baby, this stage may be longer.

- **The second stage (delivery of the baby)**

This stage normally lasts between 20 minutes to 1 hour. During this stage the baby passes through the cervix and the vagina and the baby is said to be delivered. The head of the baby is fidrst delivered and then shoulders, abdomen and legs slip out easily. The umbilical cord is then cut and tied, separating the baby from the mother.

- **Third stage / afterbirth stage (placental stage)**

This stage lasts for 10-15 minutes. This is when the placenta and the foetal membranes get detached from the uterus by a series of contractions and are expelled. This is called the “after birth”, and is accompanied by some loss of the blood because part of the uterine lining also gets shed away in this process.

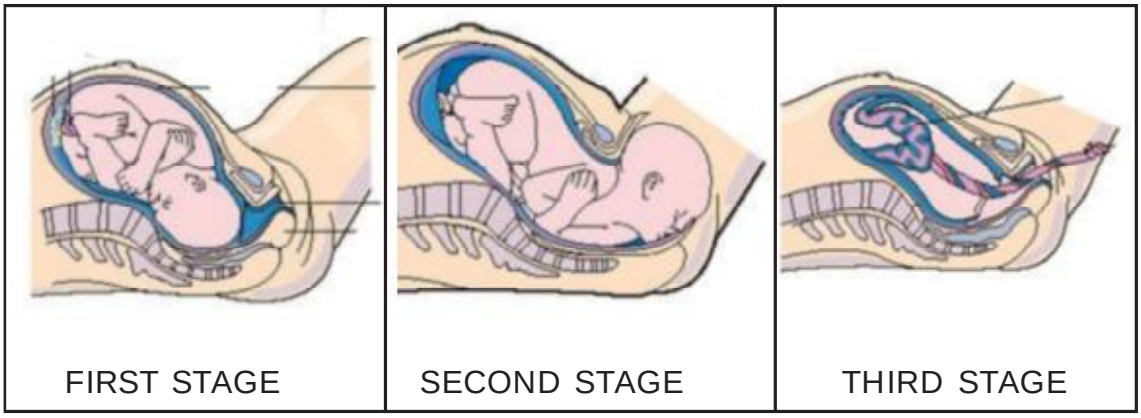


Fig. 7 Diagrammatic representation of child birth process

9.8 Types of child birth

- **Normal birth**

The baby is delivered from the mother’s vagina which is also called as birth canal. The baby presents in a head down posture for delivery.

- **Breech birth**

The baby’s buttocks or legs come out first, followed by the abdomen and then the head. This is difficult position for birth.

- **Instrumental birth**

When the baby is too large to pass through the mother’s birth canal or when the position of the baby makes normal birth impossible, the baby must be delivered by the use of instruments. The common instrument used in such cases is Forceps. Hence the procedure is also known as Forceps delivery. In recent times to avoid any birth injuries caused by using the instruments, the medical professionals and the

parents are opting for the caesarean section, which has accounted for the increase of caesarean section deliveries.

- **Caesarean Section**

This is known as Caesarean section when normal child birth might be difficult, doctors may decide to operate on the mother. This involves the delivery of a baby through an incision (cut) in the abdomen and uterus. It is a major operation involving a general or epidural anesthesia.

- **Precipitate birth**

The birth is very quick and does not take the normal duration of a normal delivery. There is no need for the use of instruments or any medication for the mother

Summary

The growth and development of human being starts from the moment of conception which is the union of sperm and ovum. Reproduction enables the progeny to continue. In human beings the male and female reproductive systems are involved in reproduction process. The female cell is released from ovary and the male cell is released from testis unite together during fertilization process. The ovum is released during the menstruation process. The released egg if it comes in contact with the sperm, the egg is said to be fertilized. Three important factors are determined at the time of conception. They are hereditary factors, sex of the baby and number of off springs. After fertilization the zygote starts growing in the uterus by implanting itself to the uterine wall which continues as pregnancy. Though the pregnancy is considered as a normal stage, it has some discomforts, which can be handled easily. Some of the discomforts could become complications if they are not addressed in the early stage of pregnancy.

Good nutrition and adequate care during pregnancy is essential to ensure the good health of mother and the foetus. Physical and psychological care also facilitates the better growth of the foetus. The foetus takes the position normally in the end of 7th month, which remains

unchanged till the delivery. Based on the foetal presentation, the type birth is decided. Child birth takes place with a series of uterine contractions. It takes place in three stages-dilation of cervix, delivery of the baby and the placental stage.

The pre-natal stage is the first stage of human lifespan which spans from conception to birth. The fertilized egg under goes a rapid cell division to form an embryo. The embryo then divides in to various layers to form the foetus and the accessory organs. The growth of the foetus is complete by the end of the pre-natal period. The growth during this period is influenced by both hereditary and environmental factors.

Glossary

Ovum: The female egg cell (reproductive cell)

Sperm: The male egg cell (reproductive cell)

Zygote: When sperm and ovum unite at fertilization the cell that results is called as zygote.

Gametes: The sex cells sperm and ovum are known as Gametes.

Ovulation: The release of mature ovum from the greafian follicle into abdominal cavity is known as Ovulation.

Graafian follicle: Each ovary contains many sac like structures called Graffian follicles which contain immature egg cells.

Reproductive organs in males: Male reproductive system consists of a pair of testis which produces spermatozoa and hormones. The other organs are vas deferens, seminal vesicles, prostrate glands, urethra and penis.

Reproductive organs in females: The female reproductive organs consist of the ovaries, fallopian tubes, uterus, cervix, vagina, and accessory organs.

Fertilization / Conception: The union of sperm and ovum is known as Fertilization.

Implantation: Attachment of fertilized ovum to the uterine wall is known as implantation.

Menstruation: A cyclical bleeding from the uterus of adult females at intervals of one lunar month (28 days) on an average.

Puberty: A process by which an individual attains sexual maturity and is able to reproduce.

Menopause: Stopping of menstruation and stopping of ability to bear children, usually occurs around the age of fifty years.

Female Hormones: Progesterone and Estrogen.

Endometrium: The inner lining of the uterus, which provides suitable environment for the growth of the embryo.

Gestation period: The duration of pregnancy, normally nine months.

Insomnia: Sleeplessness

Constipation: Difficulty in passing of bowel and passing of hard stools.

Labour: This is the pain experienced by pregnant woman because of contraction of uterus during child birth process.

Dilation of cervix: This is the opening of the cervix during child birth process to help the baby to pass through the birth canal.

Model Questions

1. What is Amenorrhoea?
2. What is Gestation period?
3. Name the gametes.
4. Where does implantation take place?
5. Where does conception take place?
6. What is Lanugo / VernixCaeseasa ?
7. What is PICA?
8. Name the stages of prenatal development
9. Name the female hormones.

10. Name the male and female reproductive organs.
11. Define menstruation.
12. Explain the stages of menstruation.
13. Explain the signs and symptoms of pregnancy.
14. Write a neat diagram of female reproductive system.
15. Explain the functions of placenta/ umbilical cord /amniotic fluid.

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UNIT – 10

INFANCY

Learning Objectives

Enable the students to:

- Understand the neonatal period
- Know the advantages of breast feeding and touch therapy
- Know the growth and development in infancy period

10.1 Introduction

Infancy is the stage of human lifespan which spans from birth to two years. There is rapid growth in all the domains. The first year is characterized by rapid physical growth. Development of motor activity follows a fairly standard sequence. The baby becomes relatively independent by the end of infancy. Growth and development in this period depends on environmental conditions as well as genetic endowment. Infancy is sub divided in to two stages- neonate and infancy. Nutrition, care and immunization play a vital role in these growing years.

10.2 Neonate

The first two weeks of life is known as "Neonatal period". It begins at birth and ends when the newborn is two weeks old (0-2 weeks). This is the shortest of all the developmental stages. This is the time needed for the newborn to adjust to the new environment outside the mother's body. This period is usually divided into two sub-divisions.

- **The period of Partunate:** The period which lasts from the time the foetus emerges from the mother's body until the umbilical cord is cut and tied is known as the period of Partunate. This period covers the first fifteen to thirty minutes after birth.

l **The period of Neonate:** The period of cutting and tying of umbilical cord until the end of the second week of life is known as the period of Neonate. At this time the neonate is no longer dependent on the uterine protection, but has become a separate, distinct and independent individual.

● Characteristics of a Neonate

Neonates differ greatly in size, physiological features, physical proportions, physiological functions and appearance at the time of birth and in their early adjustments after birth.

● Appearance of the Neonate

The average new born has a pinkish colour because of the thinness of the skin, which barely covers the blood flowing through the capillaries. The skin is covered by an oily greasy layer called 'VernixCaseosa', which protects the newborn from infections. Some neonates have a fuzzy soft pre-natal hair called 'Lanugo'.

The head may be misshapen and long because of the molding that is eased its passage through birth canal. The skull has soft spots called "Fontanels', some of which are visible. Fontanels are the soft spots on the head, where the membrane connects the bony parts of the skull. The head may be covered with a heavy growth of hair or it may be sparsely covered. The skin is wrinkled and blotched. The eyes are indefinite in colour which gradually changes to permanent colour. The eyes are large in proportion to the rest of the face. The upper part of head and face are more developed than the chin and lower jaw. The nose is very small and almost flat and the mouth looks like a slit.

● Size and Proportion

The average length of the newborn at birth is 50 cms and the average weight is 2.5 kgs. The head is approximately 1/4th of the body length. The cranial region is proportionately much larger than rest of the head, while the chin is proportionately too small. The nose is very small and

the mouth may look like a slit. The neck is very short and almost invisible and the skin covering lies in folds. The shoulders are narrow and the abdomen is large and bulging. The arms and legs are short and thin. The hands and feet are miniatures.

The muscles of the newborn are soft, small and uncontrolled. The bones and muscles are soft in nature and are also flexible because they are chiefly composed of cartilage. In the first 4-5 days, the newborns lose approximately 10% of their birth weight. This loss is due to loses of excess body fluid. By the end of a week they start to regain weight reaching the birth weight in approximately 14 days.

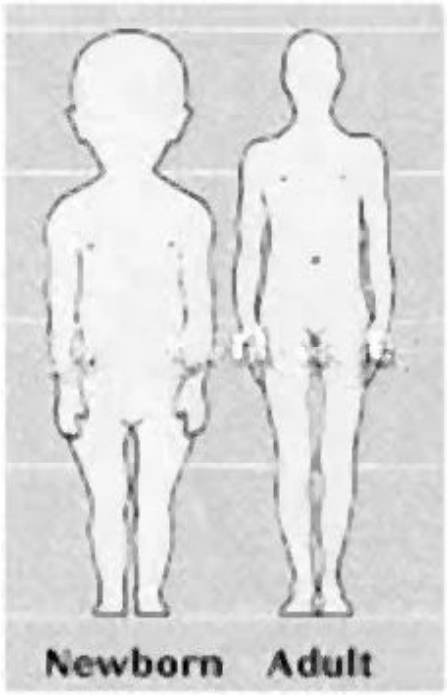


Fig 1: Proportion of the newborn

- **Sensory Capacities of a Neonate**

***Vision*:** At birth the muscles of the eye are not well developed as a result the newborn vision is blur at birth. The newborn can see and

perceive something moving, bright colouredobject and responds to light by blinking.

***Hearing*:** The ears are well developed at birth but hearing is not well established due to the presence of amniotic fluid in the ear cavities.

***Smell*:** The cells for smell are well developed at birth. It is believed that newborns can distinguish different odours by showing different responses.

***Taste*:** The sense of taste is very well developed at birth. The newborns generally show positive reactions to sweet taste and negative reactions to salty and bitter tastes.

***Touch*:** The skin of the newborn is soft and sensitive to temperature, touch and pressure. Sensitivity to cold is more highly developed, than sensitivity to heat.

10.3 Adjustments of a Newborn

Adjustment to post natal life is a challenging and difficult process for the newborn. The newborn must make adjustment in the following four major areas:

- **Adjustment to breathing**

The first adjustment a newborn baby must make is breathing. The lungs are not used to functioning while the baby was in the mother's uterus, even though they are well developed for breathing. The birth cry is nature's way of inflating (fill with air) the lungs to start the breathing progress, and the baby has to adjust to breathing independently.

- **Adjustment to temperature**

Babies spend about 9 months in a constant temperature of 1000F (380 C) in the uterus. Newborn babies must suddenly adjust to outside temperature which range from 600-800F (160-270C). Babies need to

be kept warm in soft, warm clothing in order to enable them to conserve body heat.

- **Adjustment to taking nourishment orally by sucking and swallowing**

After birth, babies must develop their sucking and swallowing reflexes to get the food they need. Even though sucking and swallowing are reflexes provided by nature to meet the need, they are not always well developed at birth. As a result, babies often suck and swallow at the same time. They may choke on food and spit it up. Thus they miss out on the nourishment needed for growth during the first few days of life. Only after the babies master the sucking and swallowing reflexes, they will regain their weight and resume the pattern of growth which was interrupted at birth.

- **Adjustment to elimination of waste products**

After delivery, when the umbilical cord is cut, the babies begin to eliminate the waste products by themselves. They should pass urine and clear the bowels within 24 hours of birth. The first stools passed by the neonates is called as 'Meconium'.

10.5 Care of a Neonate

Care of the newborn involves careful handling of the baby in bathing, diapering, clothing and feeding etc., proper care should be taken at the time of birth.

- **Care at Birth**

While cutting the umbilical cord, sterilized blades should be used. The newborn should be wiped with sterilized cloth and hygiene should be maintained at the birth place to avoid infections.

- **Care during later Neonatal Period**

l ***Lifting Babies***: A small baby should be lifted by grasping both the feet or thigh with the right hand and slipping the left hand under the

neck and head. The baby is then raised upon the left arm. By this method the entire spine is supported and no undue pressure is made upon chest. Older infants may be lifted by grasping the body under the arms but should not be lifted by the wrist.

● ***Diapering*:** A clean absorbent cloth is good for making diapers at home. They should be changed as soon as they are soiled. The diapers may be washed with hot soapy water and sun dried.

● ***Clothing*:** In warm climates, babies need a shirt and diaper with a light blanket. In cold climate a sweater or flannel coat must be added in the day time. The clothing for the babies should be made from cotton or any other soft material.

● ***Crying*:** Crying is the only means by which, the baby communicates. The cry does not always mean that the baby is hungry. Hunger cries are healthy and strong cries, if the baby puts a finger in the mouth and sucks; it is an indication that the baby is hungry.

● ***Bathing*:** A daily bath is a pleasant habit for the baby unless the baby is unwell. Traditional warm oil massage followed by a warm bath is excellent for the baby's general health. A mild soap and shampoo should be used. A clean soft towel must be used to dry the baby's skin.

● ***The Scalp*:** Sometimes there is a tendency for a crust to form on the scalp. In such cases, it is advisable to soften the crust with oil. If the crust does not clear up, a doctor must be consulted.

● ***Navel*:** The cut umbilical cord should be left alone. When it falls off, the navels may appear red for a few days. If this redness does not disappear a doctor should be consulted.

● ***Sleep*:** A newborn baby normally sleeps for about 18-20 hrs and gradually the sleeping time reduce. The bedroom should be calm and away from other disturbances and it should be warm.

l ***Burping*:** Babies usually swallow air while feeding which has to be expelled out to avoid discomfort. Soon after the feed, the mother should put her baby on her shoulder and gently rub the back or hold the baby in a sitting position and rub the back to relieve the gas from inside. This is called as burping. This should be done after every feed or sometimes if the baby seems in discomfort it could be done in between the feeds also.

10.6 Touch Therapy

Touch is a fundamental means of interaction between parents and young babies. Touch is one of the five important senses. Touching is one of the most important way in which a mother and infant bond with each other. Touch therapy teaches mothers to use touch as a way of getting to know their infants better. Physical contact is one of the basic needs of infants and is essential for normal emotional and interpersonal development. In India body massage is popular for young babies and is credited to provide all kinds of benefits.

● Definition

"Touch or massage therapy is a method of systematically stroking an infant usually starting with the face and then moving to the chest, arms, stomach, legs and back".

Touch therapy is often given by mothers by using oil or talcum powder. They also talk, sing or make baby sounds. Eye contact is important. Touch should be slow, firm and rhythmic.

● Advantages of Touch Therapy

- It helps to develop meaningful physical contact between mother and infant.
- Touch Therapy helps the mothers to bond more closely with their babies.
- It gives relaxation, reduces stress and promotes a feeling of well-being in babies.

- Touch therapy reduces the pain of infant colic.
- It improves blood circulation, improves muscle tone and relieves fatigue.
- Touch is believed to send stimulatory messages to the brain to enhance neuro-motor development of the baby.
- The oil used in giving touch therapy improves the skin tone.

10.7 Importance of Breast Feeding

Breastfeeding is the feeding of an infant or young child with breast milk. The aim of breast feeding is to produce a contented and a well-nourished baby.

● Exclusive breast feeding

Breast feeding should be initiated immediately after birth preferably within half an hour. Exclusive breast feeding for the first six months (without sugar water or honey).

● Colostrum

It is the yellowish thick liquid produced by the mammary glands for the first two or three days after the baby is born. It is rich in nutrients, has anti infective properties. It also helps in clearing the digestive tract of the newborn.

● Advantages of Breast Feeding

- It has all the nutrients in right proportions which are essential for growth.
- It has anti-infective properties.
- It is easily digested and reduces the risk of gastro intestinal disorders, allergies and respiratory infections.
- It is hygienic and safe for the baby.
- It promotes the emotional contact between the mother and the baby.

- It is natural food for the baby.
- It gives an enjoyable and satisfying experience for both the mother and the baby.
- It is readily available and is at right temperature.
- It helps the mother to shed extra weight gained during pregnancy.
- It helps the uterus to go back to its normal size.

Activity

Conduct buzz sessions on the advantages of touch therapy and breast feeding – report the opinions.

10.8 Infancy

The term infancy or babyhood is used to refer to that period extending from the end of the 2nd week after birth to the end of the baby's second year of life. By the end of babyhood, the baby is relatively independent and can do many things on its own. This period has distinctive characteristics which are specific (Table-1)

● Characteristics of infancy

Infancy is:

- the true foundation age
- the age of rapid growth and change
- the age of decreasing dependency.
- the beginning of socialization.
- the age of increased individuality.
- the beginning of sex role typing.
- an appealing age.
- the beginning of creativity.
- the hazardous age.

10.9 Developmental domains during infancy

● Physical Development

Infancy is the period of rapid growth during life span. During the first six months of life, growth continues at the rapid rate, and then begins to slow down.

● ***Weight*:** At the age of four months, the baby's weight has normally doubled. At one year, babies weigh on the average, three times as much as they did at birth.

● ***Height*:** At four months, the baby measures between 23 and 24 inches. At one year, between 28 and 30 inches, and at two year, between 32 and 34 inches respectively.

● ***Physical proportions*:** Head growth slows down in infancy, while trunk and limb growth increases.

● ***Bones*:** The number of bones increase during infancy. Ossification begins in the early part of the first year, but is not completed until puberty. The fontanel gets closed at around 1 ½ years.

●***Teeth*:** The average baby has four to six of the 20 temporary teeth by the age of one and 16 by the age of two years. The first teeth to cut through are those in the front, the last to appear are molars.

● ***Muscle and Fat*:** Muscle fibers are present at birth but in very, under developed forms. They grow slowly during infancy, but fat tissues develop rapidly during infancy, due partly to the high fat content of milk, the main ingredient in a baby's diet.

● ***Nervous System*:** Gain in brain weight is greater during the first two years of life.

● ***Sense organ development*:** The eye muscles coordinate well around the age of 3 months, and this enables the baby to see things

clearly. Hearing develops rapidly during this time. Smell and taste, which are well developed at birth, continue to improve during infancy. Babies are highly responsive to all skin stimuli because of the thin texture of their skin.

- **Motor Development**

It is the development of speed and co-ordination in the use of arms and legs and other parts of the body. This control comes from the development of the reflexes present at birth. The baby gains control over the motor activities gradually. The pattern of motor development is given below -

- **Motor development of head region**

Control of the muscles involved in the eye movement, smiling, laughing and holding up the head develops very quickly. Eye co-ordination improves as the baby grows. Smile in response to smile of another person appears at the age of four months. By the age of six months most babies can hold up their heads when seated on some one's lap. At five months the baby turns the head freely when sitting on a chair. After a few months the baby is able to hold the neck and trunk muscles for a quite long period.

- **Motor development in trunk region**

The two important developments in trunk region taking place are the abilities to turn the body by rolling and sitting up. This development starts at the age of 2 months. By 4 months the babies are capable of pulling themselves to sitting position.

- **Motor development in hand and arm region**

Control of the muscles of arms, shoulders and wrists improves rapidly during the infancy period. Control of the fine muscles of the fingers, develops at a slower rate. Working of thumb in opposition to other fingers, which helps in grasping, normally appears between the eighth and tenth months. There is rapid increase in use of hands during infancy. The

hand skills centre mainly on independent feeding, dressing and playing.

Table-2 Types of skills which are learnt during infancy

Hand Skills	Leg Skills
Self -feeding: Around twelve months, the babies can try to feed themselves with the spoon.	Babies learn to jump from an elevated position usually by movements resembling walking.
Self – dressing: Hand skills appear first in the baby's ability to remove the clothing. Play skills: These skills appear around the age of 2 years.	They learn to climb stairs first by crawling and creeping.
Writing skills: By eighteen months most babies can scribble with a pencil or crayon.	After they learn to walk alone around one year of age, they go up and down steps in an upright position. By the age of two years, few babies are able to ride tricycles.

Activity

Prepare an album of major changes in physical development from birth to 2 years of life.

- **Language Development**

Language helps the infants in thinking, problem solving, remembering, learning and perceiving the world.

- **Stages of Language Development:**

From the very beginning of life, the baby needs some means for communication. As the baby does not know any language at this time,

he uses some other ways of communication to fulfill his needs. They are called as pre-speech forms. They are:

- ***Crying*:** Babies begin life with the ability to make noise by crying. There are several types of cries like hunger, fear, pain and wetness etc., parents try to distinguish these cries. By the end of the first stage of development, infant begins to use variations in the basic cry to communicate pain or hunger.

- ***Cooing*:** The second stage starts at the age of about 3-5 months. This stage of development is characterized by the cooing (comfort sounds). The cooing lasts for about 10-12 seconds. At this stage the babies respond to human sound more definitely. They look at the speaker and try to produce some chuckling sounds.

- ***Babbling*:** The third stage of vocal development (5-12 months) is characterized by an even greater variety of speech sounds. At the age of 6-7 months infants begin to end some of their utterances with rising as well as falling tones. Most common sounds are ma ma, da or di. It is considered as the first step in meaningful communication.

- ***Gestures*:** Gesture or action is the form of communication which is a substitute of speech.

- ***Speech*:** This stage (after 9 months) is characterized by the beginning of patterned speech. The development of speech requires the infant to master the four skills – pronunciation, comprehension, vocabulary and sentence formation.

Emotional Development

At birth the emotions appear in simple almost completely undifferentiated forms. With age, emotional responses become less diffuse, less random and more differentiated, and they can be aroused by a variety of stimulate emotions influence an individual's adjustment with other individuals in society and determine his conduct towards them.

Characteristics of infant's Emotions

The emotions of infants are-brief, intense, transitory, appear frequently, responses are different, can be identified from symptoms of behaviours. Pattern of emotional expressions change over time and they also change in strength.

Common Emotional Patterns

The common emotion patterns which develop in infancy include anger, fear, curiosity, joy and affection.

Positive Emotions

- Curiosity: Infants are curious about everything. They are intensely curious about their own bodies and about everything in their environment. Babies express curiosity by tensing the face muscles, opening the mouth, stretching out the tongue, and wrinkling the forehead.

- Affection: Infants' affection is directed to many people. Animals and inanimate "love objects" are sometimes substitutes for human objects of affection. Babies under 5 months of age fix their gaze on a person's face, kick, hold out and wave their arms, try to raise their bodies smile and turn their trunks. By the end of one year, young children show affection for others in uncontrolled manner. They hug, pat, stroke and kiss the loved person or object.

- Joy/Pleasure: Among babies the pleasant emotion of joy happiness comes from physical well-being. The joyful emotions are always accompanied by smiling or laughing and general relaxation of the entire body. They jump up and down, clap their hands, hug the person animal or object that has given them joy and laugh.

Negative Emotions

- **Anger:** anger is provoked primarily by conditions that interfere with the baby's activities including restraints of his movements.. Children usually express their anger through aggressive behaviours- may be physical or verbal may be mild or intense. Violent outbursts of anger are typical in young children. They do not hesitate to hurt others by any method at their disposal – hitting, spitting, kicking, punching, poking or pulling.

- **Fear:** During infancy, fears arise in response to sudden or intense stimuli of any sort. Any loud sound a flash of light etc arouses fear. Infants hide their faces and get as far away from the feared object or person as possible.

- **Jealousy:** Jealousy is a normal response to loss of affection. It is a sort of anger directed against a person of whom the child is jealous. Often some fear is combined with anger. When the new baby arrives in a family, the older one starts feeling jealous towards the new baby. Situations, in which children feel that they have been deprived of material possessions that other children have, make them jealous of these children. The responses to jealousy may be aggressive attacks, biting, hitting, pushing, punching etc., some children show different responses like bedwetting, thumb sucking destructiveness etc. These responses are considered as attention seeking behaviours.

Social Development

The baby first develops a normal and healthy relationship with the person who takes care of the needs i.e. mother. As mother attends regularly, the mother-infant emotional bond is developed. Attachment is shown by coming nearer to the mother, touching her, crying for her in separation and smiling when she is near etc.

Foundation of social behaviour is laid in infancy. Socialization begins around the third month when baby can distinguish between people and

objects in the environment and when the baby responds differently to them. The first social smile appears at the age of around 3 months. The baby turns the head when a human voice is heard and smiles in response to a smile. They express pleasure in presence of others by smiling kicking and waving their arms. It is regarded as the beginning of social development.

By the age of 3 or 4 months, babies can distinguish between familiar people and strangers. They show fear of stranger by crying and turning heads. At the age of 5-6 months they react differently to friendly and angry voices. The baby becomes a part of the social group by imitating others. They baby shows dependency and co-operation behaviours with adults. The babies show resistant behaviours to the things which they do not like by disobeying and crying. They do show rivalry and attention seeking behaviours.

10.10 Immunization Schedule

Immunization is the process of producing immunity in the body against pathogenic organisms by injecting certain substances into the body. These substances stimulate the body to produce disease fighting antibodies. The substances which are injected to the human body to stimulate the production of fighting antibodies are called vaccines. Vaccination is done either under the skin, on the surface or through the mouth, depending upon the specific features of vaccine contents.

At birth a newborn infant gets some of the antibodies from its mother. These help the baby to fight against disease for the first few months of life. Later the baby is given vaccines and begins to manufacture antibodies. The immunization schedule recommended by the Indian Academy of Pediatricians is given table-4.

Table-4: Immunization schedule

Age	Vaccine
Pregnant woman is given three doses of Tetanus toxoid	TT *[Protects against Tetanus]*
At Birth	● BCG *[Protects against TB]* ● Oral Polio Vaccine (OPV) *{Projects against polio)* ● Hepatitis B- 1st dose *[protects against Hepatitis B]*
At 6 Weeks	● DPT – 1st dose *[protects against Diphtheria, Pertusis and. Tetanus, It is also known as Triple antigen].* ● OPV – 2nd dose.
At 10 Weeks At 10 Weeks A6 14 Weeks	● OPV – 2nd dose. ● DPT – 2nd dose § OPV – 3rd dose ● DPT – 3rd dose § OPV – 4th dose
9 months	Measles vaccine
15-18 months	● MMR *[protects against Measles, Mumps and Rubella]* ● DPT- 1st booster dose ● OPV – 5th dose § Cholera Vaccine *[protects against cholera]*
2 years	● Typhoid Vaccine *[protects against typhoid]* ● Cholera Vaccine
5 years 10 years	● DPT – 2nd booster dose § OPV – 6th dose TT – 3rd booster dose
15-16 years	TT – 4th booster dose

10.11 Complementary Feeding

Good food is important for good health. Children who are well fed during the first two years of life are more likely to stay healthy for the rest of their childhood. During the first six months of a child's life, breast milk alone is the ideal food. It continues to be an important source of nutrients until a child is at least two years old. However after six months of age all babies need increasing amounts of additional foods, before eventually changing to family foods alone. These additional foods are called complementary foods.

● Weaning/Complementary Feeding

It is the process of changing baby's diet from liquid food to semi solid and solid foods. It is the process of expanding the infant's diet to include food and drinks other than breast milk. It represents a period of dietary transition just when nutritional requirements for growth and development are high.

● Complementary Foods

The family foods which are modified by processing the ingredients to make them easily digestible by the infant and are given to infants after six months in addition to breast milk.

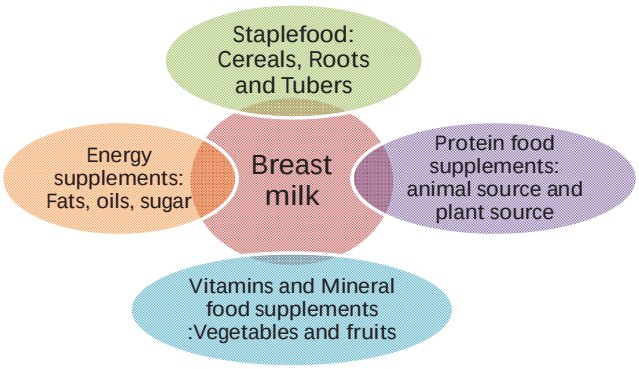
Fig 2: Complementary feeding

- **Characteristics of Complementary Foods**

  Complementary food should be:

  - rich in calories with good quantity protein, vitamins and minerals.
  - a semi-solid mass of soft consistency.
  - low in dietary fibre.
  - easily digestible.
  - easy to prepare, preferably with foods available at home.
  - clean, safe and freshly prepared.
  - free from artificial colours and flavours.

Complementary feeding:



Summary

Infancy stage is from birth to two years. The infant become relatively independent in this stage. This is subdivided into neonate and infancy. Neonate is from birth to two weeks and the infancy period spans from two weeks to two years. The neonate's average weight is about 2.5 kgs and average height is about 50 cms. The neonate's body is covered by an oily greasy layer called Vernix Caseosa, which protects the neonate from

infections. The sense organs of a neonate are well developed at birth.

The newborn baby has to make various adjustments. Some of the reflexes have the survival value. Touch therapy helps infants in their growth and development. Exclusive breast feeding should be given to the neonate upto six months and after six months complementary foods should be given to meet the increased demand of nutrients. Infancy is the period of rapid growth, and it is evident in all the domains. The growth is affected by various environmental and hereditary factors at this stage.

Glossary

- **Neonate:** A newborn baby who is two weeks old is known as Neonate.
- **Partunate**: The period which lasts from the time the foetus emerges from the mother's body until the umbilical cord is cut and tied.
- **VernixCaseosa**: The neonate's skin is covered by an oily greasy layer called 'VernixCaseosa', which protects the newborn from infections.
- **Lanugo:** Some neonates have a fuzzy soft pre-natal hair called 'Lanugo'.
- **Immunization:** Immunization is the process of producing immunity in the body against pathogenic organisms by giving certain vaccine.
- **Fontanels:** Fontanels are the soft spots on the head of the neonate.
- **Colostrum:** It is the yellowish thick liquid produced by the mammary glands for the first two or three days after the baby is born. It is rich in nutrients, has anti-infective properties.
- **Weaning:** It is the process of changing baby's diet from liquid food to semi solid and solid foods.
- **Colic:** is a form of stomach pain which starts and stops abruptly in infants.

Model Questions

1. Who is a neonate?
2. Explain the characteristics of a neonate.
3. What are fontanels?
4. Give the average height and weight of a newborn baby
5. Explain the sensory capacities of a newborn
6. What are the adjustments that a neonate has to make?
7. Explain the care of a neonate
8. What is touch therapy? Give the advantages
9. What is exclusive breast feeding?
10. Give the advantages of breast feeding
11. Give the age range of infancy.
12. Trace the physical development during infancy
13. Explain the motor development during infancy
14. Discuss the language development during infancy.
15. Write a note on emotions of infants
16. Give the immunization schedule of infancy period
17. What is Immunization? Write the schedule
18. What is complementary feeding?
19. Give the characteristicsof complementary food
20. Mention pre speech forms of an Infant.

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UNIT – 11

INTRODUCTION TO TEXTILE FIBRES

Learning Objectives

Enable students to:

- To understand the different types of textile fibres used in clothing
- To understand the Classification of fibres
- To Gain knowledge about the properties of fibres

11.1 Introduction

The word Textiles comes from the Latin word “Textilis” meaning woven. In Textile Science, however, a textile is freely defined as any product made from fibres. Thus the term refers not only to woven fabrics but also to non woven fabrics, knitted fabrics, and special fabric constructions.

The record of man’s use of textiles dates back thousands of years before the birth of Christ. Ancient people used grasses, reeds, leaves and animal hide to cover their bodies. He learnt to spin the fibres. Convert it to yarn and interlace to form a cloth. All early fibres were composed of natural plant and animal products.

The ingenuity of human beings and their desire to enhance their own appearance led, over the centuries to the development of complicated fabrics and within the past hundred years, to great technological expansion. The industrial revolution of the eighteenth and nineteenth centuries transferred the processing of fibres and the manufacture of fabrics from home or small cottage industry to the factory.

For Centuries, nature was the only source of fibres for textiles. The first manmade fibre Rayon became practical reality early in the twentieth

century followed by cellulose acetate in the 1920's. Since 1960 major changes in the production and manufacture of fibres, yarns and fabric have come about. Textile fibres and the fabrics made from them have almost limitless uses and new applications are constantly being found.

Activity

Observe different types of fabrics and list them

11.2 Textile Terminologies

Fibre – Fibre is the basic visible fundamental unit of a fabric. It is either natural or manmade.

Staple Fibre – A staple fibre is a short fibre that is measured in inches or fraction of inches or centimetres. All the natural fibres except silk are staple fibres.

Filament Fibres – A filament fibre is a long continuous fibre that can be measured in meters or yards or in the case of manmade fibres in kilometres or miles. All the manmade fibres are filament fibres.

Yarn – A yarn can be defined as a continuous strand of textile fibres, staple or filament, in a form suitable for knitting, weaving or other method of intertwining to form a yarn.

Monofilament Yarn – It is a yarn composed of only one filament fibre.

Multifilament Yarn – It is a yarn composed of several fibre filaments.

Spinning – Spinning is a process of making fibrous material into yarn or thread.

Fabric – A fabric is a flexible cloth made from fibrous or non-fibrous materials by different methods.

Loom – A loom is a device to weave cloth.

Weaving – Weaving is a method of forming fabrics by interlacing two or more sets of yarns, Warp and Weft at right angles to each other.

Non-Woven's – Non woven's are fabrics constructed of fibres held together by bonding or interlocking or both accomplished by mechanical, chemical, thermal or solvent means.

11.3 Properties of Fibres

A textile fibre is of practical value or commercial importance only when it possesses certain desirable physical, chemical and biological properties. In addition it must be readily available, economic in price and spinnable into a yarn.

All fibres possess certain basic characteristics. By knowing these properties, it can be determined if a fibre is suitable for use in a specific fabric. Textile technology can determine the best fundamental properties of fibres which will serve specific uses and then design the structure to achieve these ends.

A textile fibre has three properties. They are,

- Physical properties
- Chemical properties
- Biological properties

- **Physical Properties**
  - Length
  - Strength
  - Lustre
  - Elasticity
  - Resiliency
  - Absorbency
  - Heat conductivity

Length – The length of a fibre refers to its staple length or filament length. Staple lengths of fibres are measured in centimetres or inches. Filament length is measured in yards or Meters.

Strength – Strength of a fibre refers to the maximum stress that the fibre can withstand when being pulled or stretched. It is also known as tenacity. Tenacity is determined by mechanical devices and is interpreted using standard mathematical calculations. It is expressed as grams force per denier. Strength varies considerably among different fibres.

Lustre – Lustre refers to the gloss, sheen or shine that a fibre possesses. It is the result of the amount of light reflected by a fibre and it determines the fibres natural brightness or dullness.

Elasticity – Elasticity is the ability of the textile fibre to resume its original form, size or shape after forces which caused its deformation have been removed.

Resiliency – Resiliency is the ability of a fibre to spring back or return to original shape after compression.

Absorbancy – The ability of the textile fibre to absorb moisture and give it up again in evaporation.

Heat Conductivity – Heat conductivity is the ability of the textile fibre to conduct heat.

- **Chemical Properties**
  - Resistance to Acids
  - Resistance to Alkalis
  - Resistance to Bleach
  - Affinity to dyes

Resistance to Acids – This property indicates the ability of textile fibres to resist the action of concentrated and dilute organic and mineral acids

Resistance to Alkalis – This property indicates the ability of the fibre to resist the action of concentrated and dilute alkalis.

Resistance to Bleach – This property indicates the ability of the fibre to resist the action of strong and dilute bleaches.

Affinity to dyes – This property refers to the ability of the fibre to absorb the dyes.

- **Biological Properties**
  - Resistance to Mildew
  - Resistance to Insects
  - Resistance to Sunlight

Resistance to Mildew –This property refers to the ability of the fibre to resist the action of microorganisms and mildew.

Resistance to Insects – This property refers to the ability of the fibre to resist the attack of several types of insects.

Resistance to Sunlight – This property refers to the ability of the fibre to resist the ultra violet rays of the sun.

Activity

Observe different types of fabrics used for clothing, furnishings, carpets and list them.

11.4 Classification of Fibres

The Textile industry uses many fibres as its raw materials. As a result of the development of new fibres, difficulties arise in the textile industry in terms of identification and classification.

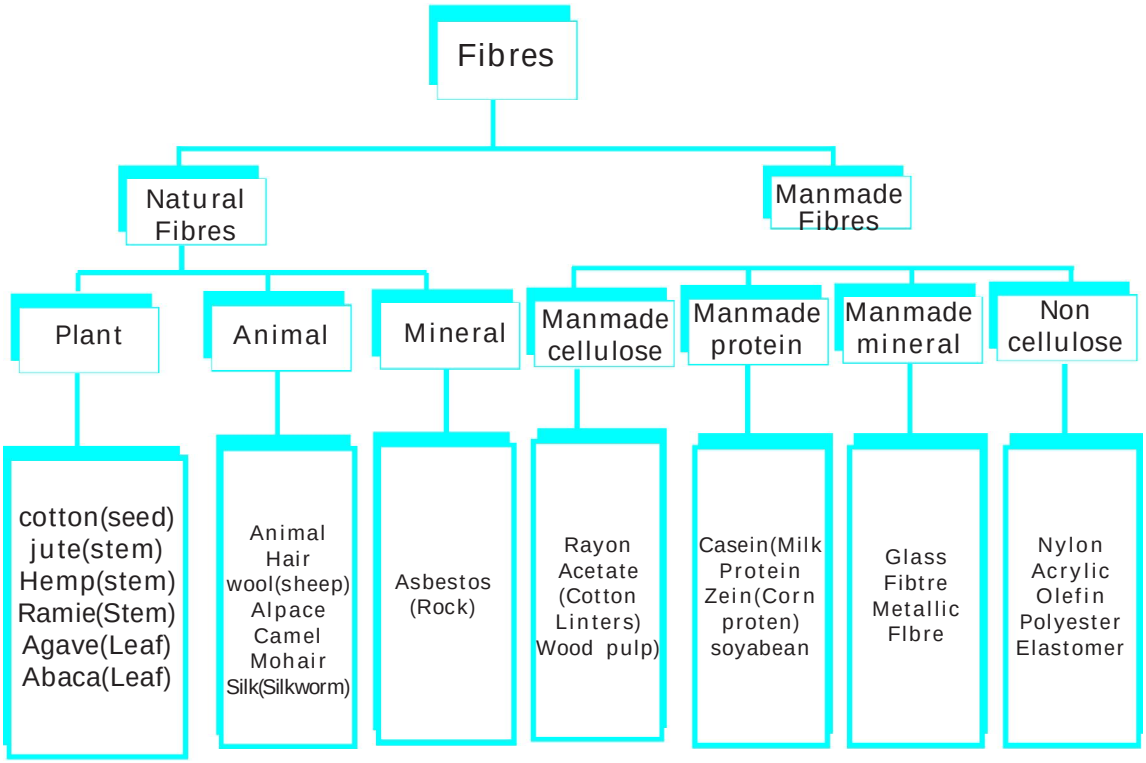
Textile fibres are classified broadly in two ways.

- **Classification of fibres by origin**

According to the source from which textile fibres are obtained, fibres are broadly classified in two ways.

- Natural Fibres
- Manmade Fibres

Classification of fibres based on origin



- **Classification of fibres by Length**

According to length fibres can be classified in two ways.

Staple fibres - Staple fibres are short fibres. They are measured in inches or fraction of inches or in centimetres. All the natural fibres except silk are staple fibres.

Filament Fibres - Filament fibres are long fibres. They are measured in meters or yards. All the manmade fibres are filament fibres.

Activity

Collect fabric swatches for cotton, wool, silk, rayon and nylon and create a resource file.

Based on the source fibres are classified as Natural Fibres and Manmade fibres. Natural fibres are obtained in usable form from plants,

animals or Mineral origin. Plant fibres are composed largely of cellulose and therefore are classified as natural cellulose or plant/vegetable fibres. Cellulose is a linear polymer or long chain molecule built by combining several thousand anhydroglucose units. Cellulose is a carbohydrate. It contains the elements carbon (44.4percent), hydrogen (6.2 percent) and oxygen (49.4percent). Cellulose fibres have several properties in common. They burn readily and quickly with a yellow flame, they give off a smell like that of burning paper they deposit a light, fluffy greyish residue or ash. Cellulose is damaged by acid solutions especially strong mineral acids, but it possesses excellent resistance to alkaline solutions. In general cellulose is low in elasticity and resilience, hence wrinkles excessively. Cellulose fibres are soft and absorbents they make comfortable products. Examples of cellulose fibres are cotton, linen, jute, ramie, hemp and pina.

Animals are the source of natural protein fibres. Most of the fibres in this group are the hair covering from selected animals. The secretions from other animal life constitute the remaining natural protein fibres. All the protein fibres are composed of amino acids that have been formed into polypeptide chains having large molecular weights.

Fibres in this group have excellent moisture absorbency. Protein fibres tend to be warmer than natural cellulose fibres. Natural protein fibres have poor resistance to alkalis and can Be dissolved in 5% solution of sodium hydroxide at the boiling point. Most fibres in this Group have good resistance to acids, the exception is silk which is damaged or completely destroyed by concentrated mineral acids. The density of the fibres in this group is less than those of cellulose fibres as a group, they have good resiliency and elasticity. The fibres burn Slowly in the flame, are self-extinguishing, leaving a brittle, beadlike residue and smells like burning hair. Examples of animal fibres are wool, silk, speciality hair fibres of alpaca, camel Cashmere, llama etc.

The only natural mineral fibre is Asbestos. It is extracted from an amphibole rock. Several Properties combine to make this type of asbestos

especially to textiles. The fibres have good Strength flexibility, toughness, low conductivity and adequate length Asbestos will not burn, But it will melt at sufficiently high temperatures. It is acid proof and rust proof. Asbestos has been used in making firefighting suits and fire-resistant fabrics and in fireproof materials of many types. Inferior grades of asbestos has been found to be hazardous to Health, as particles can lodge in the respiratory system and are carcinogenic. Its processing And use must therefore be controlled.

Manmade fibres are polymeric forms that are produced by some type of chemical action or by the regeneration of the natural polymers in a new physical form. After the polymers are formed, the chemicals are converted into a liquid or fluid state and forced through a Spinneret. These devices vary in size and in diameter of the openings. Manmade fibres can be manufactured from cellulose source, protein source, mineral source or chemically synthesised. The manufacturing process can be adapted to achieve specific properties in the final manmade fibres. This means that the manmade fibre can be developed to meet certain functional requirements and end uses. Although there are many synthetic fibres generally have the same common properties. Generally they are known for being heat sensitive, resistant to most chemicals, insects, and fungi low moisture absorbency. They are generally cheaper than natural fibres. Their principle end use is in clothing, carpets, household textiles and a wide range of technical products. Examples of manmade fibres are Rayon, Acetate, Nylon, Polyester, Acrylic etc.

11.5 Elementary Study of Fibres

• Cotton

Cotton is a fibre that grows from the surface of seeds in the pods, or bolls of a bushy mallow Plant. Cotton has been cultivated for more than 5000 years. Different kinds of cotton are grown in various parts of the world. Some of their basic characteristics differ. Variations among cotton fibres also occur because of growth conditions including such factors as

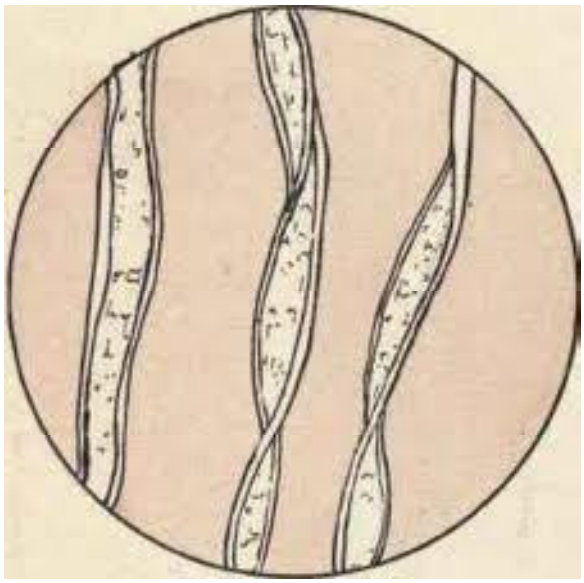
soil, climate, fertilizers and pests. Cotton is the most widely used fibre in the world.

- **Composition**

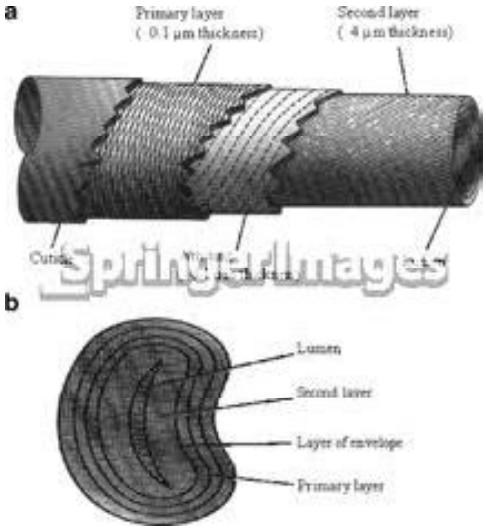
Cotton fibre is chiefly composed of cellulose. Cellulose is a carbohydrate; it contains the elements Carbon, Hydrogen and oxygen. Chemically the fibre contains about 90% cellulose and about 6% moisture and the remaining are impurities.

- **Structure - Microscopic Appearance of Cotton Fibre**

Longitudinal View: The longitudinal view of the regular fibre shows a flat ribbon like shape with twists at regular intervals. The diameter of the fibre narrows at the tip. The outer surface of the fibre is covered with a protectiv



Cross Sectional View: The cross section of the fibre usually has three areas;the outer skin,the secondary wall and the central lumen. The cross section of the fibre is kidney or bean shaped.



● Physical Properties

Length – Cotton has fairly uniform width. Diameter is 12to 20 micrometers, length varies from ½ inch to 2 ½ inches.

Lustre – Cotton is a dull fibre with low lustre.

Strength – Cotton is a relatively strong fibre. Its strength varies from 3.0 to5.0 grams per denier. When wet, cotton increases its strength by 25%.

Resiliency – Cotton has low resiliency and therefore wrinkles easily.

Absorbency – Cotton fibre is composed primarily of cellulose which is absorbent. Its centre, or lumen, aids in conveying moisture.

Heat Conductivity – Cotton is a good conductor of heat. When cotton fabrics are worn in summer the body heat is conducted away from the body and therefore keeps the body cool.

Elasticity – Cotton fibres have low elasticity.

● Chemical Properties

Resistance to Acids – Cotton is not damaged by volatile organic acids as acetic acid. However it is tendered if non-volatile organic acids as oxalic and citric are allowed to remain on it. Concentrated cold or dilute hot mineral acids such as sulphuric acid, will destroy cotton.

Resistance to Alkalis –Cotton is not harmed by alkalis. In fact; a solution of sodium hydroxide is used to mercerize cotton, making it stronger, smoother, and more lustrous.

Resistance to Bleach –All types of bleaches can be safely used on cotton fabrics. Sodium hypochlorite, sodium perborate and hydrogen peroxide bleaches may be used.

Affinity to dyes – Cotton has a good affinity for dyes.

● Biological properties

Resistance to Mildew – Cotton fabrics especially if starched, mildew easily, in damp conditions. Therefore cotton fabrics should be stored in dry atmosphere.

Resistance to Insects – Cotton is not attacked by moths because moth larvae cannot digest starch. Silverfish damage cotton which is starched.

Resistance to Sunlight – Prolonged exposure to sunlight weakens the fibre and will cause the fibre to turn yellow due to oxidation.

● Uses

Cotton is the single most widely used fibre and is an excellent choice for a multitude of purposes. It is used for apparel fabrics, for household or domestic goods and for industrial applications. Cotton is also used in furnishing and upholstery fabrics and its ability to absorb moisture and its softness has made cotton to be used as linen, bandage material, hospital use etc.

Wool

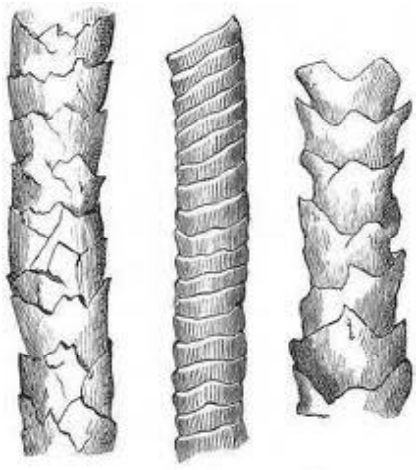
Wool is a hair fibre. It is a natural protein fibre obtained from sheep. The earliest fragments of wool fabric have been found in Egypt in about 4000 -3000 B.C. Several breeds of sheep are raised primarily for fibre. To provide the finest quality wool for the consumer, quality and characteristics of wool fabrics are dependent upon the kind of sheep from which the wool is taken, and manufacturing and finishing processes applied to the fabrics.

Composition

Wool is a natural protein fibre. The protein of wool is known as "Keratin "and is composed of 18 amino acid residues. It is composed of the elements Carbon, hydrogen, oxygen, nitrogen and sulphur.

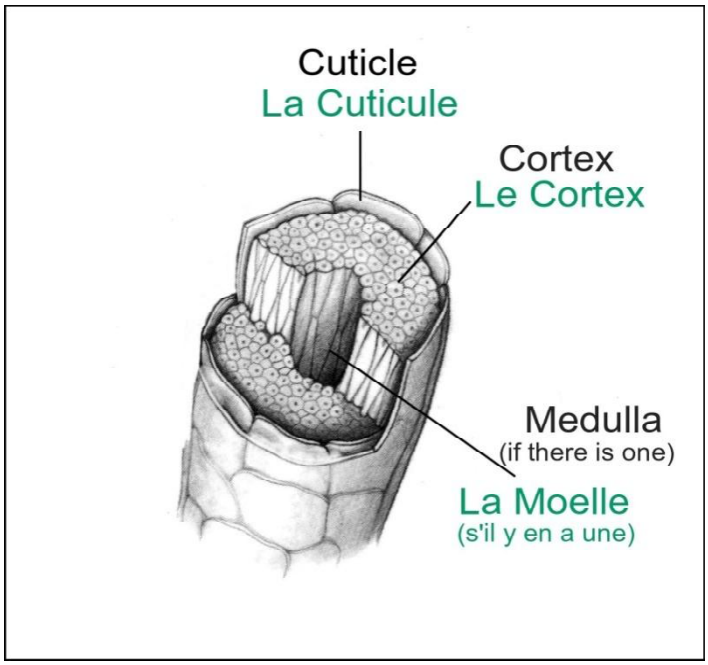
Structure – Microscopic Appearance of Wool

Longitudinal view: In the longitudinal view, the length of the fibre clearly shows a scale like structure. The size of the scales vary from very small to broad and large.



Cross Section: A cross section of the wool fibre shows three distinct parts. The outer layer, the epidermis or cuticle is composed of scales which are irregular and horny in shape. The major portion of the fibre is the cortex which is composed of cortical cells. They provide strength and

elasticity to the fibre. In the centre of the fibre is the medulla.



Physical Properties

Length – The wool fibre is scaly in appearance. The cross section of wool is elliptical in shape the length of wool fibre varies from1 ½ inches to 15 inches.

Lustre – There is some lustre to wool fibres. Fine and medium wool tends to have more lustre than coarse fibres.

Strength – The strength of wool is.0 to 1.7 grams per denier when dry. When wet, it drops to 0.8 to 1.7 grams per denier. Compared to other fibres wool is weak and this weakness restricts its usage.

Resiliency – Good quality wool has a high degree of resiliency and softness. Therefore good quality woollen fabrics don't wrinkle. However poor quality wool is harsh and tends to wrinkle.

Absorbency – Initially wool tends to be water repellent. However once

the moisture seeps in between the scales of the fibre, the fibre's high degree of capillarity will result in ready absorption. Under saturated conditions, wool absorbs more than 29% of its weight in moisture.

Heat Conductivity – As wool fibres are non conductors of heat, they permit the body to retain its normal temperature. Woollen garments are excellent for winter wear.

Elasticity – Wool has excellent elasticity and extensibility. At standard conditions wool will extend between 20 and 40 percent.

- **Chemical Properties**

Resistance to Acids – Wool is damaged by hot sulphuric acid. It is not affected by other acids, even when heated.

Resistance to Alkalis – Wool is quickly damaged by strong alkalis. Mild soaps and detergents should be used when laundering woollen fabrics.

Resistance to Bleach – Sodium hypochlorite and chlorine bleaches are harmful on wool. However hydrogen peroxide and sodium perborate bleaches can be used safely.

Affinity to dyes – Wool has a high affinity to dyes and therefore wool fabrics dye well and evenly.

- **Biological properties**

Resistance to mildew – Wool has some resistance to bacteria and mildew. However both organisms may attack stains left on wool. If wool is stored in damp conditions mildew will develop.

Resistance to insects – Wool is vulnerable to the larvae of moth and carpet beetle.

Resistance to sunlight – The ultraviolet rays of the sun will damage wool if exposed for long time.

- **Uses**

Wool fabrics are widely used all over the wool is crease resistant, flexible, elastic, warm, and comfortable. It is therefore used in sweaters, shawls, caps, blankets, dress materials etc

- **Silk**

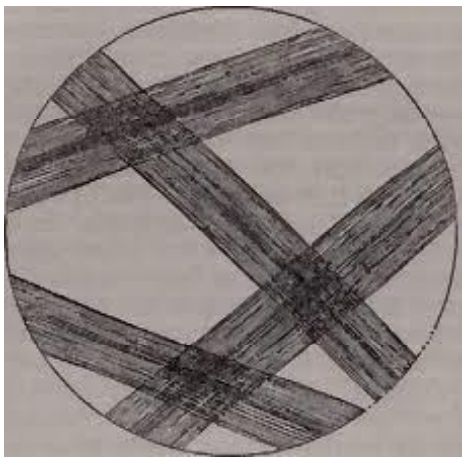
Silk is known as the queen of all fibres. The possibility of making cloth from the cocoon of silkworm was first discovered in China about 2600 B.C. Silkworms are bred for the sole purpose of producing raw silk. The production of cocoons for their filament is called “Sericulture”. Cocoon of Bombyxmori, a species of moth, produces the finest quality of raw silk.

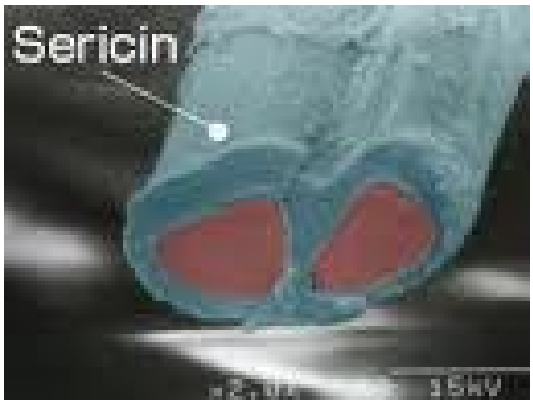
- **Composition**

Silk is mainly composed mainly of protein because it is an animal fibre. The protein in silk is known as “Fibroin”. Silk proteins are composed of amino acid. Fibroin is composed of 15 amino acids. The elements of silk protein are carbon, hydrogen, oxygen and nitrogen.

- **Structure - Microscopic Appearance of Silk**

Longitudinal view: When viewed longitudinally, silk resembles a smooth transparent rod. Silk in the gum has rough, irregular surfaces. Wild silk has longitudinal striations.





Cross Section: Cross sectional view as silk shows triangular fibres with no markings. Two filaments usually lie next to each other. They are called brins. The two filaments are extruded by the silk worm and they come together as shown in the figure.

- **Physical Properties**

Length – Silk fibres are fine and long. They measure about 100 to 1300 yards. The width of silk is from 9 to 11 microns. The fibres are quite smooth.

Lustre – Silk is a lustrous fibre, except for wild silk which is somewhat dull.

Strength – Silk is the strongest natural fibre. The continuous length of the filament provides a factor of strength. Silk has a tenacity of 2.4 to 5.1 grams per denier.

Resiliency – Silk fibres have medium resiliency. Pure silk are more resilient than wild silk.

Absorbency – Silk has good moisture absorption properties. This property is helpful in the application of dyes and finishes.

Heat Conductivity – Silk is a non conductor of heat. Because silk prevents body heat from radiating outward, it is desirable as winter apparel.

Elasticity – Silk has good elasticity and moderate elongation.

- **Chemical properties**

Resistance to Acids – Concentrated mineral acids will dissolve silk. Organic acids do not harm silk.

Resistance to Alkalis –Concentrated alkalis at high temperatures will damage silk. Mild Soaps and detergents should be used to launder silk fabrics.

Resistance to Bleach –Strong bleaches containing sodium hypochlorite will deteriorate silk. A mild bleach of hydrogen peroxide or sodium perborate may be used safely.

Affinity to dyes – Silk has very good affinity to dyes.

- **Biological properties**

Resistance to mildew – Silk is relatively resistant to bacteria and fungi. Silk will not mildew unless left sometime in a damp condition.

Resistance to insects – Silk is damaged by carpet beetles.

Resistance to sunlight – Prolonged exposure to sunlight causes fibre breakdown.

- **Uses**

Silk is widely used and is suitable for various apparel. It is versatile and is used in men's and women's apparel, dress material, furnishing fabrics, upholstery material, shawls, stoles Etc.

- **Rayon**

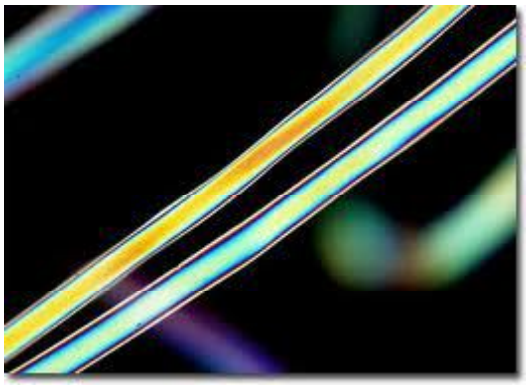
Rayon is a manufactured fibre composed of regenerated cellulose. Rayon received its name In the year 1924. Before that it was called artificial silk. The natural process by which the silk Worm transforms the cellulose of mulberry trees into two fine filaments is simulated in the process of making Rayon.

- **Composition**

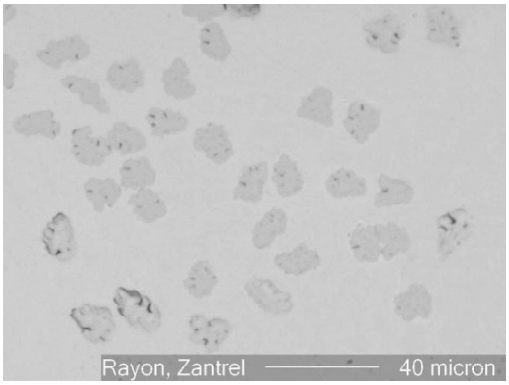
Rayon is composed of cellulose. Rayon cellulose comes from wood pulp, Bamboo or cotton linter Rayon is 99 percent cellulose. The cellulose is a carbohydrate and composed of the elements carbon, hydrogen and oxygen.

- **Structure - Microscopic Appearance of Rayon**

Longitudinal View: The longitudinal appearance exhibits uniform diameter and internal parallel lines called striations.



Cross Section: The cross section of the fibre shows highly irregular or serrated edges.



- **Physical properties**

Length – Rayon fibres can be produced in any length desired and

the width of the fibre can be controlled. Its width varies from 12 micrometers to 1000 micrometers.

Lustre – The lustre of rayon can be controlled from bright to dull.

Strength – Rayon has reasonably good strength. Its strength varies from 1.5 to 2.4 grams per denier.

Resiliency – Rayon has medium resiliency and tends to wrinkle easily.

Absorbency – Rayon is highly absorbent fibre. However rayon loses its strength when it is wet and therefore should be handled with care when it is wet.

Heat conductivity – Rayon is a good conductor of heat. It is therefore comfortable to wear in summer.

Elasticity – Rayon has greater elasticity than cotton but less than wool or silk.

- **Chemical properties**

Resistance to Acids – Rayon is disintegrated by hot dilute and cold concentrated mineral acids.

Resistance to Alkalis –Concentrated solutions of alkalis disintegrate rayon. Mild soaps and detergents should be used when washing Rayon fabrics.

Resistance to Bleach – Hydrogen peroxide, sodium perborate and sodium hypochlorite bleaches can be used in a diluted form.

Affinity to dyes – Rayon fabrics absorb dyes evenly and can be dyed with a wide range of dyes.

- **Biological properties**

Resistance to Mildew – Mildew will damage rayon when stored in the damp conditions.

Resistance to Insects – Silverfish will destroy all types of rayon.

Resistance to sunlight – Rayon fabrics will deteriorate when exposed to the ultraviolet rays of the sun for a long time.

- **Uses**

Rayon fabrics are extensively used in furnishing material and apparel material for men, women and children. High tenacity rayon's are used in industries and automobiles.

- **Nylon**

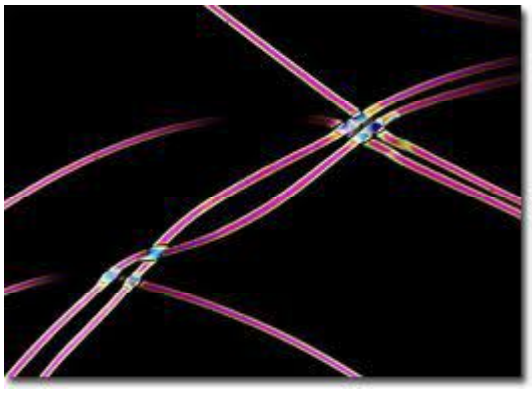
Nylon is a manmade synthetic fibre. It is one of the most widely used fibres. The first manufactured nylon is referred to as nylon 6,6. The numbers derive from the fact that in each of the two chemicals used in making this nylon, there are six carbon atoms.

- **Composition**

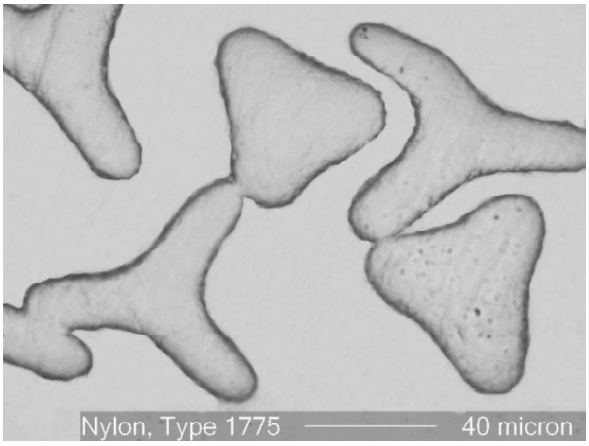
Nylon 6,6 is made from the chemicals Hexamethylene di amine and adipic acid. The elements are Carbon, Hydrogen, Oxygen and nitrogen.

- **Structure - Microscopic Appearance of Nylon**

Longitudinal view: In the longitudinal view nylon fibres are smooth and shiny. The length and diameter can be controlled.



Cross section: When viewed in the cross section, nylon is perfectly trilobial. However shape can be controlled.



- **Physical properties**

Length – Nylon is a manmade fibre and therefore the diameter and length of the fibre is determined by the manufacturer. Shape can be round or trilobial.

Lustre – The lustre of nylon can be controlled and may vary from dull to bright.

Strength – Nylon is a very strong fibre. It has a tenacity of1.3 to 9.0 grams per denier. The strength of nylon will not deteriorate with age. It is also lightweight, tough and pliable.

Resiliency – Nylon has excellent resiliency and will not wrinkle. Nylon fabrics retain their smooth appearance, and wrinkles from the usual daily activities fall out readily.

Absorbency –Nylon does not absorb much moisture. Therefore they dry quickly. Nylons low absorbency has a disadvantage in that the fabrics feel uncomfortable when worn in humid weather.

Heat conductivity – Nylon fabrics do not conduct heat and are therefore uncomfortable when worn in humid weather.

Elasticity – Nylon is a highly elastic fibre.

- **Chemical Properties**

Resistance to Acids – Nylon is decomposed by cold concentrated solutions of such mineral acids as Hydrochloric Sulphuric and nitric acids.

Resistance to Alkalis – Nylon is substantially inert to alkalis.

Resistance to Bleach – With proper care nylon fabrics retain their whiteness. However if they become yellow or grey they may be bleached using most types of bleaches like hydrogen peroxide sodium hypochlorite, sodium perborate or chlorine bleaches.

Affinity to dyes – Nylon has good affinity for dyes.

- **Biological Properties**

Resistance to Mildew – Nylon is highly resistant to microorganisms and mildew has no effect on nylon

Resistance to Insects – Nylon is highly resistant to insects.

Resistance to Sunlight – Sunlight has a destructive effect on nylon and there is a marked loss of strength if exposed for a long time

- **Uses**

Nylon is a widely used fabric and is used as apparel for men, women and children, furnishing and upholstery fabrics, hosiery, sportswear, raincoats, umbrellas. Nylon can also be blended with other fibres and used.

Summary

Every person uses and comes in contact with a variety of textile products each day. Everyone is concerned with the selection and maintenance of the products. Knowledge of chemical, physical, and microbiological properties of fibres, guides the consumer in making wise selections when purchasing textile products. Knowledge of proper maintenance techniques for the many fibres, fabrics and finishes helps ensure satisfaction after purchase.

Textile fibres and fabrics have almost limitless uses and new applications are constantly being found. The performance of textile fibres is dependent upon its physical, chemical and biological properties. The fibre can influence product aesthetics by the way in which it reflects light. Comfort is dependent upon thermal conductivity. Maintenance and durability are dependent upon fibre properties.

All Textile fibres come from natural vegetable, animal or mineral matter or manufacturing processes that utilize natural fibrous materials or synthesized fibres from certain chemicals. Fibres may be classified by their origin and length. Natural fibres tend to have high moisture absorption, good sunlight resistance, a dry crisp hand and good dyeability. Manmade fibres tend to have lower moisture absorption and a slick and a cool hand but may be textured to provide improved comfort properties. The major advantages of manmade fibres are higher strength, lower cost and improved ease of maintenance.

Fibre properties are usually the dominant factors affecting comfort, maintenance, durability and have some affect upon appearance and cost.

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Model Questions

1. Write the composition of the following fibres Cotton, Wool, Silk, Rayon, Nylon.
2. Discuss the Physical, Chemical, Biological properties and uses of the following fibres Cotton, Wool, Silk, Rayon, Nylon.
3. Draw the microscopic appearence of the following fibres.

   Cotton, Wool, Silk, Rayon, Nylon.
4. Classify fibres with suitable examples.
5. Write short notes on the following:

   Cellulose fibres, Protein fibres, Mineral fibres.
6. Discuss the burning characterstics of Cotton, Wool, Rayon, Nylon, Silk.

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UNIT – 12
FABRIC CONSTRUCTION

Learning Objectives

Enable Students to:

- To understand the process of Yarn Construction by Spinning
- To Know the kinds of Yarn twists and types of yarns
- To understand the parts and functioning of a Loom.

12.1 Introduction

To convert textile fibres into fabrics, some type of fibre arrangement is required. The most common method is to covert fibres into yarns, which are then constructed into fabrics. Yarns are essential for knitted, woven, or knotted structures and for many braided ones. Spinning is a part of the textile manufacturing b process where fibres are converted to yarn. Spinning is the twisting together of drawn out strands of fibres to form yarn. Artificial fibres are made by extruding a polymer through a spinneret into a medium where it hardens. Wet spinning (rayon) uses a coagulating medium. In dry spinning (Acetate),the polymer is contained in a solvent that evaporates in the heated exit chamber. In melt spinning(nylons and polyesters)the extruded polymer is cooled in gas or air and sets. All these fibres are of great length.

Natural fibres are either from animal's mineral, or from plants. Yarns can be made from short, staple fibres (natural fibres),or long fibres (manmade fibres and silk) or from a combination of both. Yarns composed of short staple fibres may be called spun yarns and if they are composed of filament yarns, they are called filamentous yarns. Those yarns composed of both staple and filament fibres are known as composite yarns. The characteristics and quality of yarns bear importantly on the appearance, durability, care, characteristics and other properties of textile material.

Activity

Collect different types of yarns available in the market and make a resource file.

12.2 Steps in Yarn Construction (Cotton System)

Yarns can be made of staple fibres by any one of several techniques. The method used is dependent upon such factors as the manufacturer's preference of equipment, the economic implications, and the fibres to be used and desired properties of the yarn to be produced. Ring spinning is the oldest technique. Open end spinning is another method. Newer methods have been developed, and experiments to find more effective and suitable processes continue. The formation of yarn from staple fibres by spinning becomes possible when they have surfaces capable of cohesiveness. This quality is exemplified by the natural twist of the cotton fibres which enables them to entwine around each other. The production of cotton yarn lends itself to a simple description of the manufacturing operations that make the staple fibre into yarn. Hence cotton fibre has been used to illustrate the spinning process.

The development of short fibres or staple into yarn in terms of manufacturing process is as follows:

- Blending, opening and cleaning
- Carding
- Combing
- Drawing
- Roving
- Spinning
- Winding

● Blending, opening and cleaning

The opening and blending machines separate the fibres and blend fibres from different bales. Opening is necessary to loosen hard lumps of fibre and distangle them. Cleaning is required to remove trash such as dirt, leaves etc. When the cotton emerges from the opener, it is converted

into a lap which is a loosely entangled mass about one inch thick and 40 inches wide.

- **Carding**

In this step, cleaning of the fibres continue, removing those too short for use in yarns. The fibres are laid somewhat parallel lengthwise. When the fibre leaves the carding machine, the lap gets converted into a rope like strand of fibres about3/4th to 1 inch in diameter called a sliver. The sliver is called card sliver and is not completely uniform in diameter and the fibres are somewhat random in arrangement.

- **Combing**

For high quality cotton yarns of outstanding evenness, smoothness, fineness and strength, fibres are combed as well carded. In this operation, fine toothed combs continue straightening the fibres until they are arranged with a high degree of parallelism. The combing process forms a comb sliver made of longest fibres.

- **Drawing**

The combed sliver enters the drawing machine. The draw frame has several pairs of rollers, each advanced set of which revolves at a progressively faster speed than the other. This action pulls the staple lengthwise over each other, thereby producing longer and thinner slivers. As yet no twist has been inserted.

- **Roving**

In the roving frame, each sliver will be attenuated(made slender) until it measures approximately 1/8th of the original diameter. A slight amount of twist is imparted to give strength. The new strand called roving is laid on to a bobbin.

- **Spinning**

The spinning operation is the final process in yarn construction. The roving is fed down into the spinning area where it feeds between sets of rollers. In this step, the yarn attenuates and makes it even smooth and uniform. In this step twists are inserted.

- **Winding**

The yarns are wound on spools or bobbins and are now ready for further use.

12.3 Yarn Twist

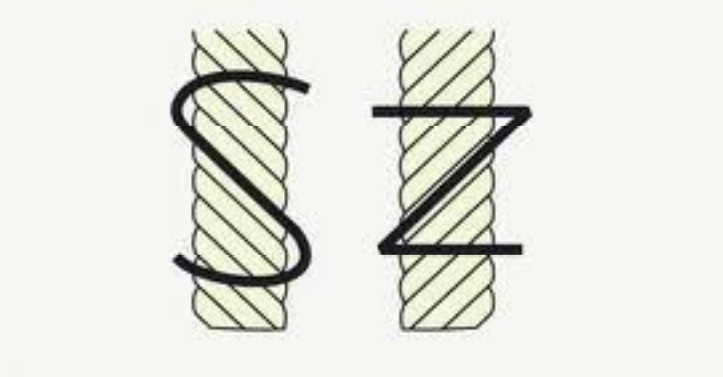
As fibres staple or filaments are formed into yarns, twist is inserted to hold the fibres together. The amount of twist is an important factor in finished consumer goods. It determines the appearance as well as the durability and serviceability of a fabric. Fine yarns require more twist than coarse yarns. Warp yarns which is used for lengthwise threads in

woven fabrics are given more twist than the filling yarns which are used for crosswise threads.

The amount of twist is suggested broadly by such terms as low. medium and high, but it is more accurately indicated by the number of turns per inch(TPI).Yarns intended for soft, smooth surfaced fabrics are given many twists. Such hard twisted yarns contribute strength, smoothness, elasticity and some wrinkle resistance to fabrics.

- **'S' and 'Z' Twists**

As fibres, staple or filament are formed into yarns, twist is added to hold the fibres together. The strength of the yarn is due in part to the amount of twist that has been imparted. The direction of the twist is also important. The twist can be given in two directions namely from right to left and left to right. When the twist is given from right to left (clockwise direction), the spirals in the twist conform to the direction of the slope in the letter S. The twist is then called 'S' twist. When the twist is given from left to right, (Anti clock wise)



Direction, the spirals in the twist conform to the slope of the central part of the letter 'Z'. The twist is then called 'Z' twist. Various effects can be obtained by combining yarns of different twist direction and durability may be increased by efficiently plying of Sand Z twist single yarns.

12.4 Yarn Count

In the spinning process, there is always a fixed relation between the weight of the original quantity of fibre and the length of the yarn produced from that amount of raw material. This relation indicates the thickness of the yarn. It is determined by the extent of drawing process and is designated by numbers which are called yarn count. There are two systems of yarn count

- Direct system
- Indirect system

In the direct system, the yarn number systems are called Tex and Denier. In the indirect system it is called count number. Tex determines the yarn number by determining the weight in grams of 1000 meters of yarn. The denier is equal to the weight in grams of 9000 meters of yarn. In this system, the lower the Tex and Denier number, the finer the yarn.

In the indirect system, the yarn number is called yarn count. This is used for cotton. The standard for the yarn count in cotton is one pound. If one pound of fibre is drawn out to make 840 yards, the resultant thickness or size is known as count 1.If the yarn is drawn further, so that one pound makes 840X2 yards, then the count number is 2 and so on. The higher the count number the finer the yarn.

12.5 Types of Yarns

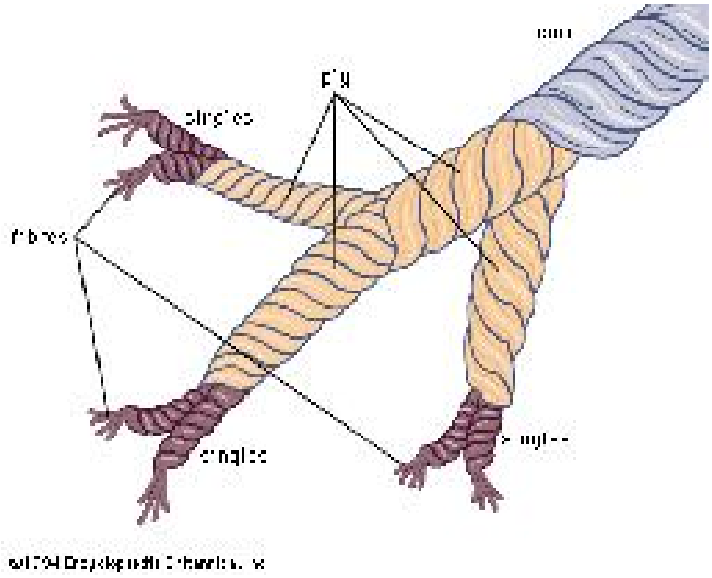
There are various types of yarns, each having its own characteristics. These characteristics vary according to the construction and treatment given in the manufacture of yarn. Yarns are of two types

- Simple Yarns
- Novelty Yarns

● Simple Yarns

These are yarns that are even in size, have an equal number of turns per inch throughout and are relatively smooth. Simple yarns are of three types

- Single yarns
- Two ply yarns
- Cord



Single Yarns: These are known as one ply yarns. They are composed of fibres held together by at least a small amount of twist, or of filaments grouped together either with or without twist, or of filaments grouped together either with or without twist, or of narrow strips of material or of single manmade fibres extruded in sufficient thickness for use alone as yarn. Single yarns may be given either an' S' twist or' Z' twist.

Two ply yarns: Two ply yarns are composed of two or more single yarns twisted together. These yarns provide strength for heavy industrial fabrics and are also used for delicate looking sheer fabrics.

Cord: Cord yarns are produced by twisting ply yarns together, with the final twist being applied in the opposite direction of the ply twist. Cord yarns may be used as rope or twine.

Novelty Yarns

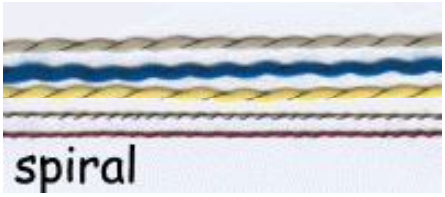
Novelty yarns are also known as complex yarns. They are usually uneven in size, varied in colour, or modified in appearance by the presence of irregularities deliberately produced during their formation. A novelty yarn is usually composed of the following:

- A base or core yarn
- A tie or binder yarn
- Fancy yarn

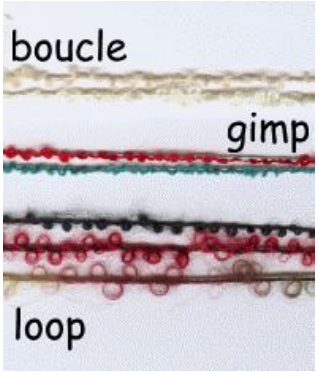
There are several types of novelty yarns

- Spiral or corkscrew yarn
- Loop or curl yarn
- Knot yarn or Knop yarn
- Slub yarn

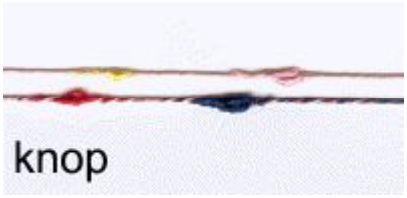
Spiral or corkscrew yarn: In this yarn, the desired effect is obtained either by twisting together yarns of different diameters different sizes, or different fibre content or by varying the rate of speed or the direction of the twist.



Loop or curl yarn: The loop yarn is of at least 3 ply constructions. The base yarn is rather coarse and heavy. The effect yarn which forms loops or curls is made of either a single or a ply. It is relatively fine and has a small amount of twist. The loops are held in place on the base yarn by one or two single yarns that are used as ties.



Knot Yarn or Knop Yarn: A knot or knop yarn is made on a special machine that holds the base yarn almost stationary while the effect yarn is wrapped around it several times to build up a knot or enlarged segment. Sometimes the effect yarn is held in position by a tie or binder yarn, but in many cases the knot is so secure that no binder is needed.



Slub Yarn: A slub yarn may be either a single yarn or a 2 ply yarn. In a slub yarn, the yarn is left untwisted or slackly twisted at irregular intervals in order to produce soft, bulky sections. The lack of twist at irregular intervals causes the yarn to be fluffier and softer at those points.

Activity

Prepare a chart for Yarn Twist (Collect Samples)§Types of Yarns

12.6 Weaving

Weaving is one of the oldest arts known. It is a major method of fabric construction. Primitive people interlaced grasses and twigs and thus discovered how they could make clothing for themselves, baskets and nets and thatch like huts and fences. Spinning developed when people discovered that the raw materials could be improved before they were woven In the course of time, crude looms were made which were simple and hand operated. Early looms were very crude compared with modern mechanical weaving devices. However all looms, old and new, have a few basic principles in common. The modern power loom used in the textile industry today essentially performs the same operations as the simple hand operated loom.

Definition

Weaving is the method of cloth production by interlacing two or more set of yarns at right angles to each other.

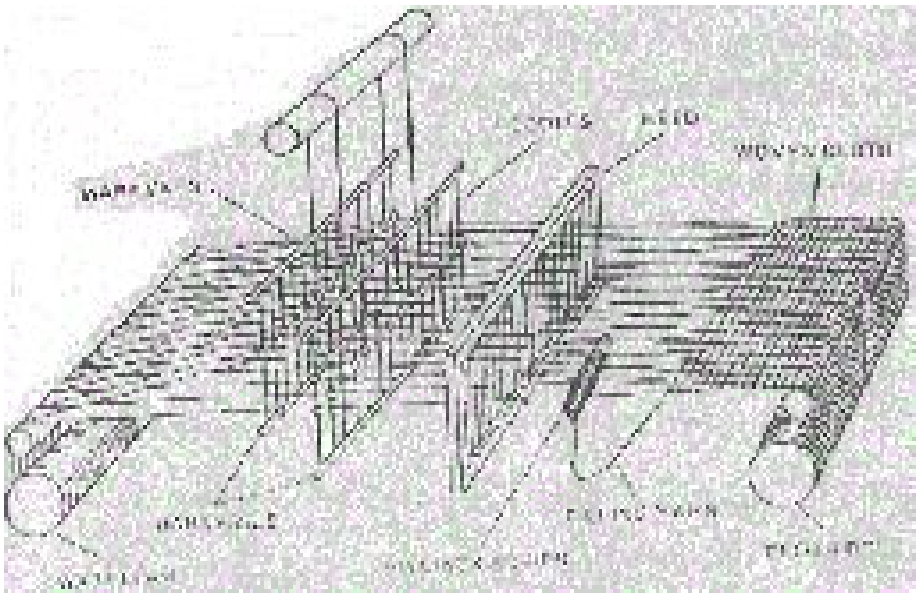
Warp Yarns: Warp yarns are the lengthwise yarns in a cloth. The warp yarns are parallel to the selvedge or the finished edge of the fabric. Warp yarns are stronger because they have to be stretched on the loom for weaving.

Weft Yarns: Weft yarns are the crosswise yarns or filling yarns in a cloth. The weft yarns are perpendicular to the warp yarns.

12.7 Loom

A loom is a device used to weave cloth. The basic purpose of any loom is to hold the warp threads under tension to facilitate the interweaving of weft threads.

Weaving is done by interlacing the lengthwise threads, 'Warp' with the crosswise threads, 'Weft' at right angles to each other. Looms may be operated by hand and they are called Handlooms or by power and are called power looms.



- **Parts of a Basic Loom**
  - A loom has the following parts
  - The warp beam
  - Heddles
  - Harness
  - Shuttle
  - Reed
  - Cloth beam

The warp beam: The warp beam holds the lengthwise yarns. It is located at the back of the loom and is controlled so that it releases yarn to the loom as needed.

Heddles: The heddles are wire or metal strips with and are located in the centre through which warp yarns are threaded.

Harness: The harness is the frame that holds the heddles in position. Each loom has at least two harnesses. it may have 20 or more harnesses in total. This harness can be raised or lowered in order to produce the shed through which the filling yarns are passed.

Shuttle: The shuttle moves back and forth in the shed passing the filling yarns between the warp yarns.

Reed: The Reed is a comb like device and the opening between the wires in the reed are called dents. The warp yarns pass through the heddles and through the dents. The reed keeps the warp yarns from tangling. It also beats and packs the crosswise yarns into their proper positions. The reed is parallel to the harness.

The cloth beam: The cloth beam is located at the front of the loom which holds the completed fabric. Uniform distance and tension is maintained between the warp beam and cloth beam.

- **Functioning of the Loom**

The basic weaving operations consists of four steps

- Shedding
- Picking
- Battening
- Taking up and Letting off

Shedding: Shedding is the raising and lowering of the warp by means of the heddles and harnesses to form the shed, the opening between warp yarns through which the filling yarn can be passed.

Picking: The actual procedure of placing the filling yarns into the shed is called picking. The shuttle moves across the shed laying the pick of filling yarns as it goes along.

Battening: It is sometimes called beating or beating in. It consists of evenly packing the filling yarns into position on the fabric. It gives a compact construction to the fabric.

Taking up and Letting off: It involves the taking up of the newly manufactured fabric onto the cloth beam and letting off or releasing yarn from the warp beam. The operation maintains uniform distance from harness to the cloth.

Many fabrics are woven on a simple Loom. For elaborate fabrics, modification of the basic loom, addition of special attachments to the loom or specially designed looms are used.

12.8 Classification of Weaves

The manner in which groups of yarns are raised by the harnesses to permit the insertion of the filling yarn determines the pattern of the weave and in large measure the kind of fabric produced. Weave patterns can create varying degrees of durability in fabrics, adding to their usefulness and also to their appearance.

Weaves are classified as

- Basic weaves
- Decorative Weaves

Activity

Using craft paper prepare samples for plain weave, twill weave and satin weave.

● Basic Weaves

In a basic weave construction, consisting of the filling going under one warp and over the next, two harnesses are needed, one to lift the odd numbered warp yarns and a second to lift the even numbered warp yarns.

There are three types of basic weaves. They are:

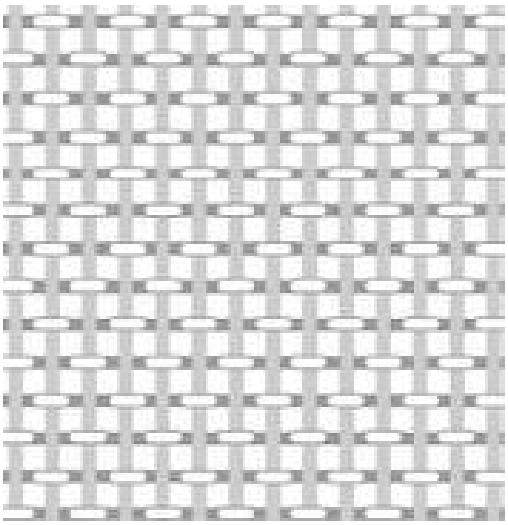
- **Plain weave** and its two variations namely Basket weave and Rib

weave

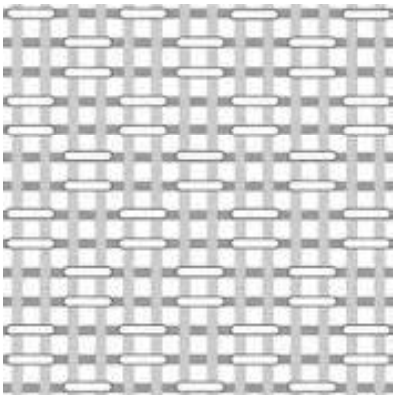
- Twill weave
- Satin weave

- **Plain Weave**

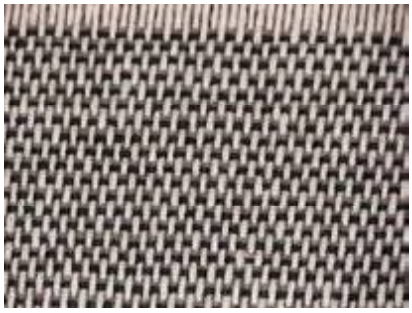
The plain weave is sometimes referred to as the tabby home spun, or taffeta weave. It is the simplest type of construction and is inexpensive to produce. On the loom plain weave requires only two harnesses. Each filling yarn goes alternately under and over the warp yarns across the width of the fabric. On its return; the yarn alternates the pattern of interlacing. The plain weave is used extensively for cotton fabrics and for fabrics that are to be decorated with printed designs.



- **Basket Weave:** One variation of plain weave is known as basket weave. Two or more filling yarns with little or no twist are interlaced with the corresponding number of warp yarns. They are woven in a pattern of 2X2, 3X3, or 4X4.The basket weave produces an attractive, loosely woven fabric that is flexible, somewhat wrinkle resistant and hangs well. The fabrics made in this weave are suitable for drapery fabrics but not desirable for apparel because of their low strength.



- **Rib Weave:** Ribbed or corded, effects are further variations of the plain weave. The rib may be produced in the warp or in the filling by alternating fine yarns with coarse yarns, or single yarns with double yarns. ribbed fabrics are medium weight. The cloth may be smoother and softer, depending upon the yarn and finish used. Rib weave fabrics are mostly used as furnishing fabrics.



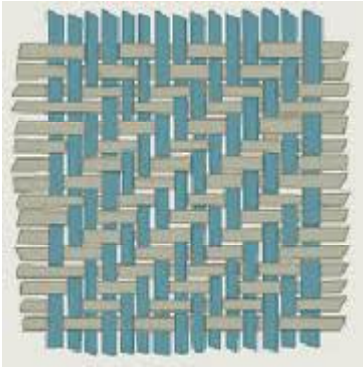
Activity

Collect fabrics made of different types of weaves and make a resource file.

- **Twill Weave**

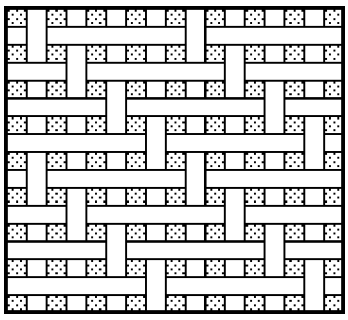
A distinct design in the form of diagonals is characteristic of the twill weave. In this weave, the filling yarn interlaces more than one warp but never more than four. On each successive line, or pick, the filling yarn moves the design one step to the right or to the left, thus forming a

diagonal. A majority of fabrics in twill weave are medium weight. They are mainly used in dress materials and furnishing materials.



- **Satin weave**

In basic construction the satin weave is similar to twill weave but generally uses from five to as many as twelve harnesses. It differs in appearance from the twill weave because the diagonal lines are not visible. The fabrics are smooth and soft, lustrous. The satin weave may have a warp or weft face construction. Satin weaves drape well and are suitable for apparel.



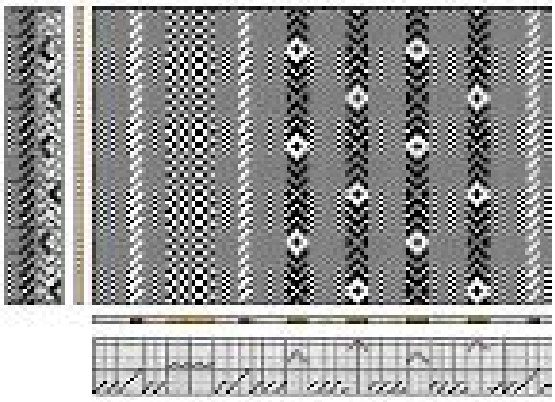
- **Decorative weaves**

Decorative weaves are also called as fancy weaves. There are four types.

- Dobby weave
- Jacquard weave
- Pile weave
- Leno weave

Dobby weave

Dobby weaves have small figures such as dots, geometric designs and floral patterns. These designs are produced by the combination of two or more basic weaves, and the loom may have up to 32 harnesses. The dobby weave is created on a plain loom by means of a mechanical attachment called as dobby attachment which raises as many as 24 to 40 harnesses, containing a series of warp yarns that form a pattern.



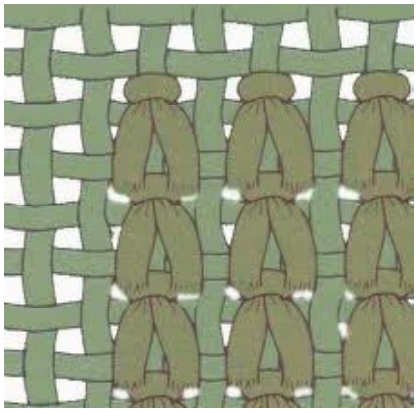
Jacquard weave

Fabrics with complicated and decorative woven designs are manufactured using the jacquard loom. The major advantage of the jacquard machine is its ability to control each individual warp independently, instead of a series as in the regular harness loom. This separate yarn control provides greater freedom for the fabric designers because large intricate motifs can be transferred to fabrics. The pattern for the jacquard loom is transferred to a series of perforated cards, one

for each picking fill in the pattern. The card is punched to permit the lifting of the needles on the machine that need to be raised. The shed is formed and the pick passes through. The punched cards are laced together and pass over a cylinder at the top of the machine. Each card stops on the cylinder for the particular pick, moves on and a new card takes its place. This continues until all the cards are used. When one repeat of the pattern has been completed, the cards start over. Jacquard weave fabrics are mainly used for decorating purposes in furnishing fabrics and also apparel fabrics.

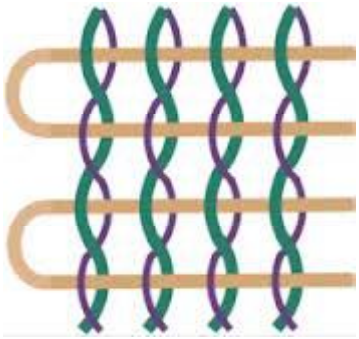
- **Pile Weave**

Pile weave is a form of textile created by weaving. Pile fabrics used to be made on traditional hand weaving machines. The warp ends that are used for the formation of the pile are woven over metal rods or wires that are inserted in the shed (gap caused by raising alternate threads) during weaving. The pile ends lie in loops over the inserted rods. When a rod is extracted the pile ends remain as loops on top of the base fabric. The pile ends lying over the rod may be left as 'loop pile', or cut to form 'cut pile' or velvet.



- **Leno Weave**

Leno weave is also referred to as gauze weave. It is an open mesh type of fabric which may be sheer or heavy. The doup attachment controls the warp threads and moves horizontally as well as vertically. Thus the warp yarns can be interlaced and crossed between the picks. Leno weave fabrics are used in furnishing fabrics, mosquito nets, household bags, food bags etc.



Summary

Yarns are necessary to weave fabrics. Yarns are composed of textile fibres and are made by the process of spinning. Spinning is the twisting together of drawn out strands of fibres to form yarn. Spinning is the oldest method of manufacturing yarn. The process requires aligning a bundle of staple fibres, pulling them out into a rope, known as roving and further pulling out and twisting the roving to form a yarn. The product of spinning operation is a twisted assembly of fibres that is strong and flexible. Spun yarns made from staple fibres may be given a twist in the S or Z direction. The size of the spun yarn is determined by yarn count.

Yarns are of two types namely simple yarns and novelty yarns. Simple yarns may be single ply, two ply or cord. Spiral or corkscrew yarns, Loop yarns, Knot yarns and slub yarns are different types of novelty yarns. Simple yarns are used in apparel where are novelty yarns are used for decorative purposes.

Weaving is the oldest method of producing cloth. The device used for

spinning is known as a loom. Woven fabrics consist of two sets of yarns namely the warp and the weft which are interlaced at right angles to each other. Different types of fabrics can be woven by changing the patterns of interlacing. Weaves may be simple or decorative. The simple weaves are plain weave with basket and rib weave as its variations, Twill weave and Satin weave. The simple weaves are mostly used in apparel. The decorative weaves are Dobby weave, Jacquard weave, Pile weave and Leno weave. These weaves are used in furnishing fabrics as well as in apparel and other house hold uses.

Glossary

Carding: A process, by which natural fibres are sorted, separated and partially aligned.

Card Sliver: A rope like strand of fibres about 3/4th inch to 1 inch in diameter, the form in which fibres emerge from the carding machine.

Denier: A unit of yarn number equal to the weight in grams of 9000 meters of the yarn.

Dobby: a dobby can be applied to machine or fabric. A dobby control on a loom governs the operation of each harness to permit the weaving of small geometric type designs. A dobby fabric is one that has been constructed on a loom with the dobby attachment. it is characterised by geometric designs.

Drawing: the process by which card slivers of natural fibres are pulled out or extended after carding or combing.

Gauze: A plain weave fabric with widely spaced yarns used for things such as bandage cloths.

Jacquard: The original jacquard attachment was developed and attached to a loom in order to provide control of each warp end.

Leno weave: a structure in which pairs of warp yarns are twisted around each other between filling yarns.

The machine used in making woven fabrics.

Novelty Yarns: yarns with such surface characteristics as uneven diameter, varied colour, or other irregularities that produce special design effects.

Pile weave: A weave in which additional sets of yarns are interlaced during weaving to form the raised effect.

Plain Weave: One of the three basic weaves. In plain weave, each filling yarn passes successfully over and under each warp yarn with each row alternating.

Ply Yarn: A yarn in which two or more single strands are twisted together.

Roving: The process by which a sliver of many fibres is attenuated to between ¼ and 1/8 of its original size, also, the product of this operation.

Satin Weave: One of the three basic weaves. Satin weave fabrics are characterized by floats running in the warp direction in such a manner as to impart a gloss, Lustre, or shine to the fabric.

Shed: The opening between warp yarns through which filling yarns are passed.

Single Yarn: A yarn composed of short staple fibres with sufficient twist to hold together.

Spinning: The process or processes used in the manufacture of yarns and of filament fibres.

Spun yarns: Yarns composed of staple fibres.

Tex: A unit for expressing linear density, equal to the weight in grams of 1000 meters of yarn, filament, fibre, or other textile strand.

Twill weave: One of the three basic weaves. Yarns are interlaced in such a manner that dominant diagonal lines are observed.

Warp yarns: Yarns that run parallel to the longer dimension of a fabric.

Weaving: The method of forming fabrics by interlacing two or more sets of yarns, warp and weft at right angles to each other.

Weft yarns: Weft yarns are those yarns in a fabric which are perpendicular to the longer dimension of the fabric.

Model Questions

1. Define the following: Yarn, Spinning, Loom, Weaving, Warp yarn, Weft yarn, Yarn count, Tex, Denier.
2. Explain the steps in yarn construction (cotton system)
3. Write a short note on the following: Yarn twist, Yarn count, spinning.
4. List the parts of a loom and explain its functioning.
5. Classify weaves.

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UNIT – 13
CARE OF CLOTHING

Learning objectives

Enable students to:

- To learn the care of different types of fabrics
- To understand and learn the washing and finishing of different types of fabrics

13.1 Introduction

Fabric care and washing is important in the maintenance of fabrics. The,. care given to a fabric is dependent on the fibre content, yarn structure, fabric construction, method of imparting colour, type of dye stuff, etc. Inherent and geometric fibre properties influence care. Proper laundering techniques should be observed for all washable fabrics. Instructions on care labels contribute specific knowledge and should be followed. Proper maintenance and washing in relation to colour results in continued good appearance. The presence of finishes is of considerable importance in the fabric care.

13.2 Hand Washing and Finishing of Various Fabrics

- **Cotton**

Examination of the fabric: The clothing should be examined for any tears and stains. Mending of the tears and holes should be done before washing the fabric. Stains, if any should be removed.

Sorting: The cotton garments should be sorted according to dark and light colours.

Steeping: The sorted clothes should be steeped separately in soapy water. The dark coloured clothes should not be mixed with light coloured clothes. If mixed the colours in the dark clothes may bleed and stain the light clothes.

Washing: The method employed in washing cotton is determined by its colour and texture. If the soil is light, light friction should be applied and then kneaded on the scrubbing board. If the soil is heavy more friction should be applied and then scrubbed with a brush and then kneaded.

Rinsing: The clothes should be rinsed several times to remove the soap completely. In the last rinse, stiffening agents, blueing or fabric softeners may be added.

Removal of moisture: The clothes should be wringed lightly to remove the excess of water.

Drying: Outdoor drying is considered the best method as the sunlight disinfects and bleaches the clothes Coloured or dark clothes should be dried in shade to protect them from fading.

Finishing: After the clothes are completely dry, they should be ironed with moderate to high heat. After ironing, the clothes should be hung on a hanger to cool and then stored in cupboards.

Activity

Do a market survey on different types of washing soaps and detergents available in the market and their cost present a report on the same.

- **Wool**

Wool needs special care in laundering because of its tendency to shrink and stretch. Woolen fibres have rough scales which soften with heat, moisture and alkalis. These softened scales interlock when they are wet. This results in shrinkage and therefore friction, excess heat and alkalis should be avoided when washing woolen garments.

Preparation: The woolen garments should be examined for any tears and stains. Tears if any should be mended and stains should be removed and outline of the garment should be marked before washing.

Washing: Woolen garments should be washed using liquid detergent by gentle kneading and squeezing.

Rinsing: The garments should be rinsed several times in water. Citric acid may be used for white woolens in the last rinse. Vinegar may be used for coloured woolens. This is done to freshen them and neutralize any alkali left in the clothes.

Removal of moisture: The garments should be pressed with both hands to remove the water. Wringing should be avoided as it damages the clothes.

Drying: Woolens clothes should be dried in the shade on a flat surface. After it is half dried, the garment should be turned so that the other side dries. Hanging the woolen garments on a line should be avoided as this will cause the garments to stretch and loose its shape.

Finishing: Woolen garments should be ironed with mild heat. A damp muslin cloth should be placed on the garment while ironing.

- **Silk**

Silk is a delicate fabric. Dry cleaning is the preferred method of care of silk fabrics. However some silk fabrics can be laundered with proper care.

Preparation: The garments should be examined for tears and stains. Tears if any should be mended and stains should be removed before washing.

Washing: A mild soap or liquid detergent should be used for washing silk fabrics. The garment should be washed gently by kneading and squeezing. A brush should not be used on silk as it will damage the fibre.

Rinsing: The garments should be rinsed several times to remove the detergent. Gentle squeezing should be done to remove the moisture.

Drying: Silk fabrics should be dried in the shade. Sunlight causes coloured silks to fade and white silks to turn yellow.

Finishing: While ironing silk fabrics water should not be sprinkled as it tends to leave marks on the garments. Silk fabrics or garments should ironed on the wrong side with moderate heat. The fabrics should be allowed to cool before storing them.

- **Rayon**

Preparation: The fabric should be examined for tears and stains. Any tears should be mended and stains removed before washing.

Steeping: Rayon is a weak fabric in wet condition. It should not be soaked in water before washing.

Washing: Mild soap can be used on rayon fabrics. Kneading and squeezing methods should be used for washing. The more dirty spots should be cleaned with gentle rubbing with the hand.

Rinsing: Clean and soft water should be used to rinse off soap water from the fabrics and extra water should be squeezed out.

Drying: Colored rayon fabrics should be dried in the shade and white ones may be dried in the sunlight.

Finishing: Rayon fabrics should be ironed with moderate heat.

- **Nylon**

Nylon is a synthetic fabric and is easy to launder. It can be washed safely at all laundry temperatures, drip dried or tumbles dried.

Preparation: The nylon garments should be examined for tears and stains. Tears should be mended and stains should be removed before washing.

Washing: The garments may be soaked in water with the detergent. Light scrubbing may be done with a soft brush.

Rinsing: The garments should be rinsed several times to remove the soap.

Drying: After rinsing, the garments may be wringed lightly to remove the excess water. They can be dried in the shade.

Finishing: Nylon garments are to a great extent wrinkle resistant. However they may be ironed with low heat and stored.

Summary

Laundering is a combination of cleaning and finishing. Laundering includes not only washing the clothes with soap or detergent and rinsing

with water to remove dirt, grease, stains etc, but also restoring the freshness, original colour and crispness.

The various stages of laundering are preparation of fabric by examining the fabric for tears and stains. The garments should be mended if there are tears and if any stains are found, they should be removed before washing. The next step is steeping the fabrics in detergent solution. The soap should be selected according to the fabric to be washed. Silk and wool are not steeped. The next step is washing by kneading and pressing to remove the dirt. Rinsing is the next step to remove all the soap from the fabrics. Drying also depends on the type of fabric. After the fabrics are dried, ironing should be done with appropriate heat for different fabrics.

Glossary

Alkali: Alkali is a substance having highly basic properties; a strong base. Alkalis are present in most soaps and detergents in varying degrees.

Blueing: Blueing is the method of adding liquid blue to white clothes to whiten and brighten them.

Detergent: A detergent is a water-soluble cleansing agent which combines with impurities and dirt to make them more soluble.

Laundering: Laundering means to wash clothes.

Rinsing: Rinsing is the process of washing something with clean water to remove soap, detergent, dirt or impurities.

Stain: A stain is a colored patch or dirty mark that is difficult to remove.

Steeping: Steeping is to soak or saturate in water or other liquid.

Model Questions

1. Discuss the need for care and laundering of clothes.
2. Explain the hand washing and finishing of the following fabrics: Cotton, Wool, Silk, Rayon, Nylon.

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UNIT – 14
EXTENSION EDUCATION AND COMMUNICATION

Learning Objectives:

Enable students to:

- Gain an understanding of what education is
- Get an insight into the different types of education
- Make a start at understanding the concept of Extension Education

14.1 Introduction

Extension is considered as the third dimension of Education. The first dimension is teaching and learning, which means knowledge, is spread; the second dimension is research, through which new knowledge is generated; and the third dimension is Extension, through which new knowledge is applied to real life situations. The concept of Extension Education was first articulated in India by the Kothari Commission in the year 1960.

Education is regarded as a process of developing life's guiding principle, and abilities to respond to life. It is considered to be a process of understanding life's responsibilities; by appreciating other people and seeing value in their different interests, abilities and achievements. Thus education is defined as a process of bringing desirable changes in human behavior; by a change in knowledge (things known), change in attitude (things felt), and change in skills (things done).

The term "Education" represents certain important elements i.e.

- Change in behavior

- Teaching
- Learning
- Learning Materials
- Methods of Teaching and Learning
- Measurability
- Learning how to learn

- **Change in behavior**

According to Leagans (1961) Behavior refers to what an individual knows (knowledge) what he can do (skills-mental physical) what he thinks(attitudes) and what he actually does (action).

Since education is a process of learning to lead a better life; education should concentrate on changing the behavior i.e. knowledge, skills, attitudes, beliefs etc., Increasing knowledge and skills alone will not make the person educated.

For Example:

Most people have the knowledge and skills required to segregate Bio-degradable and non-degradable waste. But due to their attitude and belief they do not segregate waste before disposing. Thus it could be stated that a person could be considered as educated only when there is a change in behavior.

- **Teaching**

The process of educating a person involves designing learning situation that facilitates the learners ability absorb new information.

For Example:

A class room with a Blackboard, chalk, duster, books, pencils, An information desk at the railway station, An insurance agent, A computer course, Visit to a museum, Reading a book etc.,

- **Learning**

Learning; an important element of education is an active-interactive process. It is the specific effort employed by learners to gain, put together and extend their knowledge. Learning is the method used by the student to change their own behavior; like:

Listens- when instructions are given by the teacher

Observes- the teacher conducting demonstrations

Recites- repeats the subject matter

Writes- make notes

Experiments- cooks, stitches, repair a bike etc.,

- **Learning Material**

Learning material is a set of information. This information will be selected with a clear learning objective and is presented in a way that the learner is able to acquire knowledge, skills and change their attitude. It always pertains to a particular subject for example; mathematics, sociology, nuclear science etc.

The learning material indicates what is to be learnt, provides information, gives examples, explains, questions, sets learning tasks, both for individuals and groups, marks work, answers learners' questions, checks what learners have learnt, provides feedback to individual learners on their progress, provides other resources (e.g., textbooks), gives advice on how to use those resources, gives study advice, and helps with individual problems.

- **Method of Teaching and Learning**

There are different methods of teaching and learning like:

Learning types– conditioning, verbal, motor, perceptual, attitude and problem solving

Teaching types – learnerdominated methods, teacher dominated, cooperative methods, functional methods

- **Measurability**

The whole process of education is measurable. It is possible to determine what is to be taught (verbal skills, writing skills, concept, etc.,), how much is to be taught (example: teaching parts of the body- baby learns where the eye is, primary school child learns the eye is a part of the face, the high school student learns the parts of the eye and a medical professional also learns about the eye) that means it is possible to measure the amount of information to be taught.

- **Learning How to Learn**

The most important element of education is learning how to learn. It is the teacher who helps the learner understands the fact; that it is essential to practice and when mistakes occur, they are occasions to realize the intricacies of the subject. At the end of each level of learning, it is important that the student realizes that learning is a continuous process. Example: at the end of primary education the students realizes that they have to still study at the secondary level, when they complete that, there is high school, this is followed by college and continuous throughout life.

Activity 1

Write a note outlining the role of the parent and teacher in the learning process of an adolescent and a young adult.

14.2 Classification of Teaching and Learning Process

Education is of different types and it could be broadly classified as those based on:

- Teaching Methods
- Purpose

- **Classification Based on Purpose**

The purpose of education is to expand the vision of the learner. Here education is classified as General purpose education and vocational education.

Table 1: Classification of teaching and learning process

Type	Classification	Example
Based on purpose	General	Academic programmes Professional programmes Technology porgrammes Special and welfare programmes
	Vocational	Education for specific occupation like- Carpentry, Fire fighting, Agriculture, mass cooking,
Based on Teaching method	Informal	Visits to: museums, scientific fairs, exhibits Radio, TV
	Formal	Reading texts Participating contests, etc. Attending lectures and conferences Certificate courses Diplomas courses Degrees courses
	Non- Formal	Literacy Programmes Adult education Distance education Open University Extension activities like: Agriculture, Health, Population education

l General purpose education

In this type of education a student learns the subject:

- To understand the situation in normal conditions. (Situational

knowledge).

Example: a family offers security.

- To gain supplementary knowledge. (Conceptual knowledge).

  Example: families offer security to each other and it is called social security

- To realize the procedures contained within. (Procedural knowledge)
  Example: families pool resources like an insurance scheme.

- To organize and plan. (Strategic knowledge).
  Example: Families save for particular purposes.

The whole purpose of teaching and learning is centered on comprehension and appreciation of the subject matter.

Vocational education

Vocational education provides certified training in job related and technical skills. It prepares the student for careers that are based on manual or practical activities. Traditionally vocational education has been non academic, directly related to trade or occupation in which the student wants to be employed. It provides the learner to learn in parts and pick up specific skill sets.

- **Based on Teaching Method**

Informal education

By informal education we mean the truly, life-long process whereby every individual acquires; Attitudes, Values, Skills, Knowledge, from daily experience and the educative influences and resources in his or her environment. For Example: From family and neighbors, from work and play, from the market place, the library, the mass media etc.,

It does not have any objectives and is diverse in the teaching and learning process. The informal process of learning does not impose any obligation on the learner or the teacher. Therefore does not regard the providing of certification as a necessity.

Examples:

- Listening to radio broadcasting or watching TV programmes on educational or scientific themes
- Experiments
- Reading session's biographies, scientific news, etc.
- to institutional activities
- Lectures in institutions

Activity 2

Observe how a baby learns to eat food; How does a adolescent learn to cook food; an adult learns manage resources; an elderly person manages to walk with a stick and climb stairs.

- **Formal education**

Formal education is a systematic, organized education model, structured and administered according to a given set of laws and norms. It consists of a set curriculum, specific objectives, content and methodology. It involves the teacher, the students and the institution. It is the educational process adopted by our schools and universities. There is a program that teachers and students must observe, in order to proceed to the next learning stage.

Since it follows a set of rules and regulations in the process of education it confers certificate, diplomas and degrees. In order to gain recognition by the formal education process; it is necessary to fit into its rules like: an age frame, previous educational qualification, time frame etc

- **Non-formal education**

Non–Formal education is any educational activity organized outside the formal frame work. It operates independently or as a part of a broader activity. The learners in the non formal system are identified and have clear learning objectives. The objectives of Non-Formal Education are to provide basic knowledge and skills, practice and attitudes necessary for

each group to become conscious of their needs and problems and to learn to achieve their individual and social goals. Some examples of Non Formal Education are:

- Correspondence courses
- Distance learning
- Open learning
- Extension Education

Extension Education a form of non formal learning is oriented towards the learner. It focuses on transferring conceptual knowledge developed in research centers to learners. Unlike other forms of teaching and learning; Extension Education has the researcher, the extension functionary and the learners as constituents of the process.

Because Extension is the third dimension of education; it is important that the learners understands the subject and also uses the knowledge in their daily lives.

Example: In order to increase the income of families living in poverty, members of the family may be taught the techniques of candle making.

In this situation; the family living in poverty is the learner; the extension functionary is the person who teaches them to make candles. It is not sufficient that the family learns to make candles; they will have to buy the material to make the candles, sell the candles and earn money. This would require funds. Therefore they will not be able to seek credit facility from the bank. In this case; even though the family member has acquired the skill required to increase their income, they are unable to utilize this knowledge.

14.3 Definition of Extension Education

Extension Education is an applied science consisting of content derived from research, accumulated field experiences, and relevant principles drawn from the behavioural science synthesized with useful

technology into a body of philosophy, principles, content, and methods focused on the problems of out of school education for adults and youth - J.P Leagans (1961).

In India the government established Extension services through the ministries of agriculture or local government authorities.

- It is a non-formal educational system.
- It aims at improving the social –economic situation of individuals and the communities.
- It is people oriented, knowledge based and problem focused.
- It works by providing linkages between people with problems and people with the ability to solve the problem.
- It gathers, stores, and disseminates innovation.

14.4 The Concept of Extension Education

Extension Education facilitates the adaptation of new or improved practices, by educating people. It is a process of promoting practices and techniques based on recent advances in science and technology. The essence is that it identifies people who need to use these improvements. Very often people will not have “felt” the need to change, but Extension Personnel will ‘educate’ the people and convert the “unfelt” need into “felt” need. For example: a person may be using an open utensil to cook food. The Extension Educator will educate the person about the method of pressure cooking food. During the process of educating the Extension Educator will highlight the “unfelt” need for energy conservation, cost reduction, lesser cooking time, lower fuel consumption etc.,

The concept of Extension Education is corrective in nature, modifying the deficiencies and disadvantages in current practices; and it introduces recent developments based on research. It is a persistent and intentional process of improving the ongoing system.

Extension as an applied education consists of:

- Research findings

- Accumulated field experiences
- New and appropriate technology
- A body of philosophy, principles and methods built on behavioral science

14.5 Objectives

The fundamental objective of extension education is the development of the people.

1. To assist people to discover and analysis their problems, their felt and unfelt needs.
2. To develop leadership among people and help them in organizing groups to solve their problems.
3. To disseminate information based on research and /or practical experience, in such a way that the people would accept it and put it into actual practice.
4. To keep research workers informed of the people's problems from time to time, so that they offer solutions based on necessary research.

The objectives of extension may also be categorized as follows:

Material-increase production there by income

Educational-change the outlook of people or develop the individuals.

Social and Cultural- development of the community.

14.6 Principlesof Extension Education

Principles are generalized guidelines, which form the basis for decision and action. Principles of extension education are simple, easy, educative and moral. The Principles of extension are as follows:

- **Principle of need and interest**

Extension work is initiated on the Principle of starting all extension work by relating with the needs of the people in the community. Extension worker should take notice of local peoples' needs and this will generate

interest of the people which in turn will lead to their cooperation in extension work.

Example:

The government of India has set up special programmes for the people facing crises like the widows, the aged, the physically challenged, people who die in accidents on the work spot etc., If the extension worker start work by helping one of these people utilize the benefits offered by the government the Extension functionary will be successful in further extension work.

- **Principle of cooperation and participation**

Extension is the bridge between the researcher and the user of information. For the successful utilization of new findings it is essential that the Extension personnel is able to draw the cooperation and participation of community members in all extension work.

Example:

In order to utilize the government schemes for the physically challenged, it is necessary certified by medical personnel. In such cases it is necessary that all the physically challenged get themselves certified.

- **Principle of cultural difference**

People have a set way of living. They follow certain customs and traditions. Therefore if an extension programme is to be successful; the extension functionary should be aware of the customs and traditions of the people who are to participate in the extension programme, they should be aware of the information levels of the people with whom they work. All cultural changes resulting by the introduction of the extension programme should be gradual and in harmony with the culture of the people.

Example:

Extensive use of technology has not changed the fact that even to

this day widows are expected to stay indoors for the first few days of widowhood. In such cases it would be appropriate for the Extension functionary to wait for the required time before approaching the widow to enroll with a widow pension programme.

- **Principle of applied science and democratic approach**

All Extension Education programmes operate on people's willingness to participate. Community members are asked to make suggestions and after discussions; programmes are set into operation. This democratic approach of the actual conditions of the community; increases participation. The extension functionary provides feasible suggestions during the programme so that community members are able to adopt interventions and inventions smoothly.

Example:

When the government introduced the Concept of Self Help Group (SHG) the Extension Functionary discussed the concept with the community members and helped them run groups.

- **Principle of learning by doing**

If a person has to learn new a new concept effectively it is important that the learner gains practical knowledge and experience the difficulty in implementation of this concept. It will also create a situation for the Extension functionary to observe the learner and provide proper guidance. Extension programmes should always provide the learner the opportunity to "learning by doing".

Example:

When learners have to learn any new income generating methods like for instance setting up an internet cafe.

- **Principle of trained specialists**

If a community is to develop holistically different aspect has to addressed; like, the health status, income levels of the people, sewage

facility in the community etc., In such situation, numerous Extension Functionary specialized in specific aspect will be operating. Like a person specialized in health issues. This Extension functionary will use the expert knowledge of medical professional from time to time.

- **Adaptability principles in use of extension teaching methods**

Since Extension Education programme operate in the field it is very important that the Extension functionary have a thorough knowledge of all the extension teaching methods so that they can select the method appropriate to the local condition. Through knowledge will help the functionary to adopt the teaching material to different situations like people in different age groups, educational backgrounds, economic standards and gender. Extension Education programmes always uses a minimum of two methods of teaching.

Example:

All members in a community require health care facilities. When an Extension functionary is educating members about the various governmental provisions available, they could increase their efficiency by creating posters with a lot of visual symbols rather than words. Visual symbols will explain the information to both literate and illiterate people. They should supplement posters different methods like, pamphlets, personal interactions etc., to give information to the members in the community.

- **Principle of leadership**

In all communities they will be a leader whom the community members follow. This person may be an acknowledged or unacknowledged leader. For the Extension Programme to be successful it is essential that the Extension functionary is able to locate this person and involve this person in the programme.

Example:

Involving local group leaders like the mahilamandals, youth groups, etc.,

- **Principle of whole family**

Extension Education work operates on the principle that success depends on involvement of the whole family in the programme. Unless every member in the family is aware of the changes taking place they will not be able to facilitate the adoption of the programmes.

Example:

If a garbage segregation process is to be adopted in a family all members of the family are responsible.

- **Principle of satisfaction**

The uniqueness of Extension programmes is it highlights the satisfaction people derive by participating. All Extension programmes begin by locating work which have scope for immediate benefits. Unless people feel involved and constructive they will not participate. Therefore it is important that the Extension functionary is able to gain approval of the people in the community.

Example:

When a drainage system is being set up in a community people need to be involved in construction.

- **Principle of evaluation**

It is necessary to review all Extension programmes. This process will highlight the merits and demerits and necessary changes can be carried out. Evaluation generates confidence in people.

Example:

A transport service may be initiated and after two months of operation people may feel that the timings are inconvenient and necessary changes will be carried out.

- **Principle of neutrality**

Inevitably Extension work operates at the field level. It means that

local people with their politics, religious and economic bindings are present. It is essential that the Extension personnel remains neutral and involves members from all communities in extension work.

Example:

At functions secular songs should be sung, rather than religious songs.

- **Principle of encouragement**

In an Extension programme the field functionary operates under diverse conditions. They will require a broad support system to function effectively, participate enthusiastically and remain active.

Example:

A field functionary may have to travel far. It is important that a transport facility is organized. Another example could be provision of an artist to help them prepare teaching aids.

14.7 Extension Teaching Methods

According to Leagans (1961) "Extension Teaching methods are devices used to create situations in which communication can take place between the instructor and the learner". The extension-teaching methods are the tools and techniques used to create learning situations in which communication can take place between the learner and the extension functionary. They are methods of extending new knowledge and skills to the learner by drawing their attention towards the subject, arousing their interest and helping them to have a successful experience of the new practice. A proper understanding of these methods is necessary.

Extension teaching methods are classified as:

- Individual contact method
- Group contact method
- Mass contact method

- **Individual Contact Method**

Extension methods under this category provide opportunities for face-to-face or person-to-person contact between the learner and the extension workers. These methods are very effective in teaching new skills and creating goodwill between the learner and the extension workers:

- Useful in contacting the “stay-at-home” type of people.
- For teaching complex practices.
- While selecting local leaders, cooperators, demonstrators.
- To increase confidence of learners in Extension.
- To gain first-hand knowledge of the learners home conditions.
- The learner feels a sense of personal importance which is conducive to bring about the desired changes.

- **Group Contact Method**

Under this category, the learner are contacted in a group which usually consists of 20 to 25 persons. These groups are usually formed around a common interest. These methods also involve a face-to-face contact with the people and provide an opportunity for the exchange of ideas, for discussions, on problems and technical recommendations and finally for deciding the future course of action.

- Face-to-face contacts with large number of people at a time.
- Facilitates sharing of knowledge and experience, and thereby strengthen learning.
- Saves time.
- Group influence facilitates individuals to accept changes.

- **Mass Contact Method**

Extension worker have to approach large number of people for disseminating new information and helping them to use it. Mass-contact methods are convenient options. These methods are useful for making

people aware of the new information and procedures.

1. They reinforce individual and group contacts by complementing or supplementing them.
2. They reach much larger and different audiences.
3. They save time and expenditure in reaching large numbers.

14.8 Extension Education and Community Development

Bringing awareness among people; participation of grassroots people in planning, making people self-dependent, ensuring people's empowerment is Development. And when people are involved in the process of development it is called Community Development. Thus Community Development is the method of assisting people living in local groups to desire and achieve certain improvements in their life, democratically, by increasing their own initiatives, effort and resources.

For effective community development, participants need to be provided with the right environment wherein individuals may grow to his/ her fullest potential. Techniques like training, re-training, refresher courses, exposure visits, peer group interactions, visual presentations; case studies are some of the methods adopted in community development programmes. The success of community development programmes lies in inspiring and training people to look after themselves, identify leaders, and develop institutions and local resources.

The government of India has introduced various programmes for the betterment of its people. All programmes in the country include an element of extension. It is necessary because people need to be made aware of the programmes developed by the government. Mentioned below is the role of extension in three of the government schemes.

Activity 3

Name a community development program being implemented in your ward.

- **Yashasvini Health Insurance Scheme**

The scheme was introduced throughout rural Karnataka in 2003. For a premium payment of only Rs 5 per month or Rs. 60 per year. Participants are covered for all surgical interventions, major or minor, and for outpatient services (OPD) at a network of private hospitals. The Yashasvini scheme is a voluntary programme. It provides for free hospitalization for 1,600 predefined surgical procedures. Free hospitalization includes accommodation, operation charges, anesthesia, and professional charges. For outpatient care, consultations are free but treatment costs have to be borne by the patient. Diagnostic services must also be paid for, although at subsidized rates.

The scheme is open to state co-operative members and their dependent family members (i.e., spouse and children). The only restriction is that a person must have been a co-operative memberfor at least 6 months prior to joining the scheme. The premium for membership in the programme was initially fixed; one third was subsidized by the state government. The trust has hired the services of Family Health Plan Limited (FHPL) for implementing the scheme. The FHPL negotiates tariffs at these participating hospitals, arranges for cashless treatment to be provided to beneficiaries, issues photo identity cards to members, and provides overall programme coordination. In return, it receives a commission of 5.5 per cent of the total premium. Extension Work in the programme is played by the FHPL

- **Swaranjayanti Gram SwarozgarYojana**

Assisting the rural poor in self-employment by encouraging group and cluster activities, providing skill development opportunities, credit linkages and subsidies and creation of marketing opportunities for products has been another major plank of the poverty alleviation schemes of the Government. Launched on 1st April 1999, Swaranjayanti Gram SwarozgarYojana (SGSY) is an integrated scheme for providing opportunities of self-employment to the rural poor. The assisted families (Swarozgaris) may be individuals or Groups (Self Help Groups). However,

the emphasis is on Group approach and also with particular emphasis on group formation by women and the weaker sections.

- **Members of Parliament Local Area Development Scheme (MPLADS)**

It is a scheme formulated by the Government of India in 1993. It provides each member of the parliament of India the choice to suggest to the District Commissioner the developmental works to the tune of Rs.5 crore per year, to be taken up in his/her constituency.

Activity 4

Highlight the element of extension in a programme providing social securityto the community members.

Summary

Extension Education is the process of educating people on subjects of their requirements, at times that is convenient to them. Specifically in ways, through which they gain practical experience. It has a specific subject which the community members learn. The method of learning depends on the learner. Extension Education is a process of helping people to lead a better life by focusing on a particular problem. It has its own set of objectives and principles. The term “Education” represents the following important elements i.e. Change in behavior, teaching, learning, teaching learning materials and methods, measurability, learning how to learn, planned process. This involves the selection of learning experiences and the process of teaching and learning are classified as those based on teaching methods and purpose. Some of the teaching methods followed in Extension are; Visiting individuals and families, Personal letter, Group discussions, method demonstrations, use of radio, printed matter. The process of extension education is closely linked to community development.

Glossary

Commission: A commission is a group of people appointed by the

government assigned to do a particular job.

Extension Personnel: is a subject specialist work at the community level

Concept: It is a model on which a particular programme operates

Component: The different elements of a programme

Objective: The purpose of the programme

Principles: The guiding ethics to be followed by the programme

Model Questions

1. What is education?
2. How many elements of are involved in Education
3. Write a short note on the different types of education
4. What is Extension Education
5. Mention the principles of extension

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Unit – 15
COMMUNICATION FOR HOME SCIENCE EXTENSION

Learning Objectives:

To enable the students to

- Understand the importance of communication in Home Science Extension Education
- Know the types and elements of communication
- Know about audio visual aids used in communication

15.1 Introduction

The word communication is derived from the Latin word 'Communis' which means establishing 'commonness'. It is the process of transferring an idea, skill or attitude from one person to another accurately and satisfactorily. It is the sharing of ideas, attitudes or skills, between two or more persons. The main purpose of communication is to influence the behavior of people exposed to the communication. Communication is therefore a conscious effort to share information, ideas, attitudes, skills etc., with others. A good extension worker should be a good communicator.

The success of extension workers depends largely on their ability in effectively communicating. They should, therefore, be familiar with the key elements of the communication process if the communication is to be successful.

- **Definition of Communication**

According to Leagans, Communication is the process by which two or more people exchange ideas, facts, feelings or impressions in ways that each gains a common understanding of the meaning, intent and use of messages.

Communication is a two-way process of giving and receiving information through any number of channels. Whether one is speaking informally to a colleague, addressing a conference or meeting, writing a newsletter article or formal report, the following basic rules apply:

- Know the audience.
- Know the purpose.
- Know your topic.
- Anticipate objections.
- Present a rounded picture.
- Achieve credibility with the audience.
- Follow through on what you say.
- Communicate a little at a time.
- Present information in several ways.
- Develop a practical, useful way to get feedback.
- Use multiple communication techniques.

15.2 Elements of Extension Communication System

Leagans has listed the elements of communication as:

- **The Communicator:** is the person from whom the message originates.
- **Message:** is the information or the meaning the communicator wants to convey.
- **Channel:** is the media through which the communicator sends/ conveys his message.
- **Treatment of message:** is the technique, or details of procedure, or manner of performance, in presenting messages
- **Audience:** is the receiver of the message or to whom the message is sent.
- **Feedback:** gives the details about audience response to the given communication process.
- **Effect or Impact:** is the end result of the communication.

- **The Communicator**

The communicator is the person/s/organisation who initiate the process of communication. The message originates from the communicator; they act as the source. The communicator sends messages and is the first to give expression to the message that is to reach the audience. It is important that the communicator interprets the message correctly.

A good communicator knows:

- the objectives - has them specifically defined;
- audience - its needs, interests, abilities, predispositions;
- message- its content, validity, usefulness, importance;
- channels that will reach the audience and their usefulness;
- how to organise and treat message;
- their professional abilities and limitations.

- **Message or Content**

A message is the information a communicator wishes the audience to receive, understand, accept and act upon. A successful communication is one in which the major factors influencing the message are controlled as far as possible. This is the responsibility of the communicator.

A good message must be:

- In line with the objective to be attained;
- Clear – understandable by the audience
- Specific – no irrelevant material
- Simply stated covering only one point at a time.
- Accurate – Scientifically sound, factual and current;
- Appropriate to the channel selected
- Appealing and attractive to the audience – having utility, immediate use.

- Applicable – audience can apply recommendation;
- Adequate – Combining principle and practice in effective proportion;

- **Channels of Communication**

The sender and the receiver of messages must be connected with each other; and channels of communication are used to connect the sender and receiver of messages. Channels are the physical bridges between the sender and the receiver of messages and the pathway between a communicator and an audience on which messages travel to and fro. They are the transmission lines used for carrying messages to their destination. Thus, the channels serve as essential tools of the communicator.

A channel may be anything used by a sender of message to connect with intended receivers. The crucial point is that he must get in contact with his audience. But channels are no good without careful direction or use in the right way, at the right time, to do the right job for the right purpose with the right audience, all in relation to the message.

- **Treatment of Messages**

The treatment of message is related to the procedures to be followed or the techniques that are considered to be essential in presenting the messages. The treatment of message, therefore, deals with the design of method for presenting the messages. Treatment has to do with the way a message is used to get the information across to an audience. Designing the methods for treating messages does not relate to formulation of the message or to the selection of channels, but to the technique employed for presentation within the situation provided by a message and a channel. The message can be clear, readable and interesting or it can be vague, dull or boring. It can use big and technical words or it can use words the receivers understand.

(5) The Audience

That person or the group of people to whom the message is sent, is

called audience or the receiver. They are the receivers of messages sent by the communicator. In the communication process, both the sender and the receiver play an important role and are very necessary. Communication is possible only when both are present.

An audience may consist of one person or many. It may comprise men, women, or both; youth groups, villagers or their leaders. An audience may be formed according to occupation groups as farmers or artisans; professional groups, as engineers, educators, administrators etc. The importance of clearly identifying an audience cannot be overstressed. The more homogeneous an audience, the greater the chances of successful communication. Likewise, the more a communicator knows about his audience and can pinpoint its characteristics the more likely he is to make an impact.

- **Feed Back**

Extension communication is never complete without feedback information. Feedback means carrying some significant response of the audience back to the communicator. Communication work is not an end in itself in Extension. The extension personnel should know how the audience has received the message and whether they have used the message.

- **Effect or Impact**

Effect is the end result of the communication. It is the change that has taken place with the receiver due to the communication.

Activity 1

Identify an extension programme and list the elements of communication.

15.3 Types of Communication

All communication can be broadly grouped as three types, i.e.,

- Audio communication

- Visual communication and
- the combination of Audio and visuals.

- **Audio Communication**

Audio communication is that which could be heard. This relies completely on hearing. Different learners use different learning strategies, and audio can provide additional information to support different learning styles, for example some users may learn more by hearing than reading a piece of text. Audio can add a sense of realism. Cultural associations with music allow you to convey emotion, time period, geographic location, etc. However, when using audio in this way you must be aware that meanings may differ in different cultures. It is useful for directing attention to important events. Non-speech audio may be readily identified by users, for example the sound of breaking glass to signify an error. Through this we could communicate ideas in many of the extension teaching methods like a telephonic call, a public address system or a radio.

- **Radio**

Radio is an electronic audio-medium for broadcasting programmes to the audience. It is a wireless system of communication and is a mobile medium for mass communication. Disseminating information is effective and relatively inexpensive. Radio helps in reaching people dispersed and situated in remote areas. The broadcast receiving systems are available at low costs which has facilitated its usage by a larger number of people.

- **Telephone**

It is a telecommunication device used to transmit and receive sound. It converts sound and electrical waves into audible waves. The telephone consists of two parts the microphone and a speaker. It operates through transmission of electric signals over a complex telephone network. It is a convenient way of interacting with people in the community. An Extension facilitator can use it to interact with people when direct contact is required.

- **Public Address System**

Is a set of equipment to amplify sound so that it is audible to a large audience over a distance. Public address equipment consists of three important segments viz., microphone, amplifier and speaker.

Microphone: There are many varieties of microphones available like monodirectional etc. depending upon the requirement, particular type is selected. Use of omnidirectional microphone is preferred, where the sounds can be heard from all the directions. Microphones can be of wired, cordless, conference type and collar mikes.

Amplifier: There are many types of amplifiers like cassette recorder amplifier and without cassette recorder. Amplifier may have provision of CD and DVD etc. according to number of microphones to be used appropriate amplifier should be selected.

Speakers: Different types of speakers are available. Their use depends on the situation. Sound speakers or horns are used in open areas. The columns are used inside hall. Whatever might be the speaker, the purpose is same. The speaker receives the amplified waves from amplifier and converts them into sound waves. Public Address Equipment can be operated easily at any place with little experience. It is very handy as they are available even in small towns. Playing of records before starting meeting will attract the attention of audience. Large size audience can hear the programme. It is very frequently used in extension meetings, trainings and in educational institutions.

- **Visual communication**

Visual communication is that which could be seen and helps communicate more effectively. This makes the audio communication more clear. Some examples are the charts, posters, letters, models,

- **Poster**

It is a two dimensional non-projected visual aid and it will serve first to inspire the audience. It will prove to the audience that there is an

official interest. As long as it remains in the community, it will serve as remainder to the audience. A good poser arouses or urges the audience to immediate action. It makes them to feel a part of the work at hand. A poster helps extension scientist to get across one idea to the audience. It is a visual, which has to attract the audience and deliver a simple message at a glance. Poster makes the audience to become aware of the practice or idea that needs to be communicated. A poster is designed to make a public announcement of a special idea. It usually includes few words with illustration.

- **Projectors**

LCD Projector

An LCD (Liquid Crystal Display) projector is a type of video projector for displaying video, images or computer data on a screen or other flat surface. It is a modern analog of the slide projector or overhead projector. LCD projectors have revolutionized the audiovisual industry. With a few clicks of the mouse and strokes of the keyboard, contents typed on computer appears instantly on a projection screen in real time. First introduced in watches and clocks in 1970 s, LCD is now used to project the images on a large screen.

- **Flannel board**

A flannelgraph is made from rough textured cloth, such as flannel or a blanket, which is hung or supported almost vertically. Figures, words, and symbols cut from cardboard, which are backed with similar cloth or sandpaper, are attached to it. A cheaper backing is obtained by putting glue on the back of the cut-out and then dipping it into fine sand. The backing holds the cut-outs firmly on the cloth surface. The cut-outs are prepared beforehand and can be used repeatedly.

The flannelgraph can be used very effectively to build up a story or an explanation. Unlike a wall chart, which can confuse an audience by presenting a finished diagram at the start of a talk, a flannelgraph can be

used to present in turn each part of the diagram until it is complete.

The cut-outs can be placed in different positions to show alternative outcomes. After showing the process of wind erosion, for example, the effect of wind-breaks can be demonstrated by placing cut-outs of trees between the wind direction and a field. Arrows representing the wind can then be deflected, and the general effect shown by putting back soil symbols on the surface of the field.

A modern alternative to flannelgraphs is the magnetic board. Cutouts are backed by a magnetic strip that holds them firmly to a metal board. They can be used in windy conditions when flannelgraph cut-outs would blow away, but they are cumbersome to transport. On the other hand, flannelgraphs, which can be made in a variety of sizes and designs can be folded into an agent's bag or rolled up and tied to a bicycle.

- **Charts**

Charts are visual symbols for summarizing, comparing, contrasting, or performing other services, in explaining subject matter in other words, they are diagrammatic presentations of facts or ideas.

Charts are visual symbols for summarizing, comparing, contrasting or performing other helpful services in explaining subject matter. Charts are diagramatic representation of facts or ideas. Charts are pictures of relationships these are graphic and pictorial representation used to tabulate the large mass of information or show the development. They are often referred to as symbolized visuals. Charts can help to communicate difficult, often dull subject matter in an interesting and effective way. They also

1. Make the facts and figures clear
2. Show and compare changes
3. Show the size and placement of parts in an object

Types of charts:

- **Bar Chart:**

  These are made up of a series of bars along a measured scale. Bars are used to compare quantities at different times or under different circumstances. Ex: The effect of fertilizer in increasing crop yields on test plots in three successive years may be shown in a bar chart.

- **Pie Chart:**

  These are in the shape of circles and used to show how several parts make up the whole. Each section of the pie will have its own colour. A colour code in the margin will help the audience remember what the different sections represent. They may show percentages or proportions. Ex : A pie chart may be used to show the relative proportion of different crops produced by a country or a state.

- **Tabular Chart**

  (Time or Table Chart): These are used to bring together in compact form a mass of related data. Any consolidated information can be taken as tabular chart. Ex : Area, production and productivity of crops can be shown in a tabular chart.

- **Tree Chart:**

These are in the form of a tree, used for showing the development of growth of a thing. The origin is a single line or other representation of the trunk and the various developments can be shown as branches. Ex: Audio visual aids classification.

- **Flow Chart (Organizational):**

These are shown by using lines, arrows etc. they show organizational structure of departments or institutions. Ex: Organizational pattern of an Agricultural College.

- **Pictorial Chart:**

Represented by using graphic messages like cartoons and other type of illustrations. Each visual symbol may indicate quantities and that can be given in the index. This type of chart is more useful for illiterate

audience. Ex : We can compare the number of tractors on farms in different years.

- **Overlay Chart:**

It consists of more number of sheets, which can be placed one over the other conveniently. On each individual sheet, a part of the whole is drawn. This enables the viewers to see not only the different parts but also how they appear when one is placed over the other. The ultimate product can be seen only after the final overlay is placed. This type of presentation is dramatic and more effective. Ex: Stages of seed germination, construction of gobar gas plant etc.

- **Pull Chart:**

It consists of written messages on a large sheet. Messages are hidden by strips of thick cardboard. The messages can be shown to the farmers one after another by pulling out the concealing strips. This provides suspense to viewers. These strips can again be restored to the concealing position after presentation and can be used whenever needed. Ex : Names of sprayers, names of pests and diseases.

- **Strips (Tease) Chart:**

These are similar to pull chart. Messages are concealed by using strips of thin paper instead of thick one. The ends of this paper strips are pasted at both the ends of message whenever the message is to be exposed one end of the paper strip can be stripped out. This has the advantage of surprise or anticipation. The appeal of strip tease chart is in its suspense. It teases the interest and imagination of the audience. This technique helps in recall of ideas and increases learning. Ex: Varieties of mango.

- **Flip Chart:**

It consists of series of individual charts which are bound together and hung on a supporting stand these individual charts carry a series of related messages in sequence. The instructors flip them one after another as the lesson progresses. To be effective flip charts should deal with only one broad subject and give only salient points without too much data or

details. Ex: Production practices of any one crop.

- **Chalkboards**

Blackboards are widely available in schools, rural training institutes and extension offices. They may be fixed to an inside wall or supported on a freestanding easel which can be moved around. They are useful for setting down the main headings of a talk, for sketching simple drawings and diagrams, and for noting points raised in questions and discussion.

If using a blackboard, the agent should practice writing on it, if necessary by drawing horizontal chalk lines for guidance. He should make sure that the writing is large enough for someone at the back of the audience to see clearly and that the headings and phrases are kept short. There is not much space on blackboards and the agent will lose the audience's attention if he spends a lot of time with his back to them while writing.

Whiteboards have a smooth, shiny surface on which coloured felt pens can be used, but it is important to use only pens with water-soluble ink. Whiteboards are easier to use than blackboards from both the agent's and the audience's point of view. The pens flow smoothly over the surface and the colours are much clearer than chalk on a blackboard.

- **Audio Visual Aids**

Combination of Audio and Visuals is the most effective way of communicating as it able to involve the physical senses to a greater degree. Some of the examples are personal visits, Drams, demonstrations, television etc., The term audio-visual aid refers to anything that an extension functionary uses to help to pass on the message when communicating with learners. The spoken word is the extension functionary main communication tool, its impact and effectiveness can be greatly increased by the use of suitable audio-visual aids. When selected and used properly, audio-visual aids can help in the following ways:

- The interest of the learners can be maintained if the extension

functionary varies the mode of presentation. It is difficult to concentrate for long on what someone is saying; but if the extension functionary refers to a wall chart, or illustrates a point with some slides, learner's attention can be maintained.

- When information is presented to more than one sense (sight and touch, for example, as well as hearing), more is taken in and it is better understood and remembered.

- Processes and concepts that are difficult to express in words alone can be explained. The procedure for applying for a loan, for example, may sound confusing, but a simple chart or diagram can make the process clearer. Again, the life cycle of a crop pest can be explained by showing a series of slides or drawings.

- The effects of decisions and actions that farmers might take can be shown. Photographs of a cattle dip or a model of a cooperative store can give farmers a clear idea of just what it is they might be considering.

- Pictures can have a more immediate impact on our emotions than words. Photographs of a heavy crop, for example, are likely to arouse interest more effectively than details of yields read out by an extension agent.

- **Television**

The word television comes from a Greek word meaning „seen from a far . Television is the powerful medium of communication, particularly for the transfer of latest information quickly to the larger number of rural population in far of places. Its potentiality to communicate to both the senses „Eyes and Ears simultaneously gives TV a unique place in existing media for the dissemination of information.

- **Folk Media**

Folk media are indigenous equivalents of mass media. They are used

largely for entertainment, but they can also promote educational values and help in cultural continuity. They include festivals, plays and puppet shows, song, dance, poetry, story telling, debates.

- **Smart Board**

Another technological innovation that aids audio and visual communication is the smart board. A smart board is an innovative and interactive white board that can be used to effectively communicate lessons, ideas, and presentations to an audience. The smart board is often compared to an interactive computer tablet in that it can scroll and save notes made on it. Programs such as Power Point and Auto Cad can also be loaded on to the smart board, making it an interactive tool similar to a large computer that the audience can view.

- **Communication through Satellite**

Satellites are artificial object put into orbit around earth. There are small planets that move through space around the earth, the world today has gone for ahead in developing satellite communication system. This quantum leap in communication technology has brought the world nearer to each other and the messages are flashed in seconds just after their origin to the destination of their users through satellites.

In our country, which has tremendous amount of diversities in culture, agriculture, agro-climatic variations, languages and demographic-cum-ecological imbalances exist, hence, the major thrust is to provide fastest communication system that provide unity among diversities and simultaneously operate for the location-specific programmes through messages coated with local language and culture for higher and quick acceptability. This system communicates messages to millions of people at a time.

Activity 2

List the different communication techniques used in a extension programme operating at the national level.

Summary

An understanding of communication is very important. There are different elements in the extension communication system ie The Communicator, Message, Channel, Treatment of message, Audience, Feedback, Effect or Impact. And all communication can be broadly grouped into three types, i.e., Audio communication Visual communication and the combination of Audio and visuals.

Model Question

1. Define communication?
2. What is audio communication?
3. What is visual communication?
4. Differentiate between audio and visual communication
5. What is a poster?

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