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Basics of Food & Nutrition Vol.-I

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Basic Terms

Nutrition, nourishment, or aliment refers to the nurturing of our body to keep it healthy and functioning as it is supposed to do. Nature has provided a variety of foods for man to consume and be healthy. We consume food for maintenance of health, growth and to develop greater resistance against infections. Nutrition as a science was found by Lavoiser (the father of chemistry and also the father of nutrition) towards the end of 18nth century. The science of nutrition is one of the youngest of the sciences.

Basic Terms

Food: Food is the material consisting essentially of protein, carbohydrate, and fat used in the body of an organism to sustain growth, repair, and vital processes and to furnish energy; also: such material together with supplementary substances (as minerals, vitamins, and condiments)

Nutrition: Nutrition is an art and also a science. Nutrition is defined as "the science of foods, the nutrients and other substances, they are in action, interaction and balancing in relation to health and disease."

Health: Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. – World Health Organization

Nursing: Nursing is "the unique function of the nurse is to assist he individual, sick or well, in the performance of those activities contributing to health or its recovery (or to peaceful death) that he would perform unaided if he had the necessary strength, will, or knowledge, and to do this in such a way as to strength, will or knowledge, and to do this is such a way as to help him gain independence as rapidly as possible". - Virgnia Henderson.

CHANGING CONCEPTS OF NUTRITION

• The essential nutrients, proteins, fats and carbohydrates have been recognized in the early century.

• Specific Nutritional disorders were identified such as protein energy mal nutrition, Vitamin A deficiency, Endemic goitre, Nutritional Anaemia, Nutritional blindness etc. and measures were found to prevent and control these disorders.

• The science of Nutrition was extended to other fields like agriculture, animal husbandry, economics and sociology. This led to "green revolution" and "white revolution" and increased food production.

• During recent years the science of nutrition has extended to Nutritional epidemiology.

• The old concept of "the health sector alone is responsible for all nutritional problems" is now realized that a broad multi factorial and integrated approach of sectors is essential to solve today's nutritional problems.

• The main objectives of the National Health Policy are:

- Supplementation of essential nutrients to all the vulnerable groups Maintenance of the health of the individuals.
- Prevention of nutritional deficiency disorders.

Explaining Nutrition

Nutrition is how food affects the health of the body. Food is essential—it provides vital nutrients for survival, and helps the body function and stay healthy. Food is comprised of macronutrients including protein, carbohydrate and fat that not only offer calories to fuel the body and give it energy but play specific roles in maintaining health. Food also supplies micronutrients (vitamins and minerals) and phytochemicals that don't provide calories but serve a variety of critical functions to ensure the body operates optimally.

Macronutrients: Protein, Carbohydrate and Fat

Protein: Found in beef, pork, chicken, game and wild meats, fish and seafood, eggs, soybeans and other legumes included in traditional Central America cuisine, protein provides the body with amino acids. Amino acids are the building blocks of proteins which are needed for growth, development, and repair and maintenance of body tissues. Protein provides structure to muscle and bone, repairs tissues when damaged and helps immune cells fight inflammation and infection.

Carbohydrates: The main role of a carbohydrate is to provide energy and fuel the body the same way gasoline fuels a car. Foods such as corn, chayote, beans, plantains, rice, tortilla, potatoes and other root vegetables such as yucca, bread and fruit deliver sugars or starches that provide carbohydrates for energy.

Energy allows the body to do daily activities as simple as walking and talking and as complex as running and moving heavy objects. Fuel is needed for growth, which makes sufficient fuel especially important for growing children and pregnant women. Even at rest, the body needs calories to perform vital functions such as maintaining body temperature, keeping the heart beating and digesting food.

Fat: Dietary fat, which is found in oils, coconut, nuts, milk, cheese, meat, poultry and fish, provides structure to cells and cushions membranes to help prevent damage. Oils and fats are also essential for absorbing fat-soluble vitamins including vitamin A, a nutrient important for healthy eyes and lungs.

Micronutrients: Vitamins and Minerals

Vitamins and minerals are food components that help support overall health and play important roles in cell metabolism and neurological functions.

Vitamins aid in energy production, wound healing, bone formation, immunity, and eye and skin health.

Minerals help maintain cardiovascular health and provide structure to the skeleton.

Consuming a balanced diet including fruits, vegetables, dairy, protein foods and whole or enriched grains helps ensure the body has plenty of nutrients to use. Providing a few examples of specific micronutrient functions can enhance the effectiveness of nutrition education:

- **Vitamin A** helps the eyes to see
- **Calcium and magnesium** help muscles and blood vessels relax, preventing cramps and high blood pressure
- **Vitamin C** helps wounds heal and the body's ability to fight off germs
- **Iron** helps the blood transport oxygen throughout the body and prevents anemia

The Concept of Nutrients as Building Blocks

Building blocks include protein for growing babies in uterus, for child and adolescent growth, and for repairing damaged skin, blood, and other body parts in adults who aren't growing. Some parts of the body are replaced regularly, like blood and skin, so even adults are building new body parts regularly. Calcium is also a building block for building bones. Iron is a building block for blood. Since blood cells only last a few months, the body constantly needs more iron and protein to make new blood.

Practice Question:

1. Nutrition is defined as _____

   A. Science of foods, the nutrients, their interaction and balance to health and disease

   B. Science of foods, balance to disease

   C. Science of ingestion, digestion, absorption

   D. Science of nutrients

   PhD, entrance, 2018

2. What do you mean by “malnutrition”?

3. Define Health.

4. What do you mean by the term development?

5. What do you mean by optimum nutrition?

6. Describe the role of Food & Nutrition in human development.

Food, Nutrition and Health

Definitions of food

Food is the basic necessity of man. It is a mixture of different nutrients such as carbohydrate, protein, fat, vitamins and minerals. These nutrients are essential for growth, development and maintenance of good health throughout life. They also play a vital role in meeting the special needs of pregnant and lactating women and patients recovering from illness.

Food has been a basic part of our existence. Through the centuries we have acquired a wealth of information about the use of food to ensure growth of children and youth, to maintain good health through life, and to meet special needs of pregnancy and lactation and to use it to recover from illness. When you study food composition you will know the nutritional contribution of foods. You may have been told that certain foods are very important for maintaining good health, while others are harmful. As you study the science of Foods and Nutrition, you will need to examine the ideas you have about foods very carefully and accept or reject these in the light of the knowledge you will acquire. Whatever you learn in this area should be used and applied in your personal life. A large part of our food heritage is scientifically beneficial and needs to be retained; some aspects may need to be modified in the view of the changes in our lifestyle. Food is an important topic of conversations, articles in newspapers and magazines, as also of advertisements. Some of this information may be correct, but a large part of it may not be.

Definitions

Food is that which nourishes the body. Food may also be defined as anything eaten or drunk, which meets the needs for energy, building, regulation and protection of the body. In short, food is the raw material from which our bodies are made. Intake of the right kinds and amounts of food can ensure good nutrition and health, which may be evident in our appearance, efficiency and emotional well-being.

Nutrition has been defined as food at work in the body. Nutrition includes everything that happens to food from the time it is eaten until it is used for various functions in the body.

Nutrients are components of food that are needed by the body in adequate amounts in order to grow, reproduce and lead a normal, healthy life. Nutrients include water, proteins, fats, carbohydrates, minerals and vitamins.

There are several nutrients in each of the groups: proteins, fats, carbohydrates, minerals and vitamins; hence the plural form of these words has been used. Thus there are over 40 essential nutrients supplied by food, which are used to produce literally thousands of substances necessary for life and physical fitness.

The study of the science of nutrition deals with what nutrients we need, how much we need, why we need these and where we can get them. Nutrition is the result of the kinds of foods supplied to the body and how the body uses the food supplied.

Adequate, optimum and good nutrition are expressions used to indicate that the supply of the essential nutrients is correct in amount and proportion. It also implies that the utilization of such nutrients in the body is such that the highest level of physical and mental health is maintained throughout the life-cycle.

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

The Constitution of the World Health Organization, which came into force on April 7, 1948, defined health "as a state of complete physical, mental and social well-being." The writers of the Constitution were clearly aware of the tendency of seeing health as a state dependent on the presence or absence of diseases: so they added to that definition that an individual, if he is to be considered healthy, should not suffer from any disease ("and not merely the absence of disease or infirmity")

In that way, the definition of the World Health Organization simply added a requirement to the previous position that allowed to declare someone healthy if no disease could be found: the step forward that could have been taken in the conceptualization of health as a dimension of existence which can co-exist with the presence of a disease or impairment was thus not taken.

Today, three types of definition of health seem to be possible and are used. The first is that health is the absence of any disease or impairment. The second is that health is a state that allows the individual to adequately cope with all demands of daily life (implying also the absence of disease and impairment). The third definition states that health is a state of balance, an equilibrium that an individual has established within himself and between himself and his social and physical environment.

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1: The process of taking in food and using it for growth, metabolism, and repair. Nutritional stages are ingestion, digestion, absorption, transport, assimilation, and excretion.

2: A nourishing substance, such as nutritional solutions delivered to hospitalized patients via an IV or IG tube.

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Adequate, optimum and good nutrition are expressions used to indicate that the supply of the essential nutrients is correct in amount and proportion. It also implies that the utilization of such nutrients in the body is such that the highest level of physical and mental health is maintained throughout the life-cycle.

The term ‘food’ refers to anything that we eat and which nourishes the body. It includes solids, semi-solids and liquids. Thus, two important features for any item to be called food are:
(i) It should be worth eating, that is, it should be ‘edible’.
(ii) It must nourish the body.

Food, nutrition and health. The term 'food' brings to our mind countless images. We think of items not only that we eat and drink but also how we eat them and the places and people with whom we eat and drink. Food plays an important role in our lives and is closely associated with our existence. It is probably one of the most important needs of our lives. The food that we eat is composed of small units that provide nourishment to the body. These are required in varying amounts in different parts of the body for performing specific functions. This means that good nutrition is essential for good health. However, if our diet provides the important units in incorrect amounts, either very less or in excess of what is required, it results in an imbalance of nutrients in your body. The condition is responsible for various deficiency diseases and slow or no growth of the body.

Practice Questions

1. Explain the terms nutrition, nutrients, nutritional care, optimum nutrition and undernutrition.

2. How is food related to health?

3. Discuss the physiological functions of food.

4. "Food is also used to satisfy social and psychological needs". Explain this statement by giving examples.

5. What do you understand by adequate nutrition?

6. What is nutrient density?

7. How will you use your knowledge of nutrition?

History of Food and Nutrition

1. In pre-agricultural era, entire mankind consumed meat as early man was a hunter. Possibly he ate from plants sources which grew in the wilderness.
   • With the advent of agriculture as an outcome of civilization, man acquired the ability to cultivate what he wanted, as by now he was influenced to some extent by the selection of the food that he wanted to eat.

   • The Bible, Book of Daniel - Daniel was captured by the King of Babylon and had to serve in the King's court. Daniel objected to being fed fine foods and wine, saying he preferred vegetables, pulses and water. The chief steward reluctantly agreed to a trial, comparing Daniel's dietary preference to those of the court of the King of Babylon. For ten days Daniel and his men had their vegetarian diet, while the King's men had theirs. The trial revealed that Daniel and his men were healthier and fitter, so they were allowed to carry on with their diet.

2. • 400 B.C: Hippocrates (Greece, ca460BC - ca370BC) the “Father of Medicine” stated that everybody is same, no matter what they have been eating, or where they have lived. He also said “A wise man should consider that health is the greatest of human blessings”. Hippocrates is also famous for having said "Let thy food be thy medicine and thy medicine be thy food."

   • 400 B.C: Foods were often used as cosmetics in the treatment of wounds. One story describes the treatment of eye diseases, now known to be due to Vitamin A deficiency, by squeezing the juice of liver onto the eye. Vitamin A is stored in large amounts in the liver.

   • 1500’s: Scientist and artist Leonardo Da Vinci compared the process of metabolism of the body to the burning of a candle.

3. • Antoine Lavoisier (France, 1743-1794) - became known as the father of chemistry and also the father of nutrition. He became famous for the statement "Life is a chemical process". He also designed the "calorimeter", a device which measured heat produced by the body from work and consumption from different amounts and types of foods.

   • Christiaan Eijkman (Holland, 1858-1930) - a famous physician and pathologist (doctor who identifies diseases by studying cells and tissues under a microscope). He noticed that some of the people in Java developed Beriberi, a disease which leads to heart problems and paralysis.

   • Dr. James Lind (Scotland, 1716-1794) - a pioneer on hygiene in the Scottish and Royal (British) navies. He stressed the importance of good ventilation, cleanliness of sailor's bodies,

clean bedding, below deck fumigation, fresh water by distilling sea water, and the consumption of citrus fruits to prevent and cure scurvy.

Fat is digested slowly. Stomach rumblings are caused by stomach contractions, and nothing else. Foods are not digested separately and sequentially, but rather all the time and at different rates. Digestion occurs because of digestive juices which are secreted from the stomach. There is no internal "spirit" selecting good purpose foods one way and discarding bad purpose foods to waste. The stomach is not a grinder.

• Dr. William Beaumont (USA, 1785-1853) - a surgeon in the US Army. He became known as the Father of gastric physiology for his research on human digestion. He stated that

FUNCTIONS OF FOOD

Food may be classified according to their functions in the body.

Physiological functions of food:

i. Energy yielding foods:

Foods rich in carbohydrates and fats are called energy yielding foods. They provide energy to sustain the involuntary processes essential for continuance of life, to carry out various professional, household and recreational activities and to convert food ingested into usable nutrients in the body. The energy needed is supplied by the oxidation of foods consumed. Cereals, roots and tubers, dried fruits, oils, butter and ghee are all good sources of energy.The body needs energy to sustain the involuntary processes essential for continuance of life, to carry out professional, household and recreational activities, to convert food ingested into usable nutrients in the body, to grow and to keep warm. The energy needed is supplied by the oxidation of the foods consumed.

ii Body building foods: The foods we eat become a part of us. Thus one of the most important functions of food is **building the body.** 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 eaten from birth to adulthood. The food eaten each day helps to maintain the structure of the adult body, and to **replace** worn out cells of the body.Foods rich in protein are called body building foods. Milk, meat, eggs and fish are rich in proteins of high quality. Pulses and nuts are good sources of protein but the protein is not of high quality. These foods help to maintain life and promote growth. They also supply energy.

i. Protective and Regulatory foods:

Foods rich in protein, minerals and vitamins are known as protective and regulatory foods. They are essential for health and regulate activities such as maintenance of body temperature, muscle contraction, control of water balance, clotting of blood, removal of waste products from the body and maintaining heartbeat. Milk, egg, liver, fruits and vegetables are protective foods.It includes regulation of such varied activities as:

- Beating of the heart
- Maintenance of the body temperature
- Muscle contraction
- Control of water balance
- Clotting of blood
- Removal of waste products from the body

Social functions of food:

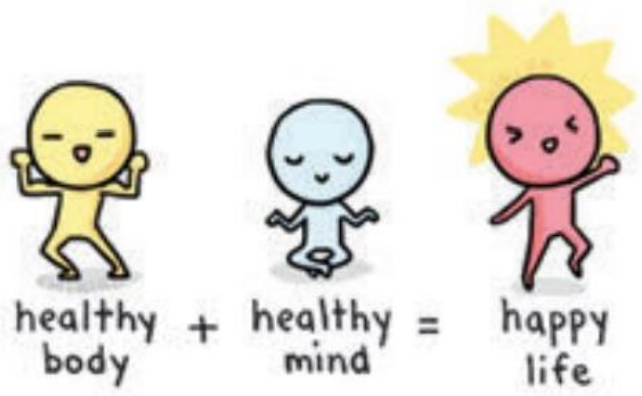
Food has always been the central part of our community, social, cultural and religious life. It has been an expression of love, friendship and happiness at religious, social and family get-togethers.

Food has been used as an expression of love, friendship and social acceptance. It is also used as a symbol of happiness at certain events in life, for example, *pedhas* are distributed to announce success in examinations, or the birth of a baby; *laddus* are associated with the celebration of *Deepavali* and marriages, cakes are associated with Christmas and birthdays and *tilgul* with *sankranti* the festival of friendship. As food is an integral part of our social existence, this function is important in daily life. Refreshments served at get-togethers or meetings create a relaxed atmosphere. The menu for such get-

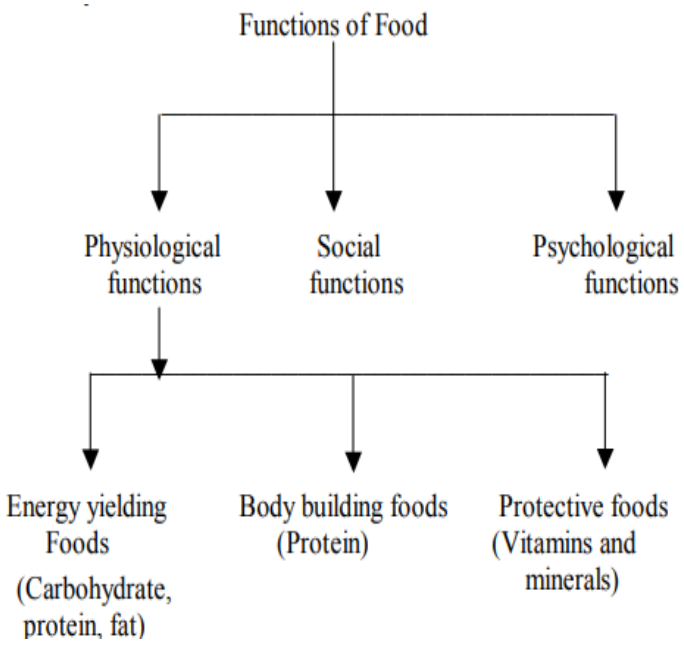
together should bring the people together, rather than divide them. This basic aspect should be considered in planning menus for such occasions

Psychological functions of food:

In addition to satisfying physical and social needs, foods also satisfy certain emotional needs of human beings. These include a sense of security, love and acceptance. For example, preparation of delicious foods for family members is a token of love and affection



Functions of food at a glance:



Practice Questions:

1. **What are the functions of food?**

NUTRIENTS

The substances which are present in the food and consumed in our body for its vital functions are called nutrients. According to the World Health Organization (WHO), these nutrients must come from food, and they are vital for disease prevention, growth, and good health. There are several constituents such as:

Functions of Nutrients

The foods which we use daily include rice, wheat, dal, vegetables, fruits, milk, eggs, fish, meat, sugar, butter, oils, etc. These different foods are made up of a number of chemical components called nutrients. These are classified according to their chemical composition. Each nutrient class has its own function, but the various nutrients must act in unison for effective action. The nutrients found in foods are — carbohydrates, proteins, fats, minerals, vitamins and water. Fibre is also an essential component of our diet. The functions of nutrients are given below.

Carbohydrates: Starch found in cereals and sugar in sugarcane and fruits are examples of carbohydrates in foods. The chief function of carbohydrates is to provide energy needed by our body. Those not used immediately for this purpose are stored as glycogen or converted to fat and stored, to be mobilised for energy supply when needed.

Fats: Oils found in seeds, butter from milk, and lard from meat, are examples of fats found in foods. Fats are concentrated sources of energy, carriers of fat soluble vitamins and a source of essential fatty acids. If excess fats are taken in the diet, these are stored as fat reserves in the body. Energy taken in excess of body needs, is stored as fat in the body.

Proteins: Casein from milk, albumin in egg, globulins in legumes and gluten in wheat, are examples of proteins occurring in foods. The main function of protein is the building of new tissues and maintaining and repair of those already built. Synthesis of regulatory and protective substances such as enzymes, hormones and antibodies is also a function of food proteins. About 10 per cent of the total energy is supplied by proteins in the diet. Protein, when taken in excess of the body's need, is converted to carbohydrates and fats and is stored in the body.

Minerals: The minerals calcium, phosphorus, iron, iodine, sodium, potassium and others are found in various foods in combination with organic and inorganic compounds. Minerals are necessary for body-building, for building of bones, teeth and structural parts of soft tissues. They

also play a role in regulation of processes in the body, e.g., muscle contraction, clotting of blood, nerve stimuli, etc.

Vitamins: Fat-soluble vitamins A, D, E and K and also water-soluble vitamins C and B group are found in foods. These are needed for growth, normal function of the body and normal body processes. Water: We get water in foods we eat and a major part from the water we drink as such and as beverages.

Water: is an essential part of our body structure and it accounts for about 60 per cent of our body weight. Water is essential for the utilization of food material in the body and also for elimination of food waste. It is a regulator of body processes such as maintenance of body temperature.

Practice Questions:

1. **Define the term nutrition.**
2. **What do you mean by optimum nutrition?**
3. **Write in detail about macro and micro nutrients.**

Inter-relationship between food and nutrition

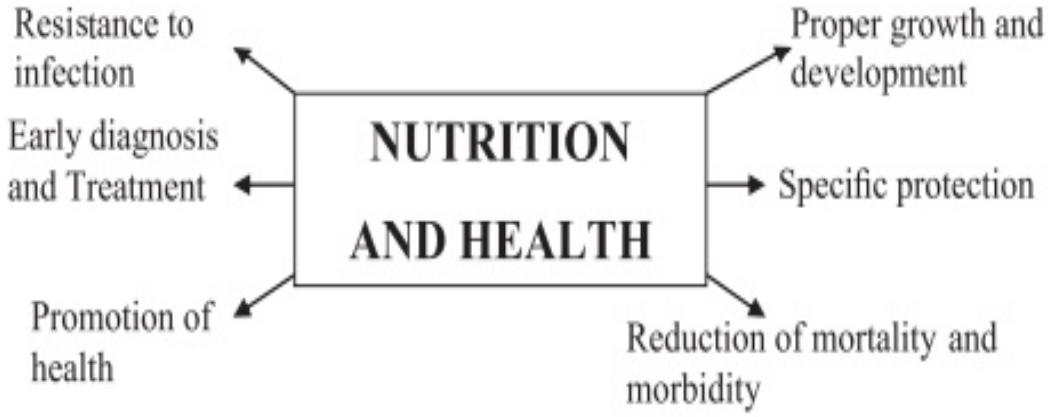
The relationship between nutrition and health

Food is a basic and foundational part of our lives. Food plays a vital role for human existence just as the air we breathe and the water we drink. The food we eat is utilized in the body and assimilated substances are used for growth and maintenance of the tissue. People who eat right foods rich in nutrients enjoy their lives more, live longer, and are at a reduced risk of disease. Good nutrition is critical in preventing not only deficiency diseases, but also chronic diseases. Nutrition is vital to our bodies as water is to plants. An unhealthy diet increases the risk of many diet related diseases.

Nutrition as a promoter of good Health

Health is much more than the absence of disease. It is a positive quality, emphasizing physical, social, intellectual, emotional, and spiritual well being. Optimum nutrition, providing all nutrients in both kind and amount, is the cornerstone of good health. The foods we eat, and the nutrients they provide, are the most important continuing factors influencing our growth, development, functional abilities, and health. A proper diet helps in preventing and recovery from certain illnesses.

Patients nutritional status is closely related to the overall level of health. Nutrition is considered as one of the important factors affecting the human health. Nurses should give more attention to the nutrition of their patients. A modification in the diet can cure certain diseases. Numerous factors and conditions have the potential to impair patients' nutritional status.



The inter-relationship between food, nutrition and health

The connections between our foods, the nutrients they provide and our health are complex, but have far-reaching consequences for individuals and society. As changing diets and dietary habits place an increasing burden on healthcare systems, it is crucial that we develop new products, interventions and refined guidelines which will improve health through diet. Achieving this will depend upon a complete understanding of the biological processes which connect the foods we eat to our long-term health.

The importance of nutrition for health and society

Eating a well-balanced diet, with adequate nutrients and appropriate calories, is a fundamental requirement for continued health. An appropriate diet contributes to healthy development, healthy ageing and greater resilience against disease. Similarly, a poor or inappropriate diet places people at greater risk of infection and a range of chronic illnesses – including cancer, type 2 diabetes and cardiovascular disease.

Despite the clear connections between nutrition and health, more than half of the UK population are obese or overweight, consumption of fruit and vegetables is falling and the calorie density of the average shopping basket is increasing. Meanwhile, around three million people in the UK are malnourished, including 25% of those in hospital and 42% in long-term care.

This represents a serious economic and social challenge. High body mass index is one of the leading risk factors for chronic disease in the UK, accounting for 9% (£5.1Bn per year) of NHS spend. The cost to the wider economy is vast at around £16Bn per year, rising to £50Bn by 2050 if action is not taken. As costs escalate, the need for new products and interventions to promote health through our diets is becoming ever more urgent.

Research to improve health through nutrition

There is enormous potential to develop new or improved products, health interventions and more accurate dietary guidelines which will improve health through nutrition. However, fully realising this potential will require a complete understanding of exactly how our food influences our health.

Although it is clear that nutrition and health are intimately connected, precisely how the biological connections work is often unclear. Large population analyses can identify a correlation between a particular food or diet and a particular health outcome, but without knowing the mechanism which links the two we cannot be sure that the effect is real – and we cannot use this knowledge to refine dietary advice or develop new products. Current uncertainty

about the health consequences of different types of sugars and fat demonstrates that our understanding of what constitutes a "healthy" diet is far from complete.

New scientific techniques are providing opportunities to develop a much more complete understanding of how we choose our foods, exactly what effects different foods and nutrients have on our bodies, how they interact and what the long term consequences for our health might be. By really getting to grips with the biological mechanisms at work, we can develop confident and accurate dietary advice which is tailored to different population grops, and nutritional interventions which will improve the health of at risk-individuals. Fully understanding the quantities and combinations of nutrients and diets which will best improve health means that new products and food processing techniques can be developed to make our diets healthier.

Nutrition and food science have each enhanced the development of an abundant, nutritious, safe food supply. A healthy diet should contain all of the required nutrients and sufficient calories to balance energy expenditure and provide for growth and maintenance throughout the life cycle. Importantly, dietary factors are associated with 5 of the 10 leading causes of death, including coronary heart disease, certain types of cancer, stroke, noninsulin dependent diabetes mellitus and atherosclerosis. National health care expenditures for 1990 totaled $666 billion of which 30% are related to inappropriate diet.

Identification of external factors that contribute to premature death would aid preventive efforts, improve the quality of life, and reduce health care costs. Even though genetic predisposition increases susceptible people's risk for many of these chronic diseases, these conditions may be diminished or prevented by improvements in the American diet.

Each stage of the life cycle has specific nutrient needs. Throughout infancy, childhood and adolescence nutrients are required to meet the growth processes as well as cognitive function. During pregnancy nutrients are required for both mother and developing infant needs. Adult nutrition focuses on tissue maintenance, nutrient and energy needs, and disease prevention. As the population of elderly increase in number and greater age, nutritional needs must be met to minimize certain disease states and assure the quality of life.

Nutrition associated health risks have been identified for coronary heart disease, cancer and diabetes mellitus. A recommendation for each includes a decrease in dietary fat, awareness of caloric intake and enhancement of nutrient density including an increase in fruit and vegetables. These recommendations also impact obesity and diminish the compounding of other disease states affected by excessive body weight. Calcium intake at early ages affects development of bone density and manifestation of osteoporosis. Current gaps in knowledge are also identified that could improve health. Numerous nutrients are being examined for their regulation of specific

gene expressions and in the processes of transcription and translation. To offer food products with greater nutrient density or improved functional health ingredients, modification of existing foods is needed to assure an improved diet.

Policies to improve health require integration of nutrition needs with economic growth and development, agriculture and food production, processing, marketing, health care and education, and includes changing life styles and food choices. Increased research support is required to achieve national health goals with emphasis on nutrition and food sciences. Education methods must be improved to better inform consumers, to encourage food producers and manufactures to produce healthier foods, to assure training of future professionals and to provide legislators with the basis to make informed decisions. Recommendations to CFERR are identified. Improved quality and availability of nutritious foods will result in a healthier, more productive population. A decrease in the occurrence and duration of chronic disease should diminish the cost of health care and allow these resources to further benefit the nation. International concerns about undernutrition include 780 million people who are malnourished, lacking sufficient food to meet their basic nutritional needs for protein and energy, and 2 billion people who subsist on diets lacking essential nutrients needed for growth, development and physiological maintenance. National concerns about under nutrition exist based on incomplete data identified by indices of hunger and characterized by an increased demand for food assistance for women, children and the elderly. Major health problems in the US impacted by diet and nutrition include coronary heart disease, atherosclerosis, some types of cancer, non-insulin dependent diabetes mellitus, hypertension.

Guidelines for Good Health

To prevent disease, the Dietary Guidelines for Americans recommend a healthy eating pattern. All food and drink choices matter. Healthy eating includes eating lots of fruits, vegetables, whole grains, and low-fat or non-fat dairy products or fortified soy beverages, and lean proteins. The guidelines also emphasize:

- Balancing the food you eat with your activity to reach and stay at a healthy weight.
- Drinking alcohol in moderation, if at all.
- Limiting foods high in salt, saturated fat , trans fat , and added sugar.

These guidelines from the United States Department of Agriculture (USDA) and the United States Department of Health and Human Services (HHS) are updated every 5 years to promote health and reduce risk for major chronic diseases.
Key recommendations for the general public include the following:

- Balancing calories
- Eat and drink the right amount for you. My Plate is the U.S. government's food guide. It can help you make your own well-balanced eating plan.
- Avoid oversized portions.
- Prevent and/or reduce overweight and obesity through healthy eating and physical activity.
- Control your total calorie intake to manage your weight. For people who are overweight or obese, this means eating fewer calories from foods and drinks.
- Increase your physical activity, and reduce the time you are not moving.
- Eat enough calories, but not too many, during each stage of life—childhood, adolescence, adulthood, pregnancy and breastfeeding, and older age.
  Foods to increase
- Make half your plate fruits and vegetables.
- Switch to fat-free or low-fat (1%) milk.
- Eat more vegetables and fruits.
- Eat different vegetables, especially dark-green, red, and orange vegetables and beans and peas. Eat more whole fruits instead of drinking juice.
- Eat at least half of all grains as whole grains, replacing refined grains with whole grains.
- Eat more fat-free or low-fat milk and milk products, such as yogurt, cheese, or fortified soy beverages.
- Eat different protein foods, such as seafood, lean meat and poultry, eggs, beans and peas, soy products, and unsalted nuts and seeds.
- Replace some meat and poultry with seafood.

- Replace protein foods that are higher in solid fats with choices that are lower in solid fats and calories and/or are sources of oils.
- Use oils to replace solid fats, like butter, where possible.
- Choose foods that provide more potassium, dietary fibre, calcium, and vitamin D. These foods include vegetables, fruits, whole grains, and milk and milk products.

For women who may become pregnant:

- Eat foods that supply the type of iron that is more easily absorbed by the body. Examples are fish, poultry, and meat. And eat foods that are other sources of iron, such as lentils, beans, cereals, and grains.
- Eat foods that help the body absorb iron, such as foods rich in vitamin C.
- Get enough folic acid (from fortified foods and/or supplements).

For women who are pregnant or breastfeeding:

- Eat 8 to 12 ounces of seafood a week. Vary the types of seafood you eat.
- Avoid fish high in mercury by not eating tilefish from the Gulf of Mexico, shark, swordfish, king mackerel, marlin, orange roughy, and bigeye tuna. Other types of fish, such as white albacore tuna, should only be eaten once a week (no more than 4 ounces).
- If you are pregnant, take a prenatal supplement as recommended by your doctor.

For people 50 years and older:

- Eat foods fortified with vitamin B12 , such as fortified cereals.
  - Foods to reduce
- Compare sodium in foods like soup, bread, and frozen meals—and choose the foods with lower numbers.

- Drink water instead of sugary drinks.

- Reduce daily sodium intake to less than 2,300 milligrams (mg).
- Reduce calories from saturated fats to less than 10% of total calories by replacing them with unsaturated fats: monounsaturated and polyunsaturated.
- Limit trans fats , which are in partially hydrogenated oils and other solid fats.
- Reduce the intake of calories from added sugar to less than 10% of total calories.
- Limit foods that contain refined grains, especially refined grain foods that contain solid fats, added sugars, and sodium.
- If you drink alcohol , drink it in moderation—up to one drink a day for women and two drinks a day for men.

Healthy eating patterns

- Choose a type of eating that gives you enough nutrition but not too many calories. Examples include the DASH diet, Mediterranean-style eating, and vegetarian.
- Remember to count the calories in what you drink.
- To reduce the risk of food borne illness, follow food safety recommendations when preparing and eating foods.

To stay at a healthy weight and prevent disease, Canada's Food Guide recommends eating lots of fruits, vegetables, whole grains, and low-fat or non-fat dairy products. It's important to balance the food you eat with your activity to maintain your weight, drink alcohol in moderation, if at all, and limit foods high in salt, saturated fat, trans fat, cholesterol, and added sugar.

Activity is also an important part of the picture.
Get enough nutrients within your calorie needs

- Eat and drink a variety of foods that are high in nutrients. Choose from within and among all the basic food groups (vegetables and fruit, grain products, milk and alternatives, and meat and alternatives) while choosing foods that limit your intake of saturated and trans fats, cholesterol, added sugars, salt, and alcohol.
- Eat only the calories you need to maintain your weight by following a balanced eating pattern, such as Canada's Food Guide or the Dietary Approaches to Stop Hypertension (DASH) Eating Plan. The number of calories you need each day depends on your age, on whether you are male or female, and on your activity level.

Weight management

- To stay at a healthy weight, balance calories from foods and drinks with the amount of calories you burn.
- To prevent gradual weight gain over time, make small decreases in calories from foods and drinks, and increase activity.

Physical activity

- To promote health, psychological well-being, and a healthy body weight, get regular physical activity and limit sedentary activities.
- Try to get 2½ hours a week of moderate to vigorous exercise. It's fine to be active in blocks of 10 minutes or more throughout your day and week.

Food groups to encourage

- Eat enough vegetables and fruit while staying within your calorie needs. Most adults need 7 to 10 Food Guide servings of vegetables and fruit each day.
- Choose a variety of vegetables and fruit each day. Select from all five vegetable subgroups (dark green, orange, legumes, starchy vegetables, and others) several times each week.
- Eat 6 to 8 Food Guide servings of **grain products** per day. Whole-grain and enriched products are best.
- Have 2 to 3 servings of low-fat **milk or alternatives** every day.

Meat and alternatives

- Choose lean meat and alternatives made with little or no added fat or salt.
- Choose meat alternatives such as beans, lentils, and tofu often.
- Eat at least two Food Guide servings of fish such as char, herring, mackerel, salmon, sardines, and trout each week.

Oils and fats

- Eat about 2 to 3 tablespoons (30 to 45 mL) of unsaturated fat each day. Don't forget to count fats used in cooking or added as a spread or condiment.
- Choose non-hydrogenated, soft margarines. They are low in saturated and trans fats.
- Limit saturated and trans fats found in butter, hard margarine, coconut oil, and shortening.

Beverages

- Choose water most of the time.
- Skim and low-fat milk, fortified soy beverages, and 100% fruit juices are healthy choices when you include them in your Food Guide servings per day.
- Limit sugary drinks and alcohol. These beverage are usually high in calories and have little nutritional value.

Sodium

- For good health, less is best. Most people shouldn't eat more than 1,500 to 2,300 milligrams (mg) of sodium a day.
- Choose and prepare foods with little salt.

Food safety

To avoid food borne illness:

- Clean your hands, surfaces that come into contact with food, and fruits and vegetables. Do not wash or rinse raw meat and poultry. Washing or rinsing meat and poultry makes it more likely that bacteria may spread from the meat or poultry to kitchen utensils, counter tops, and ready-to-eat foods.
- Do not prepare fruit and vegetables on the same cutting board that you use for raw meat.
- Keep raw, cooked, and ready-to-eat foods separate while you are shopping, preparing, and storing food.
- Cook food to a safe temperature, to kill microorganisms.
- Chill (refrigerate) perishable foods promptly and defrost foods properly. Never thaw frozen meat, poultry, fish, and shellfish at room temperature. Thaw in the refrigerator or microwave. If you thaw food in the refrigerator, be sure juices do not drip onto other food. Place these foods on the lowest shelf, never above ready-to-eat foods. Cook food immediately after thawing.
- Avoid raw (unpasteurized) milk or any products made from unpasteurized milk, raw or partially cooked eggs or foods containing raw eggs, raw or undercooked meat or poultry, unpasteurized juices, and raw sprouts.

Recommended Dietary Allowance: The RDA

Recommended Dietary Allowance: The RDA, the estimated amount of a nutrient (or calories) per day considered necessary for the maintenance of good health by the Food and Nutrition Board of the National Research Council/ National Academy of Sciences. The RDA is updated periodically to reflect new knowledge. It is popularly called the Recommended Daily Allowance.

Each day we need a number of nutrients to enable our body to carry out its activities efficiently. To determine what nutrients we need each day and how much, to keep us in good health, a lot of research has been done. The results of these studies have been used to work out the nutritional requirements of Indian people. After adding a factor of safety, the Recommended Dietary Allowances (RDAs) for Indians have been set-up. An advisory committee of the Indian Council of Medical Research (ICMR) is responsible for the setting up; review and revision of these RDAs. Let us understand why and how these RDAs were setup. Why were the Recommendations Set-up? In a number of studies the harmful effects of nutrient deficiencies on the human body and its functions were observed. These were so revealing that the League of Nations thought it necessary to set-up a committee to review available experimental data and recommend daily dietary allowances for each of the nutrients that were known at that time.

During the Second World War (1939–45), the military recruiting officers had to reject a number of young men, who wanted to enlist, because they were underweight. Naturally the governments in various countries were anxious to rectify this situation. Another related problem was the need to estimate the amount of food to be sent to various army units. This led to the setting up of Recommended Dietary Allowances (RDA) in number of countries between, 1940 and 1944.

India was one of the first countries to set-up Recommended Dietary Allowances in 1944. The desirable dietary intakes of energy, protein, calcium, iron, vitamin A, thiamin, ascorbic acid and vitamin D were suggested in the RDAs set-up in 1944. On the basis of newer research findings, these recommendations have been revised four times and fifth revision is expected in the near future. In 1958, the recommendations for energy were revised. In 1968 and again in 1978 allowances of all nutrients except energy were revised. In 1968, additional recommendations were made for four B vitamins, namely riboflavin, nicotinic acid, folic acid and vitamin B12. In 1978, the requirements for a one more B vitamin, pyridoxine (B_6) were included. In making these recommendations, the ICMR committee was guided by the dietary

allowances suggested by Expert group of FAO and WHO and also by the results of studies carried out in India on nutrient requirements. In the 1978 revision, the unit of energy joule, adopted by International Union of Sciences and IUNS (International Union of Nutritional Sciences) has also been included.

The 1978 revision was entitled Recommended Dietary Intake (RDI), to emphasize the intake of nutrients. The word 'recommended' is used to emphasize that these values need to be revised periodically on the basis of newer research data. The last revision was made in 1988. The important features of the 1988 revision are:

- The revision of body weight standards for Indians
- complete revision of energy requirements
- Definition of quantum and type of fat intakes
- Modification of RDAs of vitamin A and D
- Inclusion of several nutrients and dietary factors not considered earlier, such as fibre, electrolytes (sodium, potassium), magnesium, phosphorus, vitamin E and K, and
- For the first time a provisional recommendation on trace elements was made.

No substantial changes were made in the RDAs for protein, B-complex vitamins, iron and calcium.

A number of general principles are used to arrive at nutritional requirements of an individual or the RDA for a population. These are:

• Dietary intakes: This approach has been used to arrive at the energy needs of children. Energy intakes of normally growing children are used as the basis for RDA.

• Growth: To define requirements in early infancy, the breast milk intake of healthy infants, or the requirement of any particular nutrient for satisfactory growth has been utilized.

• Nutrient balance: As for a number of other nutrients, to arrive at the protein requirements, the minimum intake of nutrient for equilibrium (intake = output) in adults, and nutrient retention consistent with satisfactory growth in children, have been used widely.

• Obligatory loss of nutrients: is the minimal loss of the nutrient or its metabolic product through normal routes of elimination (viz., urine, feces and sweat). It is determined on a diet devoid of or very low in the nutrient. For example, a protein-free diet in case of proteins. This information is used to determine the amount of nutrient to be consumed daily through the diet to replace the

obligatory loss. In infants and children, growth requirements are added to the above maintenance requirements.

• Factorial method: In this method, the needs for various functions are assessed separately and added up to assess the total daily requirements. This is the method used to arrive at total energy requirements.

• Nutrient turnover: Data collected by studying turnover of certain nutrients in healthy persons, using isotopically labelled nutrients has been used to determine their requirements. Vitamin A, vitamin C, iron and vitamin B12 requirement have been measured in this manner.

• Depletion and repletion studies: These have been used to determine the requirements of water-soluble vitamins. The vitamin status is measured by recording the levels of vitamin or its coenzyme in serum or tissue (e.g., erythrocytes, leucocytes). The requirements of ascorbic acid (vitamin C), thiamin, riboflavin, niacin and pyridoxine have been established using this approach. The subjects are first fed a diet very low in the nutrient being studied until the biochemical parameters reach a low level. After those feeding graded doses of the nutrient is studied. The level at which response increases rapidly indicates the level of requirement of the nutrient.

How is RDA Derived?

RDA is derived on the basis of —

(a) Knowledge of the requirement of nutrients for each physiological group.

(b) It is based on nutrient requirement determined by one or more of the approaches listed above.

(c) The RDA is computed after considering nutrient bioavailability from the diet.

(d) It is presumed that the requirements of all other nutrients are met adequately. RDA is applicable only under this condition.

(e) RDA is applicable only to a healthy population living under normal conditions.

(f) The RDA is computed after considering individual variability.

(g) In practice a level of intake corresponding to the Mean +2 standard deviations, which covers the requirements of 97.5 per cent of the population, is chosen as RDA.

This safe level approach is not used in the case of energy, as excess or inadequate intake is undesirable, only the average requirement of energy is defined as RDA.

For certain nutrients, such as protein, iron, calcium, beta-carotene and vitamin B12, bioavailability from the diet is a critical factor. For proteins, the essential amino acid mix in the diet, which decides the quality of protein, is important. In the normal Indian diet, protein is derived from several sources, such as cereals, dals and legumes, milk and milk products and a variety of vegetables. Occasionally fish, eggs and other flesh foods are included according to one's taste and resources. Hence the quality tends to be satisfactory, due to mutual supplementation of individual proteins. In case of iron, while the total intake may be satisfactory, absorption from foods is a critical factor. Absorption is affected by the relative presence of both absorption promoters, (acid medium, The Recommended Dietary Allowances for Nutrients 29 e.g., ascorbic and other acids) and absorption inhibitors (phytates, tannins, oxalate, etc.). In the diets habitually consumed in India, which are high in inhibitors and low in promoters, iron absorption is only 2 to 5 per cent. In the case of vitamin A, niacin and others, provitamins present in foods, are converted to the respective vitamins in the body. The RDA for vitamin A and niacin are defined after considering these factors.

The nutrient needs vary with age and weight of an individual. Body weights and heights of children reflect their state of health and growth rate, while adult weight and height represent what can be attained by an individual with normal growth. Anthropometric measurements of Indian children up to 14 years from well-to-do groups have shown that they grow at rates similar to those of children in the developed countries. Desirable heights and weights of both children and adults (not the prevailing ones) are considered in recommending nutrient intakes as the RDA is intended for a healthy and well nourished population. In the 1978 revision of RDA, the body weights of well-to-do Indian children and adolescents were used to compute their nutritional needs. But for adults, a reference body weight of 55 kg for men and 45 kg for women have been used since 1944. The weights of adults do not match those of well nourished adolescents. Secondly with current heights of 163 cm and 151 cm of Indian adult men and women, the corresponding expected body weights would be higher than the reference weights of 55 and 45 kg used so far. Hence the ICMR committee recommended that the reference weights for Indian man and woman used for RDA be increased to 60 kg and 50 kg respectively. Reference Person Reference body weights (kg) of Indians of different age groups are given in Table.

Table1: Reference Body Weights of Indians of Different Age Groups1

Stage of Life	Age (year)	Female (Weight in Kg)	Male (Weight in Kg)
Infants	Birth-0.5	5.4	5.4
	0.5-1.0	8.6	8.6
Children	1-3	11.8	12.6
	4-6	18.7	19.2
	7-9	26.7	27.0
	10-12	37.9	35.5
Adolescents	13-15	46.7	47.9
	16-18	49.9	57.3
Adults	20-50	50.0	60.0

RAD for Indians, ICMR1990

Our nutrient needs vary with the size and age of our body. Therefore an individual of given age and size has been designated as a reference. The reference man and reference woman in the Indian RDA have been defined as–

Reference Woman Age 20–39 years and weight 50 kg Reference Man Age 20–39 years and weight 60 kg Reference woman is healthy. She may be engaged in 8 hours of moderately active work, in light industry or in general household work. Apart from 8 hours in bed, she spends 4 to 6 hours in light leisure activities and 2 hours in active household work, recreation or walking. Reference man is healthy, free from disease and fit for work. He is employed in moderately

active occupation for 8 hours, spends 8 hours in bed, 4 to 6 hours in leisure activities, sitting and moving about and 2 hours in active recreation, walking or household duties.

Reference Person

Reference body weights (kg) of Indians of different age groups are given in Table 3.1.
Our nutrient needs vary with the size and age of our body. Therefore an individual of given age and size has been designated as a reference. The reference man and reference woman in the Indian RDA have been defined as–

Reference Woman Age 20–39 years and weight 50 kg
Reference Man Age 20–39 years and weight 60 kg

Reference woman is healthy. She may be engaged in 8 hours of moderately active work, in light industry or in general household work. Apart from 8 hours in bed, she spends 4 to 6 hours in light leisure activities and 2 hours in active household work, recreation or walking.

Reference man is healthy, free from disease and fit for work. He is employed in moderately active occupation for 8 hours, spends 8 hours in bed, 4 to 6 hours in leisure activities, sitting and moving about and 2 hours in active recreation, walking or household duties.

Recommended Dietary Allowances for Indians

The recommended dietary allowances for nutrients for an adult reference woman and man are given in Table 3.2. The table contains RDAs for:

Energy and Protein
Minerals—Calcium and Iron
Water-Soluble Vitamins—C and six of the B-group
Fat-Soluble Vitamins—A, E and K

Besides these, there are other nutrients, which are required by our body for normal function. It is reassuring to know that on an average, a diet, which provides a sufficient amount of the above nutrients, will meet the need for these other nutrients also. Please remember that a liberal margin of safety is provided in the recommended dietary intakes to cover differences in needs of healthy persons. Only two nutrients are needed in large amounts—energy and proteins.

The RDA for energy is about 40 kcal per kg for a sedentary man and 37 kcal per kg body weight for a sedentary woman. Moderately active man's RDA is 48 kcal per kg and woman's 40 kcal per kg body weight. The RDA of a man engaged in heavy activity is 63 kcal and a woman

58 kcal per kg body weight. Thus knowing your body weight and the type of work you do, you can estimate your energy needs.

The RDA for protein is based on 1 g per kg body weight. It does not vary with activity.
The RDA for minerals is much less, calcium is 400 mg per day for both man and woman, while iron is only 28 to 30 milligrams per day. As you know, a milligrame is one thousandth part of a gram. An adult woman needs more iron than a man, to make up for the periodic loss of iron in menstruation.

The five water-soluble vitamins, namely thiamin, riboflavin, niacin, pyridoxine and ascorbic acid, are needed in very small amounts and their RDAs are expressed in milligrammes. The remaining two B vitamins, folic acid and vitamin B12 are needed in very minute amounts and hence their RDA are expressed in microgram (mcg). A microgram is one-millionth part of a gramme. The amount of B-Vitamins needed is related to the total energy needs and therefore varies with the RDA for energy. So you notice that an adult man requires slightly higher amounts of these vitamins than an adult woman.

Practice Question:

1. What are recommended dietary allowances?
2. What are the guiding principles used to derive RDAs?
3. What is a reference man?
4. Why are recommended allowances set-up?
5. How can recommended allowances be used?

BMR

Energy needs of the body at rest are called basal metabolism. It can also be aptly be called the cost of living. A number of processes go on to ensure the continuance of life without any conscious effort. These include the beating of heart, the circulation of the blood, breathing, the regulation of body temperature, glandular activities, etc. These processes are known as the basal metabolic processes. Basal energy expenditure (BEE) or resting energy expenditure (REE) is the energy used by the body at rest. The energy used is measured as the basal metabolic rate (BMR) or resting metabolic rate (RMR). The terms are used interchangeably. The basal energy needs account for, about 60 per cent of the total energy requirement for most people. The highly active tissues (liver, brain, heart, kidney and gastrointestinal tract), which form less than 5 per cent of the body weight, use about 60 to 70 per cent of the basal metabolic energy. The rest of the tissues, which account for most of the body weight, need much less energy to maintain their basal function.

Measurement of Basal Metabolic Rate (BMR)

The BMR is normally measured early in the morning, after the subject awakens and is in a post absorptive state (10 to 12 hours after the last meal). In clinical cases, the normal exchange of oxygen and carbon dioxide in regular breathing used to be measured with a calorimeter to determine the BMR. The amount of energy used to be calculated from the oxygen used. This test is used only in research now. A number of new efficient tests are used in clinical practice currently. These tests measure the activity of the thyroid gland. There are several ways of measuring the activity of thyroid gland, which produces the hormone thyroxine. The blood levels of thyroxine, the hormone which controls the BMR, can be measured. Iodine is used in the synthesis of the thyroid hormone. Hence serum levels of protein-bound iodine (PBI) and radioactive iodine uptake tests are also used to determine BMR. Basal energy needs can be estimated using a general formula 1 kcal/kg body weight per hour for men and 0.9 kcal/kg body weight per hour for women. The classic Harris-Benedict equations are also used to estimate the basal or resting energy needs of adult hospitalized patients.

Female REE = $655 + (9.56 \times W) + (1.85 \times H) - (4.68 \times A)$

Male REE = $66.5 + (13.8 \times W) + (5.0 \times H) - (6.76 \times A)$

Where W = weight in Kilogram's (kg), H = height in centimeters (cm) an A = age in years.

Factors affecting the BMR:

Body size and composition, age and growth, sleep, state of nutrition, climate and certain ailments affect the basal requirement.

Body Size and Composition:

The heat loss from the body is related to body size; energy needed to maintain lean muscle mass at rest is related to body composition. Original work on energy measurement was based on body surface area. Recent studies have demonstrated that the metabolic rate is primarily dependent on lean body mass (LBM). LBM can be accurately determined by underwater weighing or total count of body potassium. Athletes, who have developed muscles due to exercise, have 5 per cent increase in BMR as compared to non-athletes.

Women have 5 to 10 per cent lower metabolic rate as compared to men of same weight and height, because they have more fat and less muscle in their body than men do. If BMR is calculated on the basis of lean body mass, there is no difference between men and women.

Age:

There is a decrease in metabolic energy expenditure of 2 to 3 per cent per decade after early adulthood, due to the shift in the proportion of muscle to fat in the body. The basal metabolic rate gradually decreases after reaching adulthood; the decrease is about 30 per cent between 30 and 75 years of age.

Growth and Repair:

The metabolic rate is highest in the stages of rapid growth, namely the first and second years of life. There is a lesser peak in metabolic rate in the years of puberty and adolescence in both sexes. Infants may store 12 to 15 per cent of their energy intake in the form of new tissue. The metabolic rate increases in pregnancy due to growth of the fetus and related increased growth activity.

Sleep:

The metabolic rate falls by about 10 per cent while sleeping as compared to the resting rate when awake. This is due to relaxation of muscles and reduced activity of the nervous system during sleep.

State of Health:

The metabolism is decreased due to malnutrition; the decrease in basal metabolism is proportional to the degree of malnutrition. It is mainly due to decrease in the amount of active tissue and a decrease in the metabolic rate.

When one suffers from fever, the increase in temperature of the body increases metabolism. The increase is about 7 per cent per each degree Fahrenheit above normal (98.6°F or 37°C).

Hormonal Control:

A hormone known as thyroxine, controls the speed of our involuntary activity. The thyroid gland, situated in our neck, synthesizes this hormone. If too much thyroxine is released, the rate of energy expenditure is increased; if too little is released, the energy expenditure is reduced. The basal metabolism may decrease by 30 to 40 per cent when the synthesis of thyroxine is inadequate. On the other hand, the BMR may almost double due to a hyperactive thyroid gland. These conditions need prompt medical treatment. Luckily for most of us such abnormalities are not very common. Most of us have a normally functioning thyroid gland and hence a normal basal metabolic rate.

Climate:

Extreme environmental temperatures affect the metabolic energy needs. The metabolic rate of persons in the tropics is 5 to 20 per cent higher than those in temperate regions. In hot climate (if the temperature is greater than 86°F), the metabolic rate increases by about 50 per cent due to increased activity of sweat glands. The increase in metabolic rate due to cold depends on the body fat insulation and use of warm clothes

Practice Questions:

2. **What is BMR?**
3. **Write the factors affecting BMR.**
4. **How you calculate BMR of a person?**

Food Composition

Most food contain more than one nutrient. The nutrient contents of foods have been determined by analysing these in the laboratory. The composition of over 650 Indian foods has been determined. Of these, the nutritive value of about 160 foods is presented in the Appendix.

The food composition tables give the concentration of nutrients in 100 g of the edible portion (E.P.) of the food. Therefore it is important to know how much of the food purchased is edible. In some foods, such as milk, butter, sugar, the edible portion is 100 per cent. In fruits and vegetables, it varies from 65 per cent in bananas to 98 per cent in tomatoes.

The values for nutrients given in food composition tables are averages of the results obtained by analysing a large number of samples of each food. Therefore the figures in such tables give a fairly good idea of the composition of each 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.

It is interesting to note that there are inherent similarities in the composition of foods in each group. In Table 1.1, the composition of various foods has been presented to illustrate this point. For example, the protein content of cereals varies from 7 to 12, and that of *dals* and legumes from 17 to 25 per cent. This information has important applications in practical usage of tables. It is possible to predict the overall nutrient content of combinations used, if we know the amounts of individual foods used. If the composition of a particular food is not found in the tables, you can roughly predict its nutrient contribution, by knowing the group to which it belongs.

You may observe from Table that cereals and *dals* do not contain vitamins A and C. Therefore you will realise how important it is to include vegetables and fruits, which are rich source of these two vitamins, in our daily menu of cereals and *dal.* Most of the vegetablres and fruits, as you will observe from Table are low in calories. Oils, fats and sugars are mainly sources of calories. Thus you get an idea of the contribution of various foods by studying Table.
Most of the analytical work on Indian foods was carried out in various laboratories under the auspices of Indian Council of Medical Research. A compilation of results is published as the *Nutritive Value of Indian Foods,* by the Indian Council of Medical Research (ICMR). A number of new varieties of food with high contents of certain nutrients, have been developed at research centres under the
auspices of the Indian Council of Agricultural Research. You get a number of these foods in the market and use these in your dietary. The nutritive value of these new varieties of foods need to be included in the book on Nutritive Value of Indian Foods. There are two International Food

Value tables published by the Food & Agriculture Organisation (FAO) (please refer to these books, which are listed in Further Reading at the end of this book).

It is good to remember that the nutritive value of natural foods does not vary a great deal for a particular variety of the same food from one country to another. But there is a great variation in the composition of prepared foods such as bread, biscuits, cakes, etc., due to variation in recipes and the basic ingredients used from one region to another**.**

Table 1.1: Food Composition at a Glance[1]
(Approx. Group Values per 100 g. E.P.)

Foods	**Moisture**	**Calories**	**Proteins (g)**	**Vitamin A (mcg)**	**Vitamin C (mg)**	**Vitamin B-Comp Minerals**
Cereals-rice, wheat, Bajra, Jowar	10	340	7to 12	-	-	**some**
Dals, Legumes	10	340	17-25	-	-	Some
Milk	85	70	3	48	-	Some
Eggs	75	170	13	960	-	Some
Meat, Fish, poultry	75	100-190	18	some	-	some
Leafy & Orange-Yellow Vegetables & Fruits	90	20	2	1,800	30	some
Fruits-Vit. C Rich	85	50	1	some	50	some
Other Vegetables	90	30	2	some	some	some
Other fruits	85	50	1	some	some	some
Roots &	60-85	50-100	1	some	some	some

Tubers						
Oils and Fats	0	900	-	750	-	-
Sugar, Jaggery	0	400	-	-	-	-

Food Exchange Lists

In 1950, the American Diabetes Association and the American Dietetic Association collaboratively developed a system of food lists to help diabetic patients to select foods in their diets. Similar food lists were prepared in other countries to help diabetics to choose their foods. In India also food lists were prepared based on the foods available and our meal pattern. Since India is a large country there are three major agencies that have evolved their food exchange lists. These agencies are dietetic departments of major regional hospitals, the Home Science colleges, which train dietetic students, and the dietetics department of the National Institute of Nutrition.

Each of the list includes a group of foods, which supply about the same calories in the portion indicated. Each food choice within a list is called an exchange. It represents an amount of food that has about the same macronutrient value as other foods in the same group.

The exchange lists are very useful tools in diet planning in hospitals and in personal diet management in the home.

Nutrient Density

It refers to the quantity of one or more nutrients supplied by a food in reference to its calorie content. For example, if one compares the protein content of isocaloric portions of *dal,* bread and milk, one can see that *dal* has the highest nutrient density for protein, milk next and bread the least.

Thus nutrient density is an important aspect to be considered in selection of foods, especially in diets of children, pregnant women, nursing mothers and in therapeutic diets for patients.

How will you be a responsible nutrition student?

First, use what you learn in nutrition and benefit yourself. It will help you to look better, feel better and work effectively. By practising what you learn, you will set a good example for others. Secondly take care of nutrition of your family. Help the children in the family to develop good

food habits, the adults to make good food choices in eating and seniors to meet their changed needs.

Thirdly, as a professional you will be able to help people, who seek your advice, to make appropriate changes to improve their food choices to improve their well-being.

Lastly, as a member of the community, you can influence the choice of foods served in social events.

Practice Questions:

1. Explain the concept of exchange lists.
2. What is nutrient density?
3. How will you use your knowledge of nutrition?

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Appendix I

Weights and Measures

Equivalents

1 katori (large) – 175 milliliters
1 tea cup – 145-150 milliliter
1 Ladle – 40 milliliter
1 cup – 16 tablespoons or 237 milliliters
1 tablespoon – 3 teaspoons or 15 milliliters
1 teaspoon – 5 milliliters
20 drops – 1 milliliter

Abbreviations

tsp – teaspoon
T. or tbsp – tablespoon
c – cup
g – gramme/gram
ml – milliliter

Appendix II

SUMMARY OF RDA FOR INDIANS – 2020

Age Group	Category of work	Body Wt	Protein	CHO	Calcium	Magnesium	Iron	Zinc	Iodine	Thiamine	Riboflavin	Niacin	Vit B6	Folate	Vit B12	Vit C	Vit A	Vit D
		(kg)	(g/d)	(g/d)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/day)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/d)	(µg/d)	(mg/d)	(µg/d)	(IU/d)
Men	Sedentary	65	54.0	130	1000	385	19	17	150	1.4	2.0	14	1.9	300	2.5	80	1000	600
	Moderate									1.8	2.5	18	2.4					
	Heavy									2.3	3.2	23	3.1					
Women	Sedentary	55	45.7	130	1000	325	29	13.2	150	1.4	1.9	11	1.9	220	2.5	65	840	600
	Moderate									1.7	2.4	14	1.9					
	Heavy									2.2	3.1	18	2.4					
	Pregnant woman	55 + 10	+9.5 (2nd trimester) +22.0 (3rd trimester)	175	1000	385	40	14.5	250	2.0	2.7	+2.5	2.3	570	+0.25	+15	900	600
	Lactation 0-6m		+16.9	200	1200	325	23	14	280	2.1	3.0	+5	+0.26	330	+1.0	+50	950	600
	7-12m		+13.2	200						2.1	2.9	+5	+0.17	330				
Infants	0-6 m*	5.8	8.1	55	300	30	-	-	100	0.2	0.4	2	0.1	25	1.2	20	350	400
	6-12m	8.5	10.5	95	300	75	3	2.5	130	0.4	0.6	5	0.6	85	1.2	27	350	400
Children	1-3y	11.7	11.3	130	500	135	8	3.0	90	0.7	0.9	7	0.9	110	1.2	27	390	600
	4-6y	18.3	15.9	130	550	155	11	4.5	120	0.9	1.3	9	1.2	135	1.2	32	510	
	7-9 y	25.3	23.3	130	650	215	15	5.9	120	1.1	1.6	11	1.5	170	2.5	43	630	
Boys	10-12y	34.9	31.8	130	850	270	16	8.5	150	1.5	2.1	15	2.0	220	2.5	54	770	600
Girls	10-12y	36.4	32.8	130	850	255	28	8.5	150	1.4	1.9	14	1.9	225	2.5	52	790	600
Boys	13-15y	50.5	44.9	130	1000	355	22	14.3	150	1.9	2.7	19	2.6	285	2.5	72	930	600
Girls	13-15y	49.6	43.2	130	1000	325	30	12.8	150	1.6	2.2	16	2.2	245	2.5	66	890	600
Boys	16-18y	64.4	55.4	130	1050	405	26	17.6	150	2.2	3.1	22	3.0	340	2.5	82	1000	600
Girls	16-18y	55.7	46.2	130	1050	335	32	14.2	150	1.7	2.3	17	2.3	270	2.5	68	860	600

* AI

ICMA, 2020

Appendix III

Food Exchange Lists

1. Food Exchange List from the Diet Manual of AIIMS, New Delhi-110016.

1. What is an Exchange List? (AIIMS)

It is a group of foods of the same caloric value and similar protein, fat and carbohydrate content that can be substituted for one another in a meal plan. Foods have been divided into six groups of exchanges. Any one of the exchange groups cannot by itself supply all the needed nutrients for a well balanced diet. It requires all six of them put together as a team to supply the normal nutritional needs for good health. The six major exchanges are:

1. Milk exchange

2. Vegetable exchange
3. Fruit exchange
4. Cereals and pulses exchange
5. Meat exchange
6. Fat exchange

Milk Exchange

Glass (250) milk exchange or substitute contains-

Food	Quantity	
Toned milk	1 glass 250ml	
Skimmed milk	1-1/2 glass	Carbohydrate 10-12 gm
Butter milk	4 glass	Protein 8gm
Curds	250 gm(1 cup)	Fat 8 gm
Fresh paneer	50 gm	Calories 140-150
Icecream	100 gm(1 smll cup)	

Vegetable Exchange

Food Root Vegetable	Quantity	Group A
Arbi	40gm	Carbohydrate 3gm Proteins 2gm Calories 20gm
Potato	40gm	
Zimikand	40gm	
Kachalu	40gm	
Sweet Potato	40gm	
Tapioca	25gm	

Leafy Vegetables		Group B
Spinach	100gm	Carbohydrate 6gm Proteins 2gm Calories 32gm
Bathua	100gm	
Cabbage	100gm	
Sarson	100gm	
Mathi	100gm	

Seasonal Vegetables		Group C
Lauki	100gm	Carbohydrate 6-8gm Protein 2gm Fats nil Calories 32-40gm
Tinda	100gm	
Brinjal	100gm	
Cauliflower	100gm	
Knolkhol	100gm	

Fruit Exchange

Foods	Approx. measures	
Apple	100gm 1 medium	Carbohydrate 10 gm Protein 1 gm Fats nil Calories 40 Kcal
Orange	100gm 1 medium	
Banana	100gm 1 small or big	
Guava	100gm 1 small	
Mausambi	100gm 1 small	
Big grapes	100gm 20 no.	
Papaya	100gm 1 slice	
Musk melon	250gm ¼ of medium size	
Cherries	100gm 2 no.	
Plums	100gm 4small	
Pears	150gm 4 small	
Peaches	100gm 2 medium	
Water melon	200 gm 1 cup	

Cereal Exchange

Foods	**Approx. measures**	
Wheat flour	1-1/2 medium chapati	Carbohydrate 17-18 gm Protein 2 gm Fats Nil Calories 80-85
Bread	1-1/2 slice	
Bajra	Small chapati	
Barley	½ cup cooked	
Maize	1 small roati	
Cornflakes	½ cup cooked	
Oat meal	½ cup cooked	
Rice	½ cup cooked	
Rice (puffed)	1 cup	
Sanvai	½ cup cooked	
Dalia (wheat)	½ cup cooked	
Macronai	½ cup cooked	
Biscuits	5-10 salt and 3-5 sweet	
Soyabean flour	2 table-spoon	

Legumes and Pulses

Foods	Approx.measures	
Bengal	½ cup cooked	CHO 15 gm Proteins 5 gm Calories 80 Kcal Fats :nil
Bengal gram (roasted)	½ cup cooked	
Beasn	2 table spoon	
Black/Green/White gram/Rajmah/Lobia/Soyabean	½ cup cooked	

Meat Exchange

Foods	**Approx. measures**	
Mutton	4 pieces or ribs	CHO 1–2 gm Fats 2–4 gm Proteins 5 gm Calories 65 Kcal
Chicken	1 leg or breast	
Fish	2 pieces	
Egg Hen	2 medium	
Paneer	40 gm	
Ham	25 gm (1 slice)	

Fat Exchange

Foods	Approx. measures	
Butter	15 gm	CHO nil Fats 11 gm Proteins nil Calories 100
Ghee	11 gm	
Oil	11 gm	
Vanaspati	11 gm	
Almonds	15 gm	
Cashew nuts	30 gm	
Peanuts	20 gm	