FOOD SCIENCE AND TECHNOLOGY

Lecture04

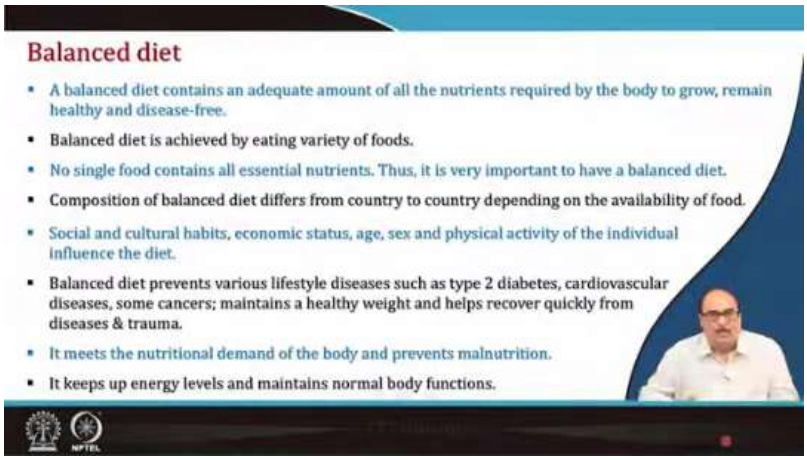
Lecture 4: Balanced Diets

Hello everyone, Namaste.

In this fourth lecture of the first week, we will discuss balanced diets.

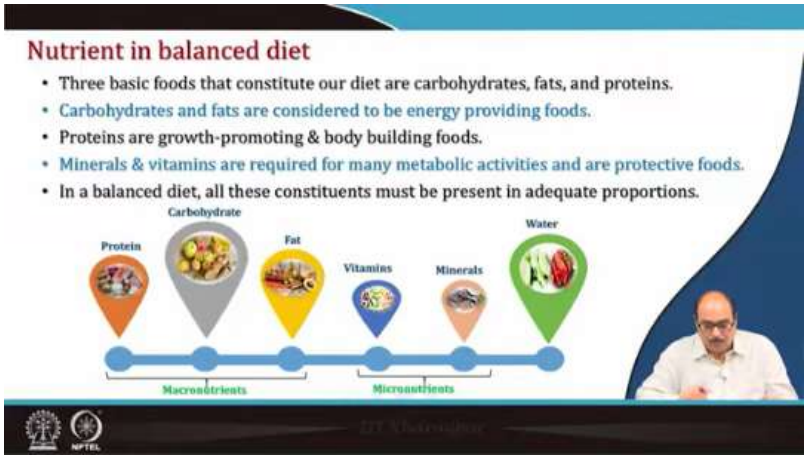
We will talk about what balanced diets are, their definition, and the ICMR guidelines for balanced diets. We will also briefly touch upon malnutrition. How to select ingredients for a balanced diet, the formulation of a balanced diet, and finally, we will also discuss the access and affordability of a balanced diet to various people.

So, earlier, we also discussed what food does and protects against vitamins, minerals, and other nutritional deficiencies. It provides energy, repairs injured tissues, helps our body grow, contributes to good general health, and also helps build up immunity. So, obviously, the food we consume should provide all the nutrients needed by the body in the proper amount. It should produce energy for working muscles and recovery after exercise. So, accordingly, we need to eat a proper balanced diet.

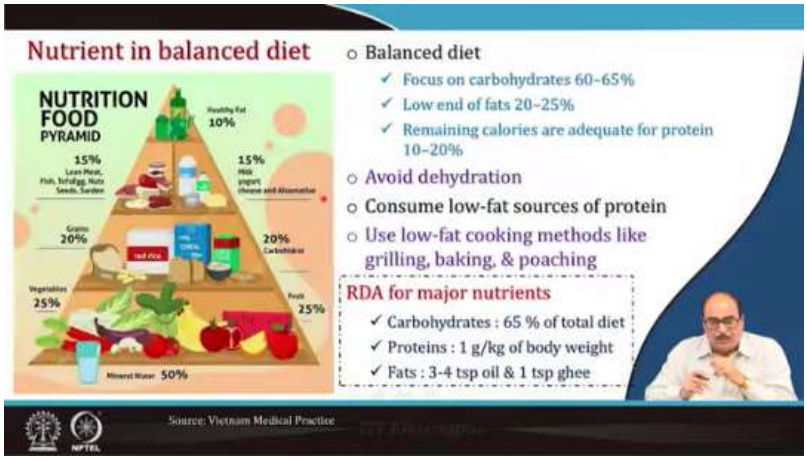


A balanced diet means a diet that contains an adequate amount of all nutrients, that is, a diet that contains all the required nutrients by the body in the proper amount. That is the nutrients required by the body to grow, to maintain health, and to live a disease-free life. So, a balanced diet is achieved by eating a variety of foods. In the earlier class, we discussed what types of food they contain and what types of nutrients. So, no single food contains all essential nutrients, which is why it is very important to have a mix of nutrients. Like, you take cereals, pulses, dry fruits, fruits, vegetables, leafy vegetables, and all types of foods you also take. So, the composition of a balanced diet differs from country to country depending on the availability of food. Social and cultural habits, economic status, age, sex,

and physical activity of the individual also influence the diet. A balanced diet prevents various lifestyle diseases such as type 2 diabetes, cardiovascular diseases, and some forms of cancer. It maintains a healthy weight and helps in quick recovery from diseases and trauma. A balanced diet meets the nutritional demands of the body and prevents malnutrition. It keeps up the energy levels and maintains normal body functions.

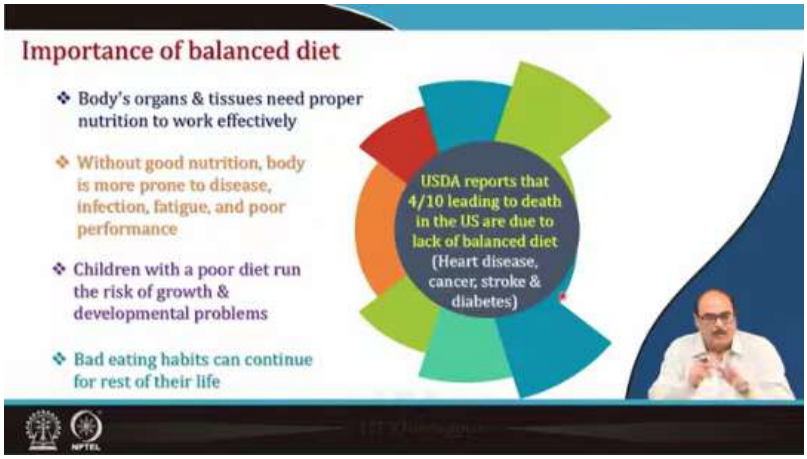


So, the nutrients in a balanced diet, all these nutrients, are the basic foods that constitute our diet. It contains, as we discussed earlier, carbohydrates, proteins, and fats. So, in a balanced diet, all these nutrients, carbohydrates, proteins, fats, vitamins, minerals, bio-actives, essential nutrients, etc. should be present in adequate proportions.



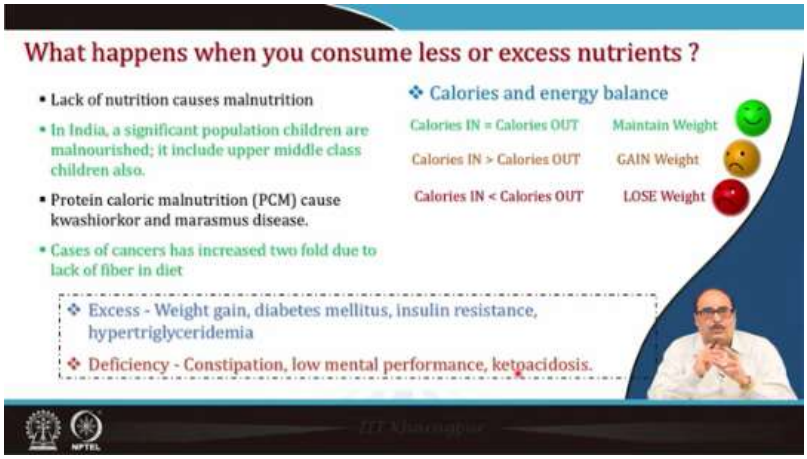
So, obviously, it is, in fact, shown here in the nutrition and food pyramid, and the percentage is how much water, fruits, vegetables, carbohydrates, yoghurt, lean meat, etc., are healthy fats. What should be the proportion of these components in our diet that is provided. It is taken from the Vietnam medical practice, and in general, the balanced diet here focus should be on carbohydrates that are 60 to 65 per cent, the low end of fats is 20

to 25 per cent and the remaining calories are adequate from protein like 10 to 12 per cent. It should contain a good amount of moisture to avoid dehydration processes and consume low-fat sources of protein. Use low-fat cooking methods like grilling, baking, poaching, etc. So, the RDA for the major nutrients includes about 65% of the total diet should be carbohydrates, protein should be consumed 1 gram per kg body weight and fats 3 to 4 teaspoonfuls of oil or 1 teaspoonful of ghee one should consume.



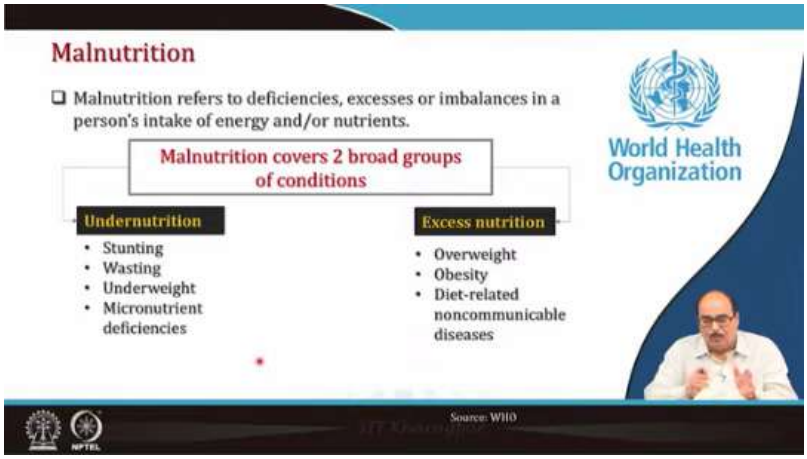
So, obviously, the importance of a balanced diet in the USDA as per the USDA reports, 4 out of every 10 leading to death in the US are due to a lack of a balanced diet that mainly causes heart diseases, cancers, stroke, diabetes, etcetera are there. So, the body's organs and tissues need proper nutrition to work effectively. Without good nutrition, the body is more prone to diseases, infections, fatigue, and poor performance. Children with a poor diet run the risk of growth and developmental problems. And bad eating habits can continue for the rest of their lives. So, in children, it is very important that their eating habits should be developed. They should be provided with a balanced diet, and good eating habits should be developed.

The ICMR Indian Council of Medical Research Guidelines for a balanced diet have provided very specific guidelines, and depending upon age, sex, physiological conditions, and physical activity, all these influence the amount of food required to meet daily nutrient needs. So, they give that ICMR, NIN National Institute of Nutrition, Hyderabad, have recommended the consumption of cereals like rice, jowar, wheat, pulses, vegetables, fruits, roots and tubers, milk and milk products, fats and oils, sugar, and groundnuts or additional intake of meat, fish, and oils, and they have given the proportion, etcetera, like, for example, cereals and millets should be about 250 grams. vegetables, roots, and tubers, 300 grams, and even green leafy vegetables, 150 grams, and even nuts, etc. Dry fruits, nuts, and dry fruits are around 40 grams, dairy is about 400 ml, so these are for the animals, etc., they have also given about 250 grams to 350, 300 grams of marine fish, lean fish, meat, etc., all those things. So, they have detailed recommendations If you are only interested, you can visit the ICMR or NIN website; you will get this detailed.

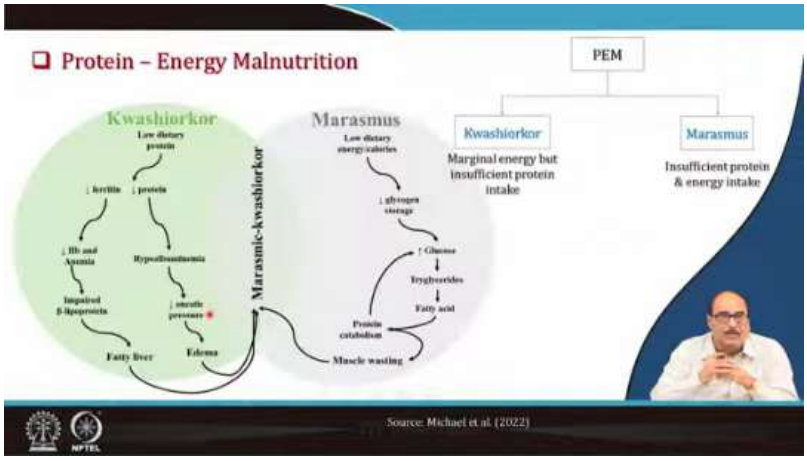


So, what happens when you consume fewer or excess nutrients? Lack of nutrition causes malnutrition, and in India, a significant population of children, even elderly persons, are also malnourished. It includes upper-middle-class children as well. So, protein-calorie malnutrition, as we discussed earlier, causes kwashiorkor and marasmus, and cases of cancer have increased due to lack of fibre in the diet. So, calorie energy balance is very important. So, for example, whatever calorie you are taking in the body, the calorie should be utilized or out. So, that is to maintain proper health. So, calorie in is equal to calorie out. So, if the calorie intake is more than the calorie output, then this will result in weight gain, and you will become healthy and bulky. If calorie intake is less than the calorie output, a person loses weight and will become lean and thin. So, an excess of calories will result in weight gain, diabetes mellitus, insulin resistance, hypertriglyceridemia, etcetera, and a

deficiency or less consumption of nutrients, etcetera, calorie, it may result in constipation, low mental performance, ketoacid formation, etcetera.

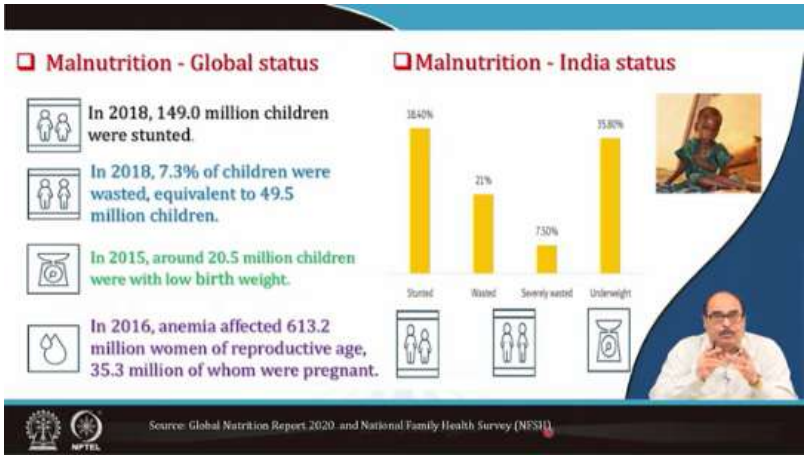


So, malnutrition, which refers to deficiency diseases or imbalances in a person's intake of energy and other nutrients, there are two groups, broad conditions: undernutrition and excess nutrition. Like undernutrition we discussed, such as kwashiorkor and marasmus, like stunting, wasting, being underweight, or other micronutrient deficiencies, there will be undernutrition. Whereas excess nutrition, if you take more than the required amount of nutrients, may also result in overweight, obesity, or diet-related non-communicable diseases, etc. So, this undernutrition is mainly because overcoming this nutrition inequity is the major challenge, which is why not everyone gets the proper amount of nutrition.

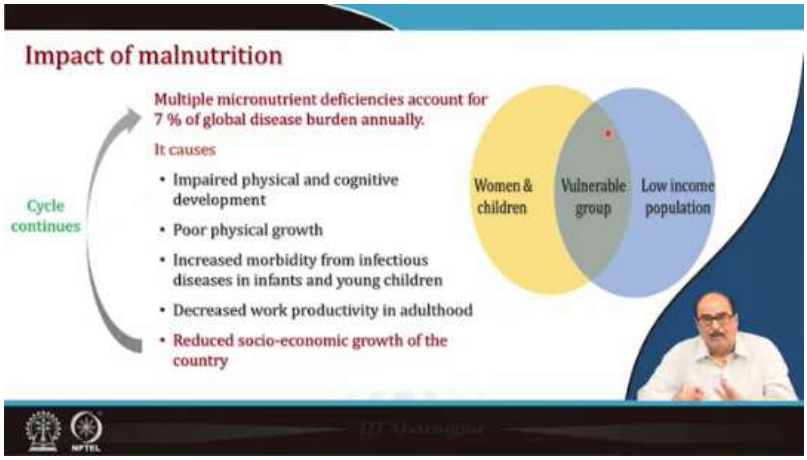


So, here you see that is the protein-energy malnutrition. As I told you earlier, when you are taking protein, it goes hyper. Albuminemia, osteoporosis, pressure, edema, etc., and then, if the protein, the ferritin, is Hb and anaemia, it is impaired fatty liver. So, it may be edema or fatty liver. So, if it is not proper, you are not taking or getting proper protein. Similarly,

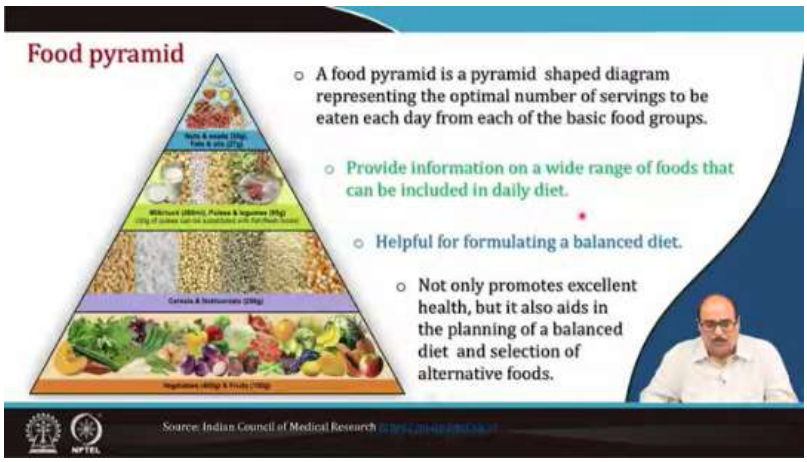
this is kwashiorkor, marasmus is low dietary energy intake. So, glycogen storage, glucose, triglycerides, and fatty acids. That is the protein catabolism, and there will be muscle wasting. So, either muscle wasting or edema or fatty liver, these conditions like kwashiorkor and marasmus. So, kwashiorkor is a marginal energy but inefficient protein intake. It will result in kwashiorkor.



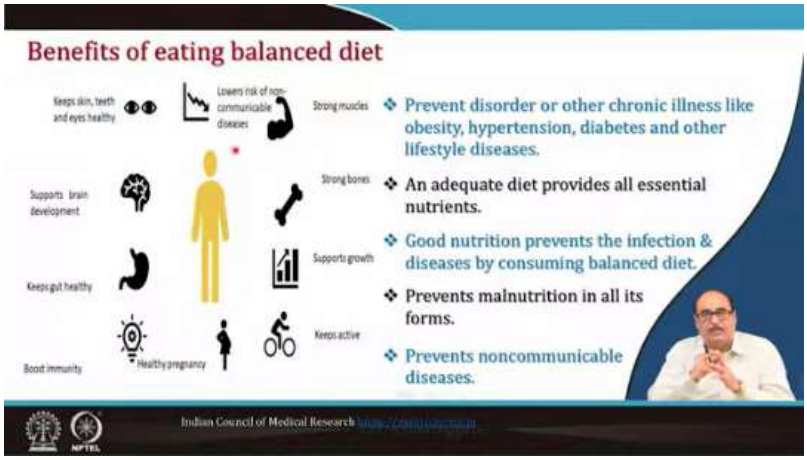
If there is insufficient protein and energy intake, it will result in marasmus and the global status in 2018, as per the NFHS survey 2018, about 149 million children were stunted. In 2018, 17.3 percent of children were wasted, equivalent to 49.5 million children. In 2015, around 20.5 million children had low birth weight. And in 2016, anemia affected 613.2 million women of reproductive age, 30.3 million of whom were pregnant. This is the global status. In the Indian status, if you see, Again, like the National Family Health Survey latest, Global Nutrition Report 20 was there, and National Family Health Survey and FSS, there is about 38.4% of the children, are stunted, 21% wasted, severely wasted 7.5%, and underweight are about again 35.8% children.



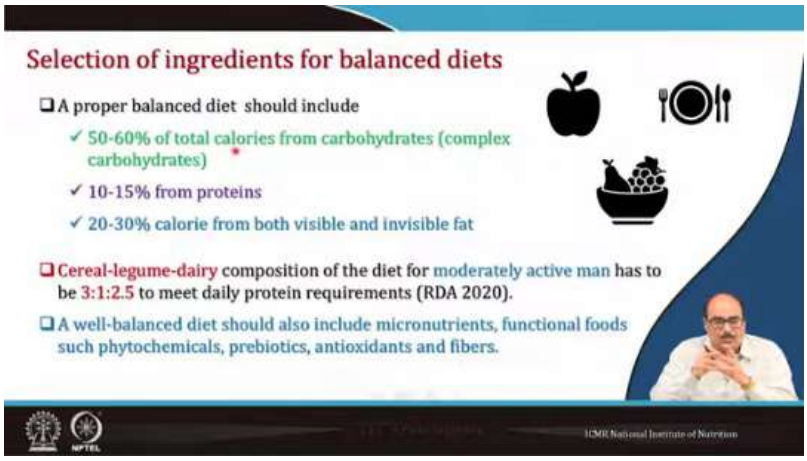
So, the obvious impact of malnutrition is that multiple micronutrient deficiencies account for even 7% of the global disease burden annually and it causes impaired physical and cognitive development, poor physical growth, increased morbidity from infectious diseases in infants and young children and decreased work productivity in adulthood and obviously the reduced socio-economic growth of the country at this cycle continues And the most vulnerable groups are the women, children, and low-income population. They are the vulnerable groups for this impact.



So, the food pyramid, again you see that the food pyramid is recommended by the Indian Council on Physical Research. Again, ICMR NIN with the pyramid-shaped diagram representing the optimal number of servings to be eaten each day from each of the basic food groups. It provides information on a wide range of foods that can be included in the diet. It is helpful for formulating a balanced diet and not only does it promote excellent health, but it also aids in the planning of a balanced diet. And the selection of alternative foods. So, you can say vegetables and fruits. There are about 400 grams of vegetables, 100 grams of fruits, 250 grams of cereals, and nutrient cereals, which are about 85 grams. pulses and legumes, milk curd 300 grams, 300 ml, nuts and seeds 35 and fats and oils 27 grams, that is for a healthy adult, etc. This is required, and it may vary depending upon the adult, male, female, age, sex, type of work, etc., so one should act accordingly. The important thing is that one should take a variety of mixed fruits from various categories.

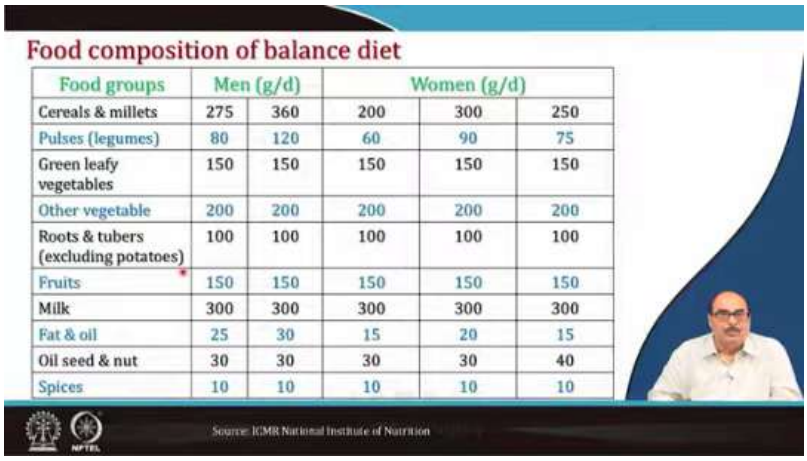


So obviously, the benefits of eating a balanced diet, it prevents disorders or other chronic illnesses like obesity, hypertension, diabetes, and other lifestyle diseases. An adequate diet provides all essential nutrients, it is good nutrition that prevents infection and disease by consuming a balanced diet. It prevents malnutrition in all its forms and prevents non-communicable diseases. If you eat a properly balanced diet, you will have strong muscles and strong bones; it will support your growth, keep you active, and already feel healthy. During pregnancy, it keeps the guts healthy and supports brain development. If you eat good food, always required, you will be intelligent also. It will ensure the brain develops properly. Healthy skin, teeth, eyes, and all those things are good if you are eating a balanced diet.



So, the selection of ingredients for a balanced diet, like a properly balanced diet, should include 50 to 60 per cent of total calories from carbohydrates like carbohydrates, around 10 to 15 per cent from protein, and 20 to 30 per cent from calories, both from visible and invisible fats. So, cereal, legumes, dairy. The composition of the diet for a moderately active man has to be in the proportion of 3 to 1 to 2.5, like 3 cereal, 1 legume, and 2.5 dairy,

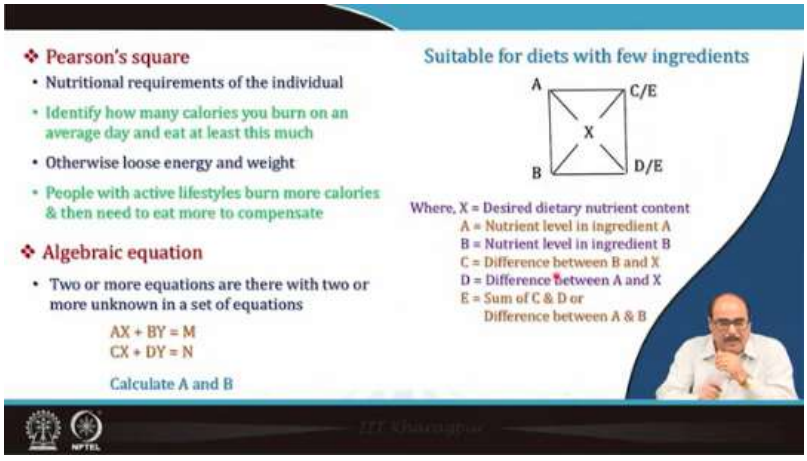
to meet daily protein requirements, and it gives, as per the RDA recommended, dietary allowances of 2020 by the ICMR diet. So, a well-balanced diet should also include micronutrients, functional foods like nutraceuticals, phytochemicals, prebiotics, antioxidants, and, more importantly, fibres, that is, dietary fibres.



Food groups	Men (g/d)		Women (g/d)		
Cereals & millets	275	360	200	300	250
Pulses (legumes)	80	120	60	90	75
Green leafy vegetables	150	150	150	150	150
Other vegetable	200	200	200	200	200
Roots & tubers (excluding potatoes)	100	100	100	100	100
Fruits	150	150	150	150	150
Milk	300	300	300	300	300
Fat & oil	25	30	15	20	15
Oil seed & nut	30	30	30	30	40
Spices	10	10	10	10	10

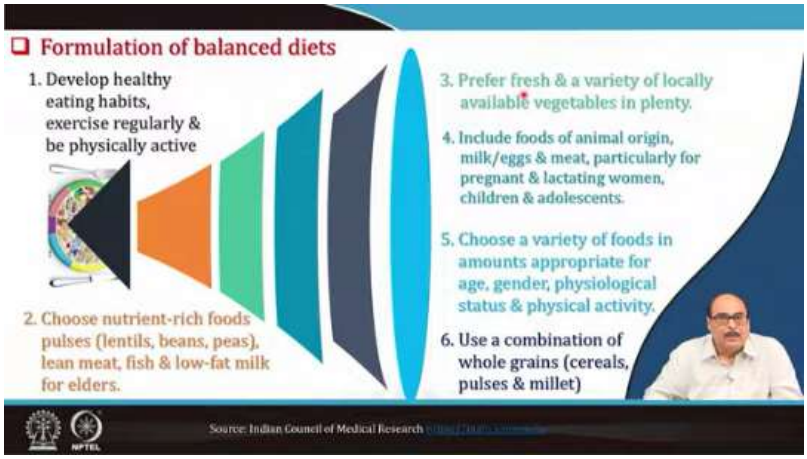
So, here, the food composition of a balanced diet is provided for men as well as for women in three groups, that is, for women, normal healthy women during pregnancy, during lactation, moderately working persons and hard-working persons doing more physical work, etcetera. So, cereals and millet normally should be about 275 to 360 grams depending upon the physical activity status, etc. Pulses 80 to 120 grams, roots and tubers 100 grams, fruits 150 grams per day, milk 300 ml per day, fats and oils 25 to 30 grams, and so on. Similarly, for women also, that is the amount of cereals less and, but other vegetables almost the same, and these fruits, milk, fats and oils, oilseeds are almost similar in women and men, only this in the pulses, cereals. There may be differences depending on the balanced diet composition. So, for the formulation of a balanced diet, obviously to produce a balanced diet, number one, you have to take on an average basis 50% fruits and vegetables. If you are taking that, it is a good healthy diet. 25% fiber-rich carbohydrates and 25% protein-rich foods.

But to produce a diet that is nutritionally balanced and economically least cost, the product must meet one's understanding that daily nutrient requirements according to gender, age, and weight. The type of work the person is engaged in, knowledge about the ingredient that is availability and price, nutritional value, anti-nutrients present in it, or inclusion levels, etc. and also understanding the end product, that is, in which form you are consuming these products right, that is palatability, pellet consumption quality, effect on meat, milk, quality, threshold level of antinutrients, etc. So, all these must be considered while formulating a balanced diet, and there are different methods for manual formulation; one can go for Pearson's square method or even algebraic equations one can use. Like in Pearson's square method, if the nutritional requirement of the individual can be calculated, particularly this method is used if there are two major ingredients and if you want to find a particular nutrient from two major ingredients, one can use Pearson's square.

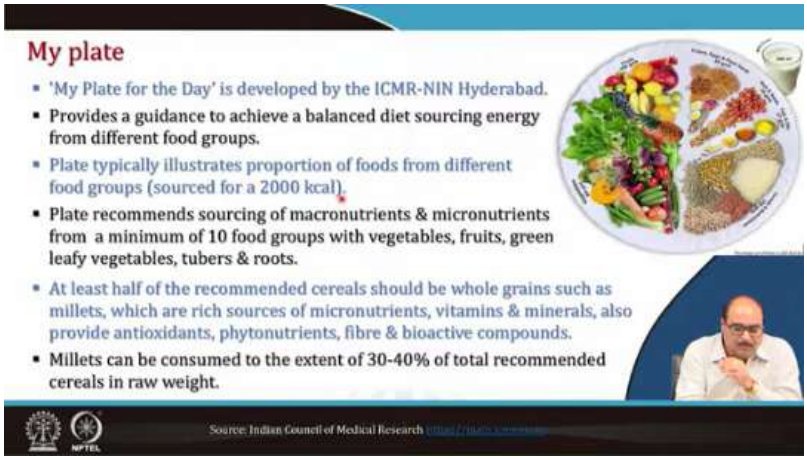


This is a very common method, even in the dairy industries, for the standardization of fat and other things. So, identify how many calories you burn on an average day and eat at least this much; otherwise, lose energy and weight. So, people with an active lifestyle burn

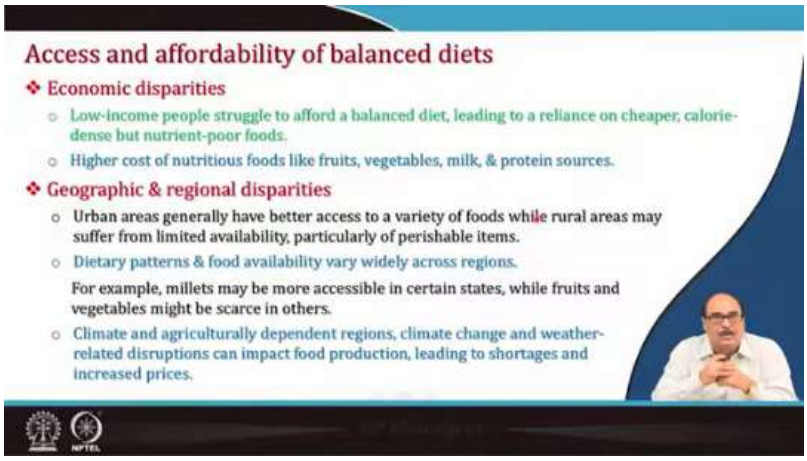
more calories and need to eat more to compensate. So, in the Pearson square, you see that this is the squaring method and A and B are written on the top corners, two corners, that A is the nutrient level in ingredient A, and B is the nutrient level in ingredient B. Then C and D, they are the differences between B and X and A and X, that is, what is the amount you want and what is the difference. E is the sum of C and D, which are the differences between A and B. So, from this, you can find out that if you are taking two commodities, what should be the quantity of these commodities that should be consumed? Similarly, there are various algebraic equations, that is, two or more equations for two or more unknowns in a set of parameters like $AX + BY = M$ or $CX + DY = N$, and one can calculate the amount of A and B using these objects. So, these are simple calculations. Apart from this, there are many if you are dealing with complex scenarios, having more than two or three or even a large number of ingredients, and you want to optimize. So, there are linear programming methods or other complex algebraic equations, etcetera, one can use. So, in fact, we will devote a full week to this food formulation calculation that is, the linear programming and such other methods which are used. So that can be used herein in algebraic equations as well.



So, for the formulation of a balanced diet, the first thing is to develop healthy eating habits, exercise regularly, and be physically active. Then choose nutrient-rich foods. Pulses like lentils, beans, peas, lean meat, fish, and low-fat milk for elders. Then prefer fresh and a variety of locally available vegetables in plenty. Include foods of animal origin, milk, eggs, and meat, particularly for pregnant and lactating women. Children and adolescents should choose a variety of foods in amounts appropriate for age, gender, physiological status, and physical activity, and use a combination of whole grains, cereals, pulses, and millet. So, all these materials, a variety of materials, should be included and should be found in there.



Then my plate, actually my plate for the day, is developed again by the ICMR NIN, Hyderabad National Institute of Nutrition. It provides guidance to achieve a balanced diet by sourcing energy from different food groups. A typical plate is typically illustrated with proportions of foods from different food groups that are sources of 2000 kilocalorie energy. It recommends sourcing micronutrients and macronutrients from a minimum of 10 food groups, including vegetables, fruits, green leafy vegetables, tubers, roots, etc. At least half of the recommended cereals should be whole grains, such as millet, which are rich sources of micronutrients, vitamins, and minerals, and also provide antioxidants, polyphenols, fiber, bioactive compounds, etc. Millet can be consumed to the extent of even 30 to 40 percent of the total recommended cereals in raw weight. That is what my plate recommends.

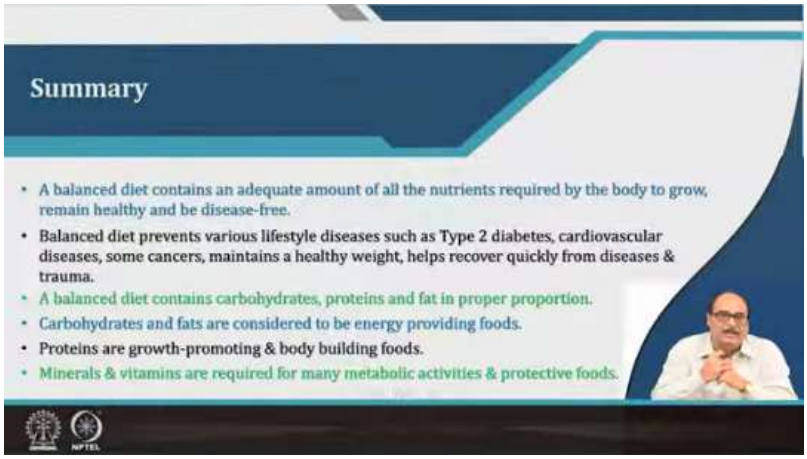


Now, what is the access and affordability of a balanced diet, alright? Economic disparities mean low-income people struggle to afford a balanced diet, leading to reliance on cheaper, calorie-dense, but nutrient-poor foods. Higher costs of nutrient-rich foods like fruits, vegetables, milk, and protein sources are the problem factors. Then, geographic and

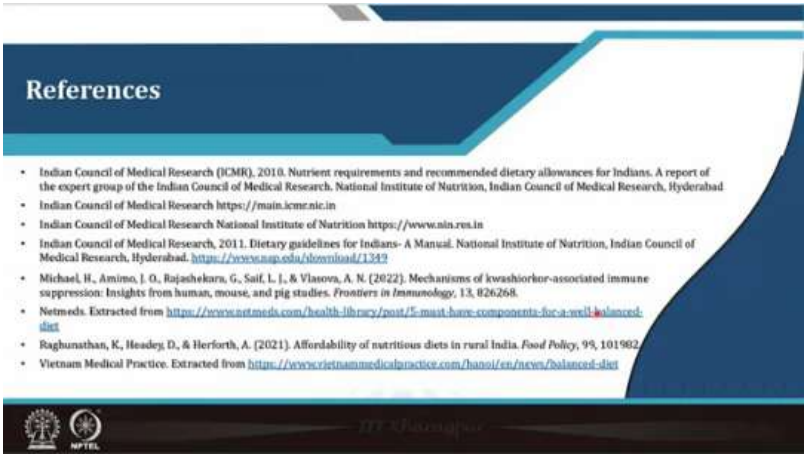
regional disparities mean urban people generally have better access to a variety of foods, while rural areas may suffer from limited availability, particularly of perishable foods. Dietary patterns and food availability vary widely across regions. For example, millet may be more accessible in certain states, while fruits and vegetables might be scarce in other states. Climate and agriculture-dependent regions, like those affected by climate change and weather-related disruptions, can impact food production, leading to shortages and increased prices.

Social and cultural preferences, like traditional diets in India, are diverse and often region-specific, and there might be a lack of awareness of the importance of a balanced diet, which can also lead to poor dietary choices. The public distribution system is another factor affecting the intake of a balanced diet, as it provides subsidized food grains to millions of low-income families. Government policies and programs, like the midday meal scheme, provide free meals to school children. Fortifying staple foods with essential vitamins and minerals is another very important aspect that should be included, as fortified foods should be part of a balanced diet. Stabilizing the prices of essential nutritious foods can make them more affordable for low-income households. The government should make sure that the prices of essential commodities are stabilized. Then, supplementing nutritional programs like integrated child development services provides nutrition to children under 6 years of age, pregnant and lactating women, etc. So this also becomes very important.

Then here, we will take another very important factor in the accessibility as well as the affordability of a balanced diet, which is market access and supply chain issues like inadequate cold supply storage and transportation infrastructure leading to significant post-harvest losses and this reduces again the availability of the material and, in fact, the supply chain. Remote or underserved areas provide limited nutritious food. So you can see here that cereal, dairy, vegetable, and fruit in this table are shown as the supply chain areas; in fact, there is the average cost of that, which is the market access and cost, etc. and how from the period 2001 to 2011, etc. So, in fact, from 2001 to 2011, if you see around 13.9 per cent to a 50 per cent increase in the cost and affordability, the average cost of the recommended diet has increased by 50 per cent. Even from 2011 data, if you see the latest data, it is not much; look at those data also you will find that the cost to get a balanced diet, the cost has increased. So, this becomes an important issue; even agencies, concerned agencies, responsible agencies, government and non-government agencies should ensure that these ingredients and materials are made easily available at a cheaper cost to the people so that they can get their proper balanced diet.



So, finally, I will summarize, like to summarize this lecture that is a balanced diet. contains an adequate amount of all the nutrients required by the body to grow, remain healthy, and be disease-free. A balanced diet prevents various lifestyle diseases such as type 2 diabetes, cardiovascular diseases, and some cancers, maintains a healthy weight, and helps recover quickly from diseases and trauma. A balanced diet should contain an adequate amount of carbohydrates, proteins, and fats in proper proportions. It should also contain a good amount of nutraceuticals and functional foods, bio-actives, and antioxidants in the required proportions. Carbohydrates and fats are considered to be energy-providing foods, but proteins are both body-building foods and minerals and vitamins are required for many metabolic activities and are productive foods. So, more and more fruits, vegetables, etc., should be consumed very, very importantly, that is diverse. Diverse types of food from all those categories, as you have seen earlier in the food pyramids, and it is in chromate and my plate, etc. But where there is, these many times for many reasons, there is a variety of foods, etc. may not be available easily at affordable prices, so efforts should be made to fortify the staple foods. So, staple food fortification is another very important aspect. I am sure I am happy to say that even now, the Government of India has taken a very significant step in this direction. Various staple foods like rice, wheat flour, oil, milk, and salt, these five staples are being fortified and provided to the people, and even rice, fortified rice is being fed in the PM Poshan scheme through various schemes, various schemes for the distribution systems, and in order to take care of micronutrient micro-deficiency to overcome the hidden hunger problems.



So, these are the references that were used in preparing this lecture.

Thank you very much for your patient hearing. Thank you.