agMOOCs

Carbohydrate

V. Vijaya Lakshmi

Welcome back. So all these previous classes we have seen the general introduction about the nutrients then the digestion, absorption of nutrients and the recommended dietary elements.

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Now let us start going into each nutrient in detail starting with the major nutrients out of which carbohydrate is the main major nutrient among the three carbohydrates proteins and fats.

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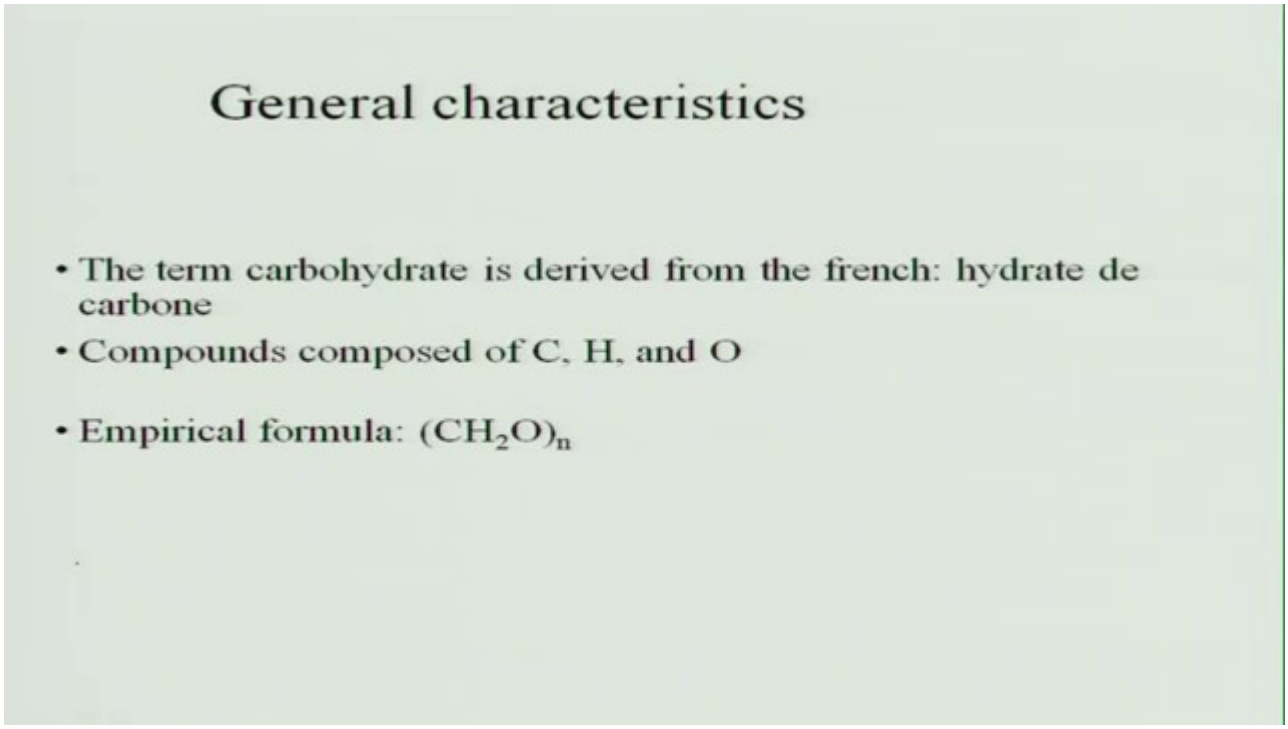

So, the general characteristics of carbohydrates; the term carbohydrate is derived from a French word hydrate de carbone. So it is composed of carbon, hydrogen and oxygen and the empirical formula is CH_2O.

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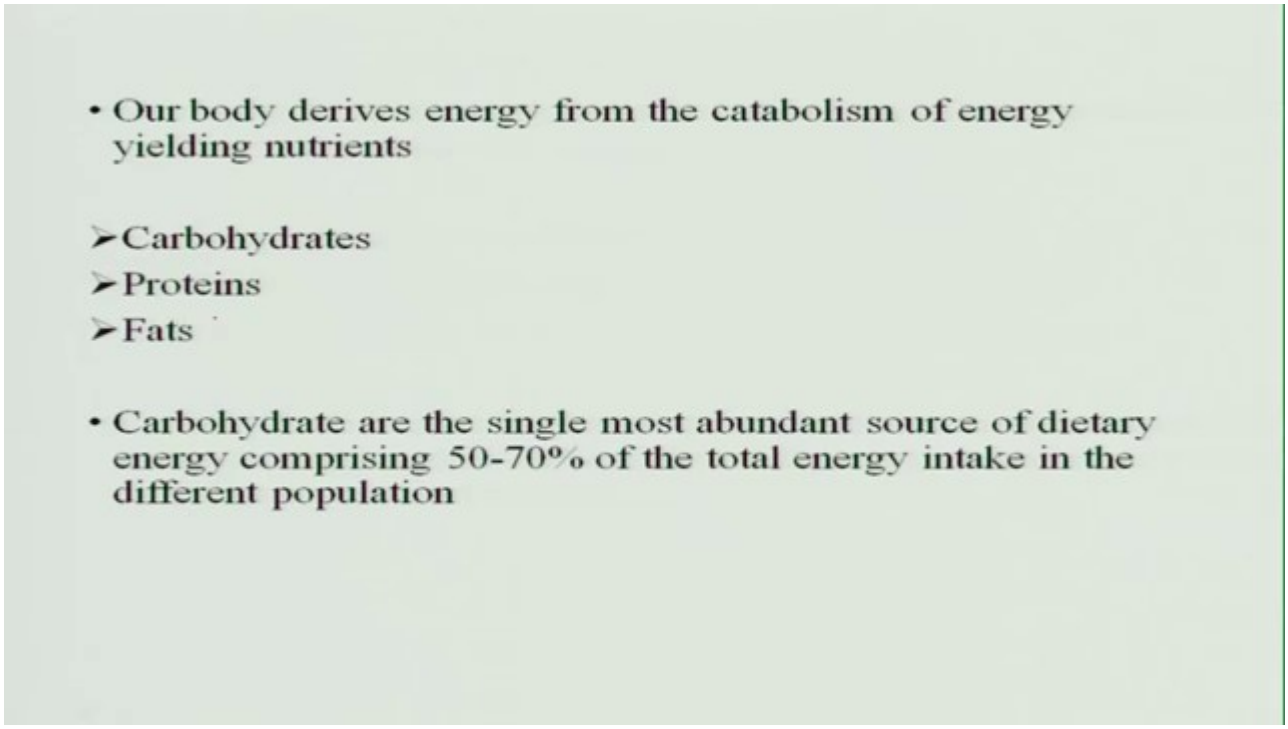

Our body derives energy from the catabolism of energy yielding nutrients like the carbohydrates fats and proteins. So carbohydrates are the single most abundant source of dietary energy which comprises 50 to 70 percent of the total energy intake of our diet. So any area population you see the carbohydrate is the major content giving the energy.

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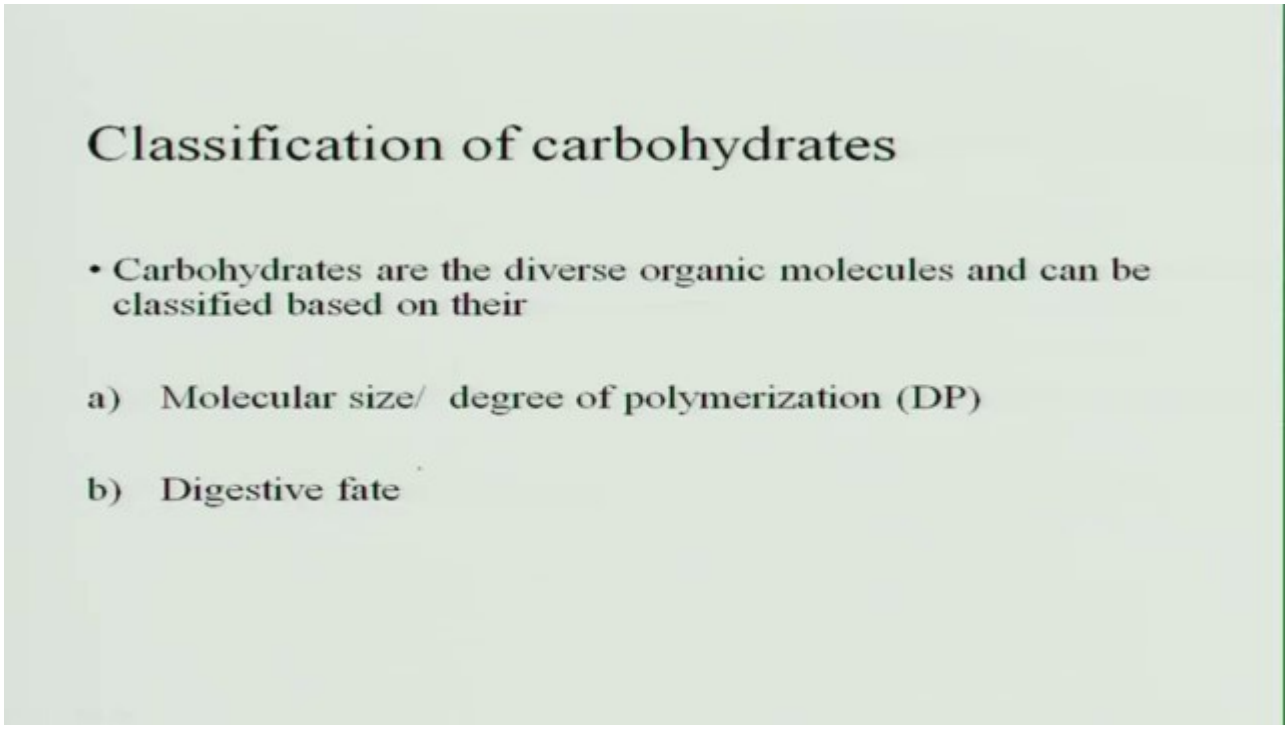

Now let us see the classification of carbohydrates. So these are diverse organic molecules, they can be classified based on their molecular size or degree of polymerization and their digestive fates.

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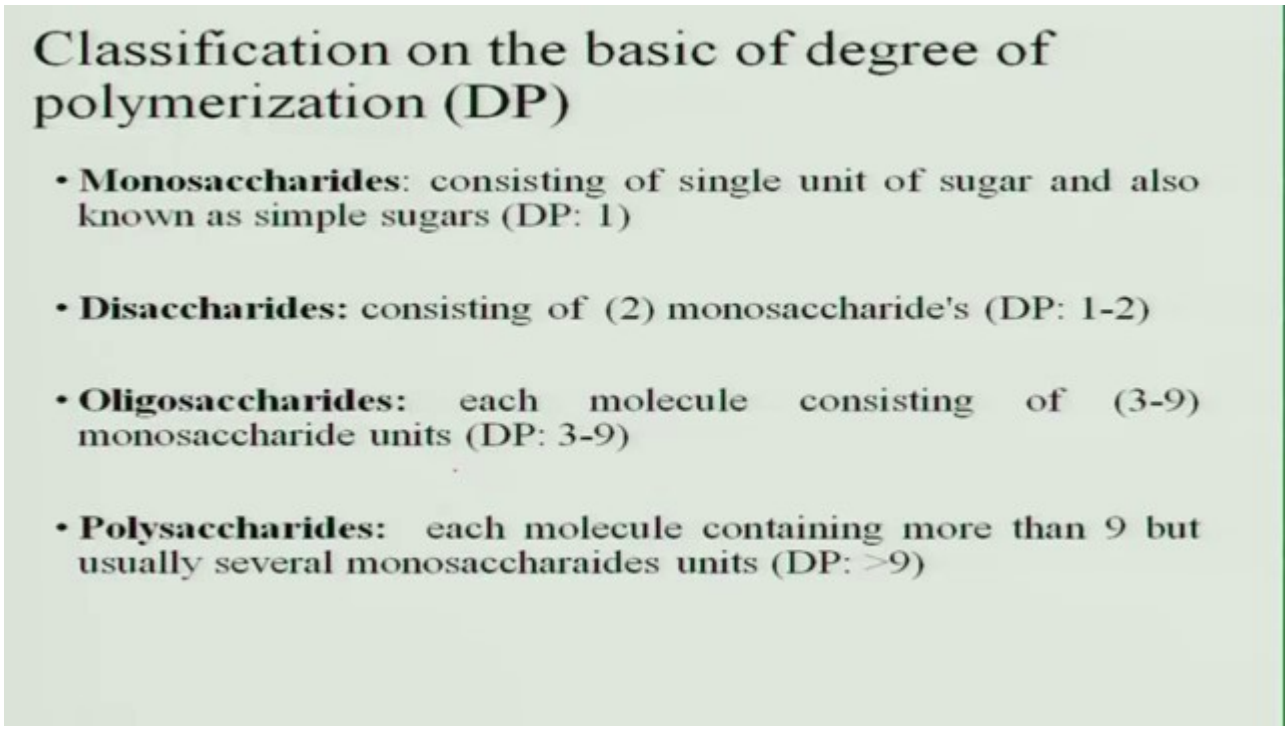

So classification based on the degree of polymerization. They are classified into monosaccharides, disaccharides, oligosaccharides and polysaccharides. So monosaccharides, they are consisting of single unit of sugar and they are also known as simple sugars. So the degree of polymerization is one. And they cannot be further hydrolyzed. And disaccharides consists of two monosaccharides where the degree of polymerization is 1 to 2. And

oligosaccharides the polymerization is 3 to 9 and you can get so many monosaccharide units when they are hydrolyzed. Polysaccharides each molecule contains more than 9 degree of polymerization and you get several molecules of monosaccharide units.
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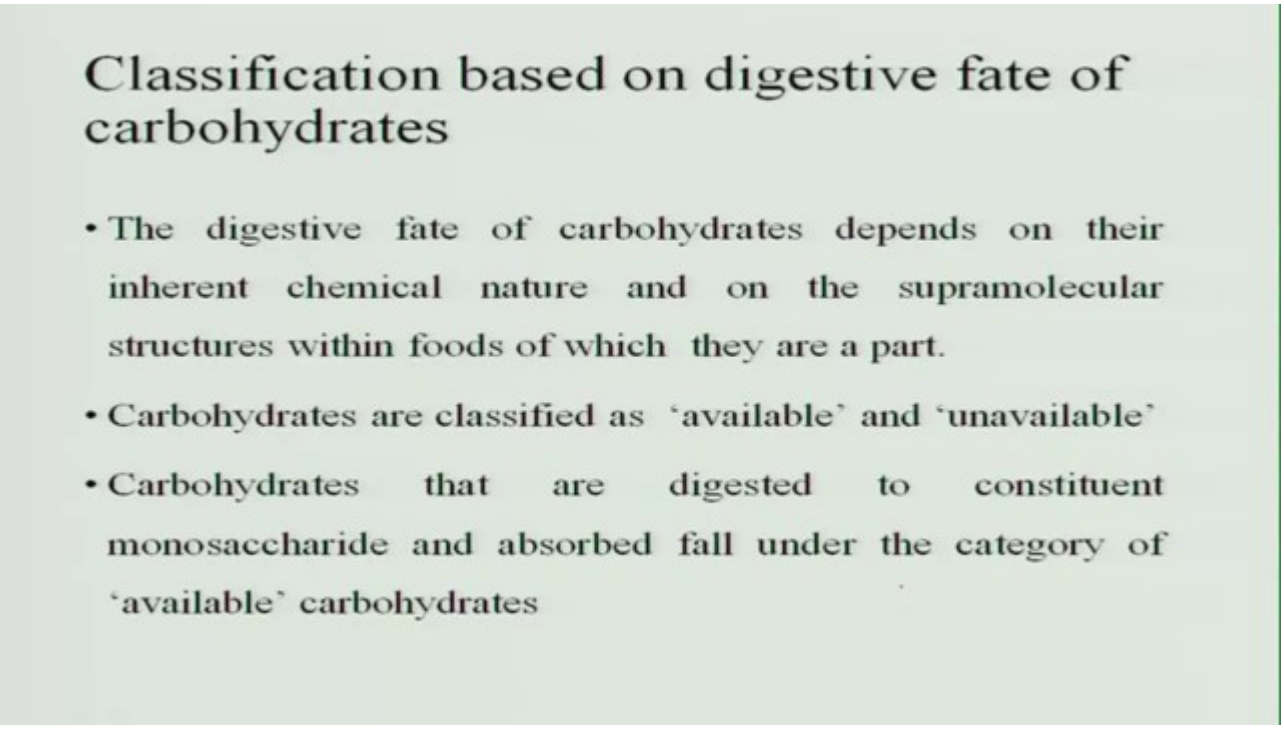

And classification based on the digestive fate of carbohydrates, so the digestive fate of carbohydrates depends upon their inherent chemical nature and the supramolecular structures within the foods of which they are a part. So they are classified as available and non-available or unavailable carbohydrates. So carbohydrates that are digested to constituent monosaccharides and absorbed fall under the category of available carbohydrate.
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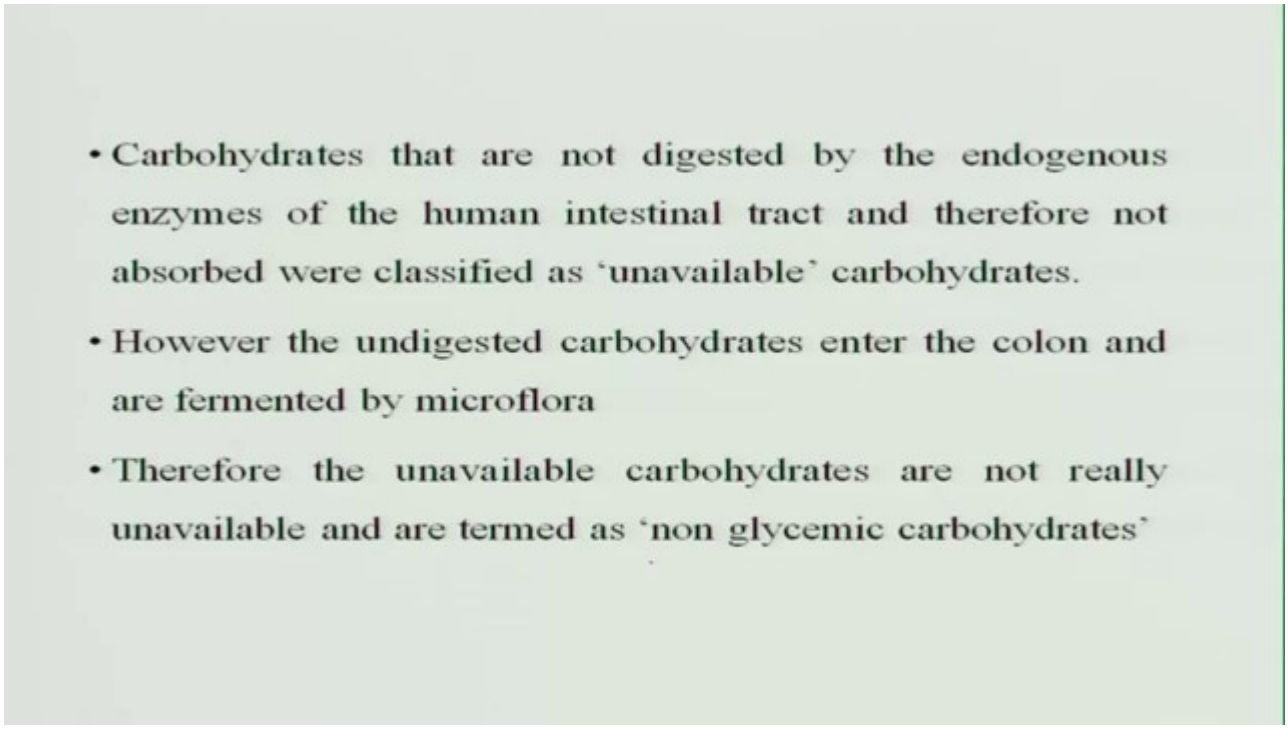

Whereas the carbohydrates that are not digested by the endogenous enzymes and we have don't have the capacity of digesting those carbohydrates in the intestinal tract they are classified as unavailable carbohydrates. So these undigested carbohydrates they finally enter the colon. We cannot separate digested and undigested carbohydrates and eat. So we eat food totally. Therefore the undigested carbohydrates they reach the colon and here they are fermented by the microflora that are present in the intestines. Therefore unavailable carbohydrates are not really unavailable, but they are termed as non glycemic carbohydrates. That means they do not provide any energy or in the stomach and they go undigested into the intestines.

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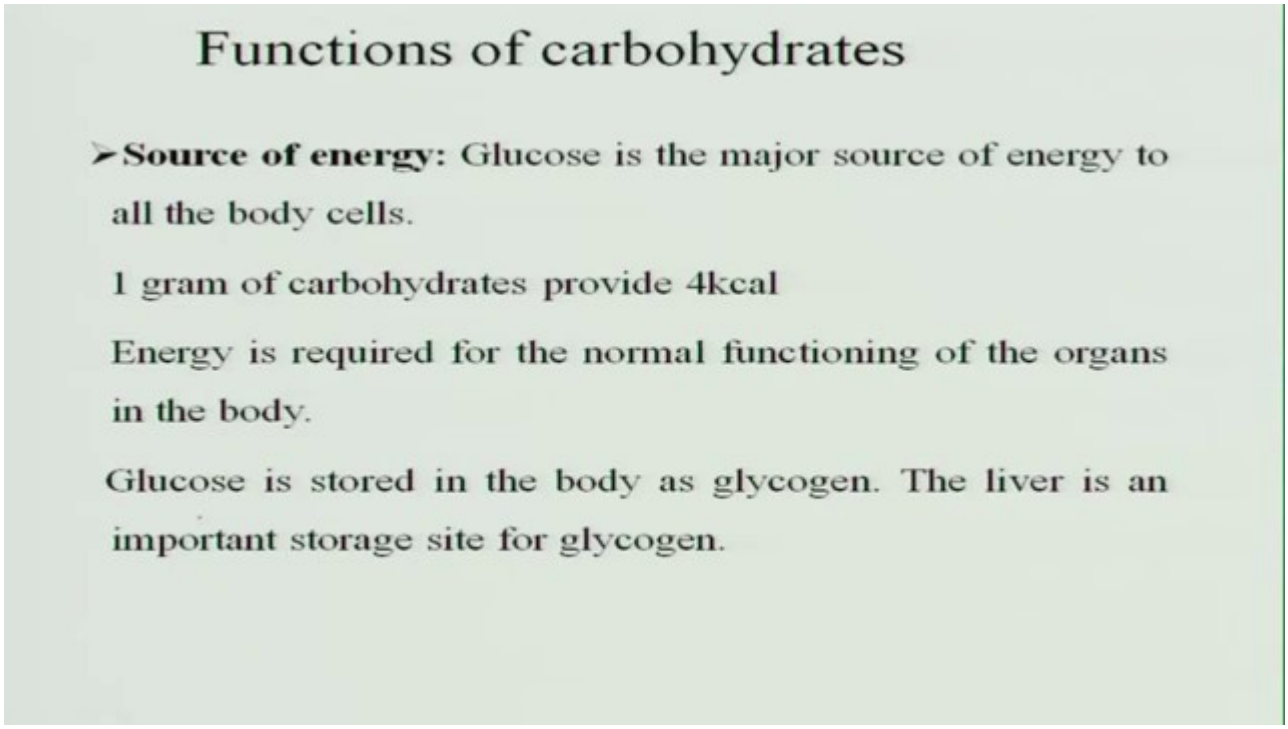

Now functions of carbohydrates. The main function of carbohydrate is they are the source of energy. And glucose is the main source of energy to the body cells. One gram of carbohydrate provides four kilocalories of energy, I've been repeatedly telling this so that you don't forget. And energy is required for normal functioning of organs in the body. And the glucose is stored in the liver as glycogen. So a liver is the storage organ for glycogen. And whenever the body requires glucose the glucose is released from the liver and the levels in the blood are maintained.

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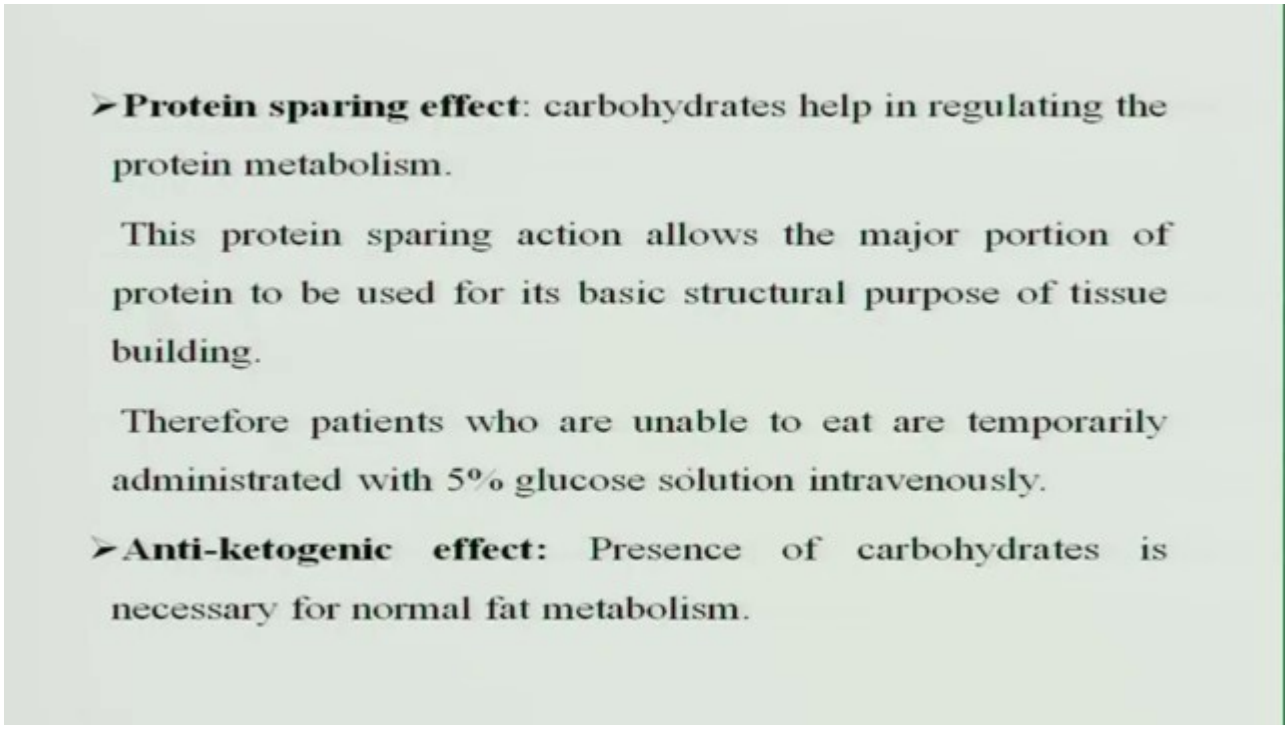

Then protein sparing action; so carbohydrates help in regulating the protein metabolism, because the main function of protein is to building up of the body and repair of tissues, but protein also provides four kilocalories of energy. So if carbohydrates are not provided proteins will start giving energy, therefore when you give sufficient amount of carbohydrates proteins are spared for their functions. That is this protein sparing action. Now therefore the patients who are unable to eat temporarily we give them some dextrose intravenously so that proteins are not spared. Then they have an anti-ketogenic effect, the presence of carbohydrates is also necessary for the fat metabolism. Without carbohydrates fats also are not digested.

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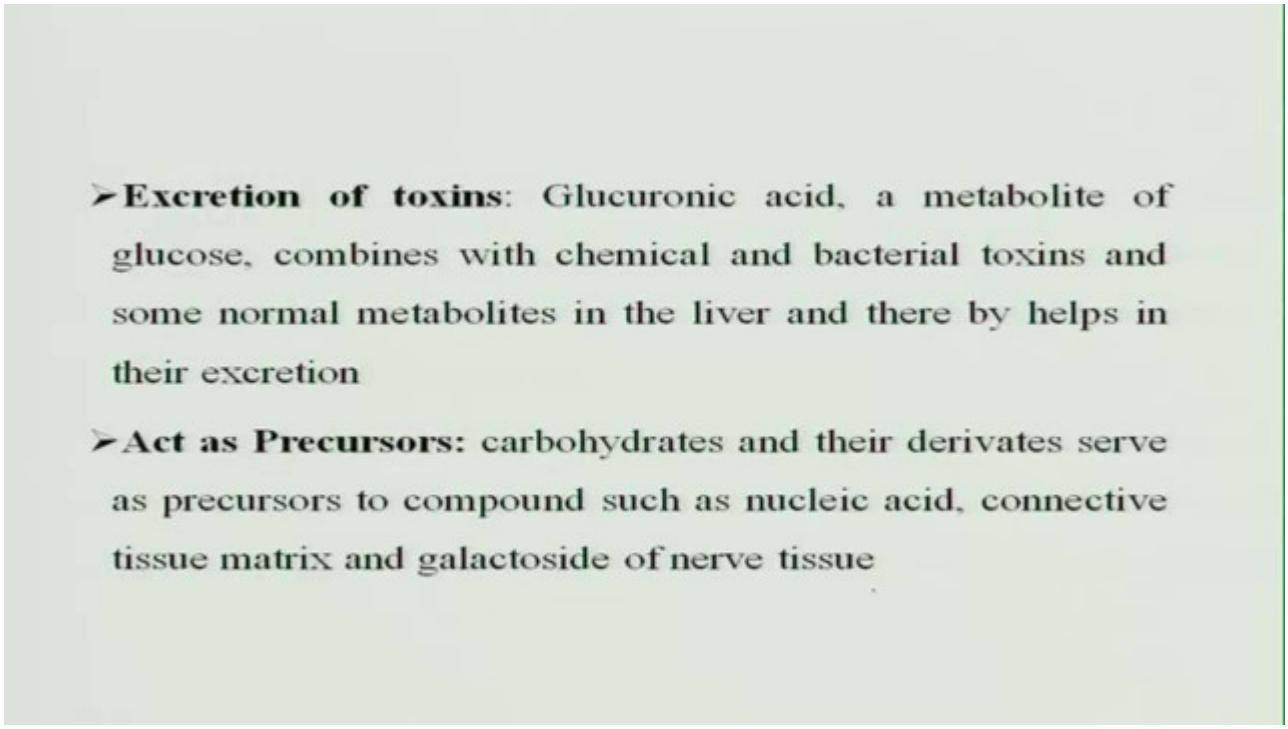

Then excretion of toxins; glucuronic acid which is a metabolite of glucose, it combines with chemical and bacterial toxins and some normal metabolites in the liver and thereby it helps in excretion. So carbohydrates also help in the excretion of toxins that are present in the body. Then they act as precursors, so carbohydrates and their derivatives are precursors to the compound such as nucleic acid connective tissue matrix and galactoside of nervous tissues.

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➢**Over all positive health:** non glycemic carbohydrates including non starch polysaccharides are beneficial for the function of gastrointestinal tract and thus have a positive effect on over all health

And they are generally required for overall health of the individual. So non-glycemic carbohydrates, I told you which are not digested in the body including non-starch polysaccharides, these because they are not digested they can be utilized for beneficial purpose like the function of gastrointestinal tract is improved because when you have undigestible carbohydrates they start absorbing more water and or help in the regular peristalsis of the gastrointestinal tract prevent from constipation. So like this they have positive effect on the health of an individual.

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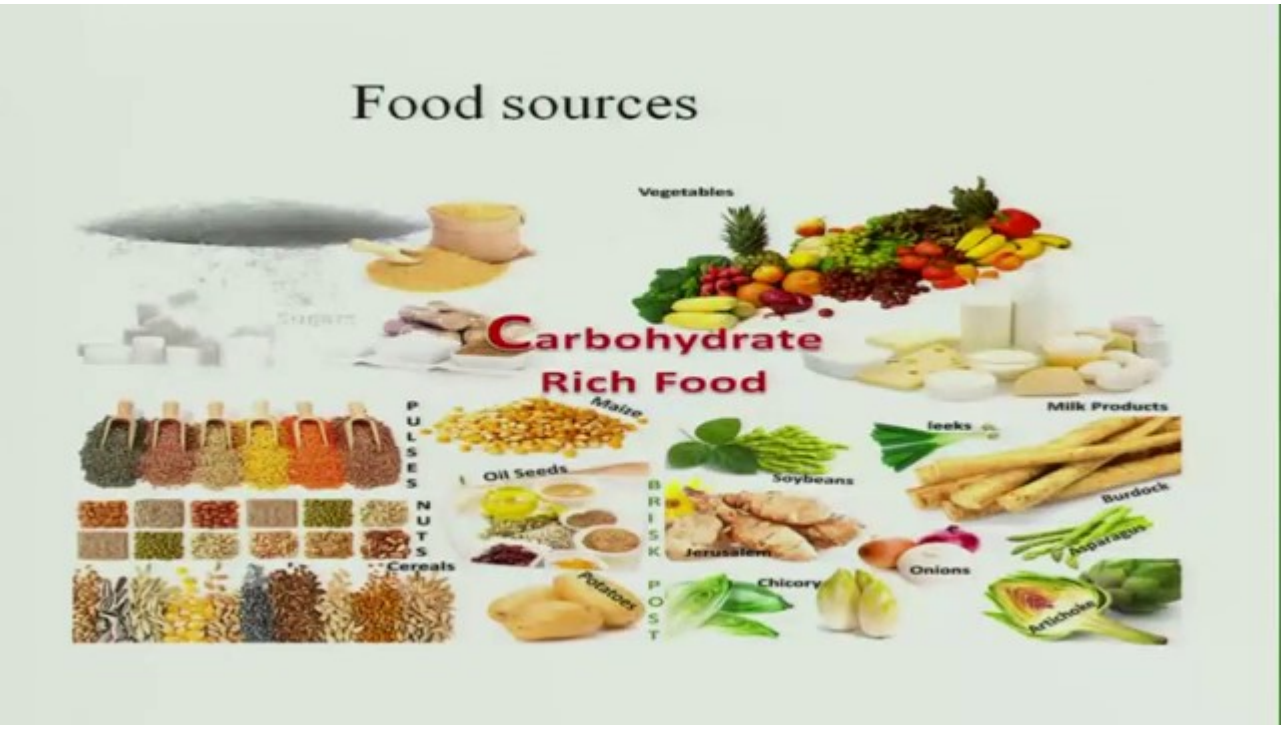

Now what are the food sources of carbohydrates? You have all the grains, cereal grains then you have sugar is the concentrated source. I mean it is the only source of carbohydrate if you take one teaspoon of sugar, one teaspoon contains 5 grams and you will get multiplied into 4 you get 20 kilocalories directly as kilocalories. Then you have some amount in fruits and vegetables, then now you have in milk, meat, egg and say all the foods and pulses, nuts and cereals, oil seeds, potatoes, roots and tubers and these beans and other roots and tubers, all these are rich foods of carbohydrates.

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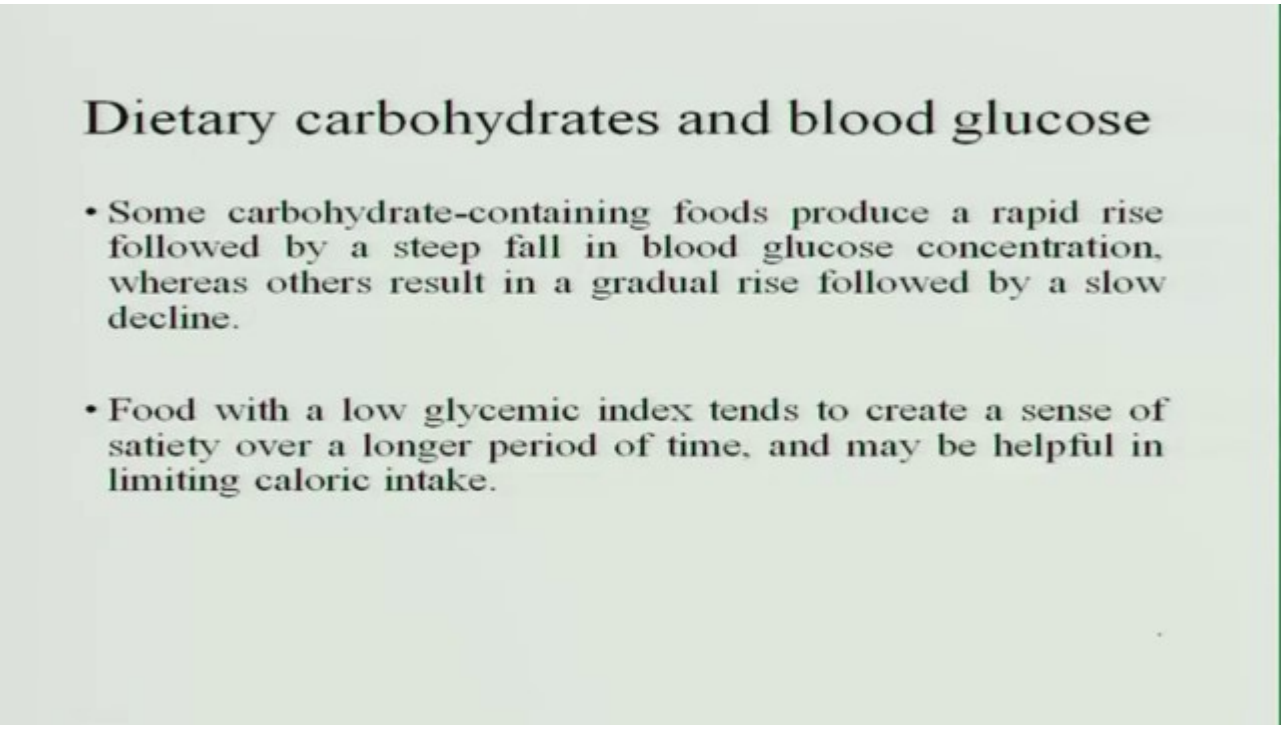

Now dietary carbohydrates and blood glucose, since we are saying it is a glucose blood glucose has to be maintained to maintain normal health otherwise you become diabetic. So some carbohydrate containing foods like pure source of glucose they produce rapid rise in the glucose or followed by the blood glucose concentration is steeply falling down. Like after taking a meal if the curve goes like this, so within half an hour you will have a steep rise in the blood glucose curve and it falls very fast. Then what happens you feel giddy. Isn't it? So foods with low glycemic index tend to create a sense of satiety, satiety is satisfaction. That means you have more of unavailable carbohydrates or undigested carbohydrate then you have a feeling of fullness you eat fibrous food. So this states over a long period of time and releases the glucose very slowly into the blood. So therefore at the same time you also limit a calorie intake.

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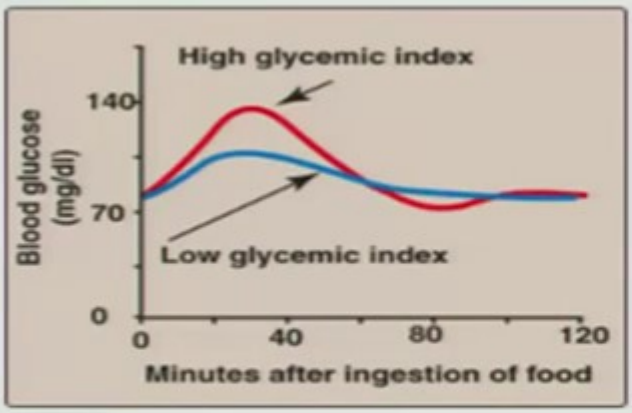

Glycemic index

- Glycemic index is defined as the area under the blood glucose curves seen after ingestion of a meal with carbohydrate-rich food, compared with the area under the blood glucose curve observed after a meal consisting of the same amount of carbohydrate in the form of glucose or white bread.

So this is how glycemic index is carried on. So it is defined as the area under the blood glucose curves and which is seen after digestion of a meal by taking the carbohydrate rich meal and it is compared to the area under curve of glucose. So when you compare these two you have the your glycemic foods. If there is a steep rise in the curve then it is said to be high glycemic index which is not good for health. So you always have to take low glycemic index foods to have a healthy normal blood glucose levels in the body.

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Requirements for carbohydrate

- Carbohydrates are not essential nutrients, because the carbon skeletons of amino acids can be converted into glucose .
- However, the absence of dietary carbohydrate leads to ketone body production ,and degradation of body protein whose constituent amino acids provide carbon skeletons for gluconeogenesis .

So requirement of carbohydrates, carbohydrates are not essential nutrients because the carbon skeletons of amino acids can be converted into glucose. I told you the protein also can be

converted into energy. So they are not called as essential nutrient. However when you do not take sufficient amount of carbohydrate it leads to ketone body production, so the ketonic acids are produced because it does not help the assimilation of fats and there is degeneration of body protein. So where the role of protein is to provide body building functions otherwise it is providing energy. So it protects the proteins.

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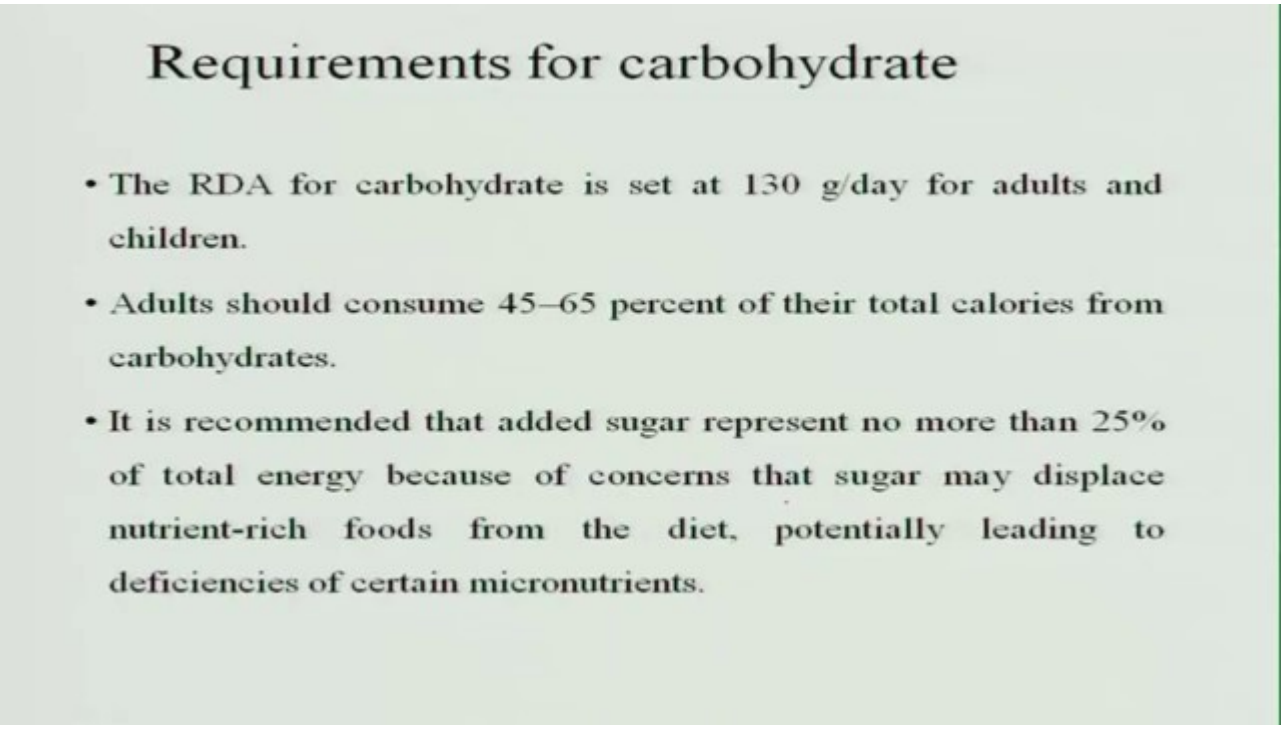

Requirement the RDA for carbohydrate is set as 130 grams per day for adults and children. So adults should continue. The main thing is it should give 45% to 65% of the total calories that is taken per day and it is recommended that added sugar represent should not be more than 25% of total energy, because it may dispense the other nutrient for rich force from the diet. Once you take more than 25% of sugar in your diet you don't feel like taking the other food. So it dispenses the other foods. So thereby it would leads to deficiency of certain micronutrients.

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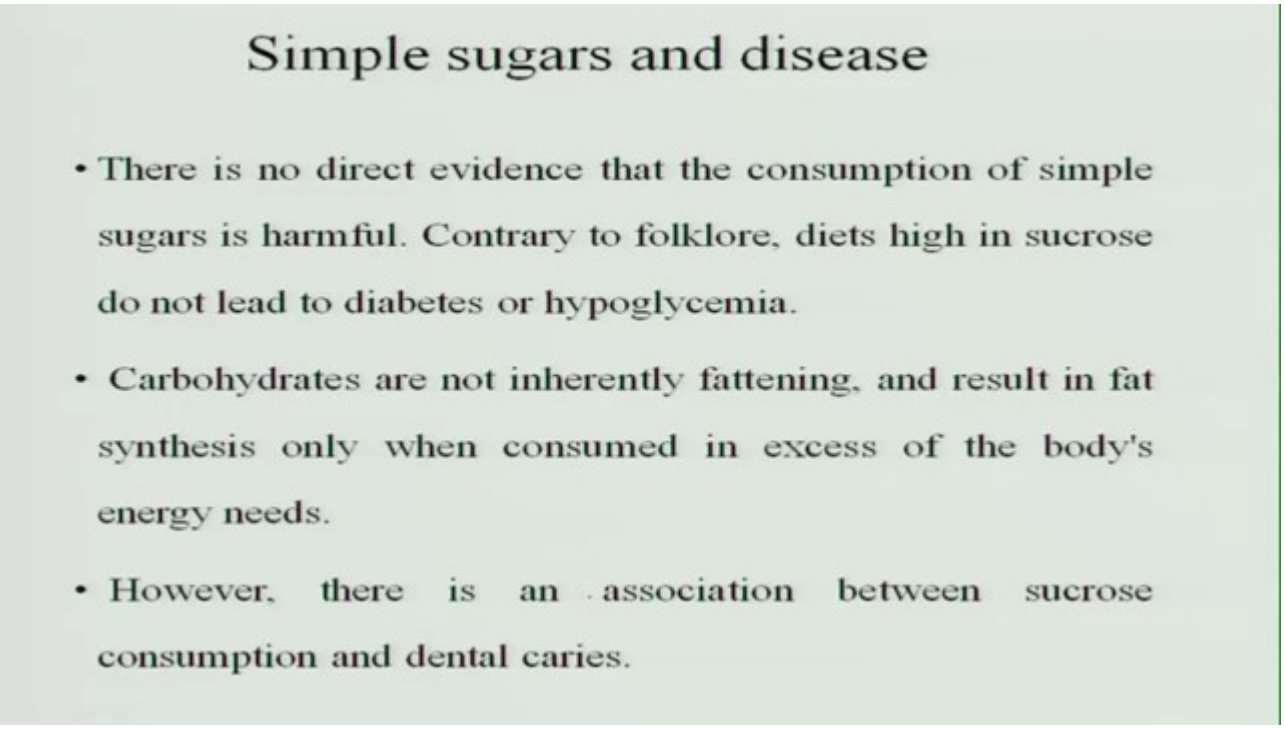

Now simple sugars and disease; the consumption of simple sugars is harmful, that is pure sugar is harmful because generally it say that whenever we take high amount of sugar it leads to diabetes or hypoglycaemia. That is wrong. So carbohydrates are not inherently fattening unless you take excess amount of carbohydrates the energy is stored as fat, but naturally they are not fattening and result in fat synthesis, only when consumed in excess in the body. However there is an association between sucrose consumption and dental caries, because it attracts all the bacteria on the teeth and forms cavities on the teeth.

So this is about the carbohydrates, the structure of carbohydrates, the classification of carbohydrates, then the food sources, the requirements and the deficiency or excess of carbohydrates. How it leads to diseases and how it hampers the health. Thank you.