agMOOCs

Water soluble Vitamins 3

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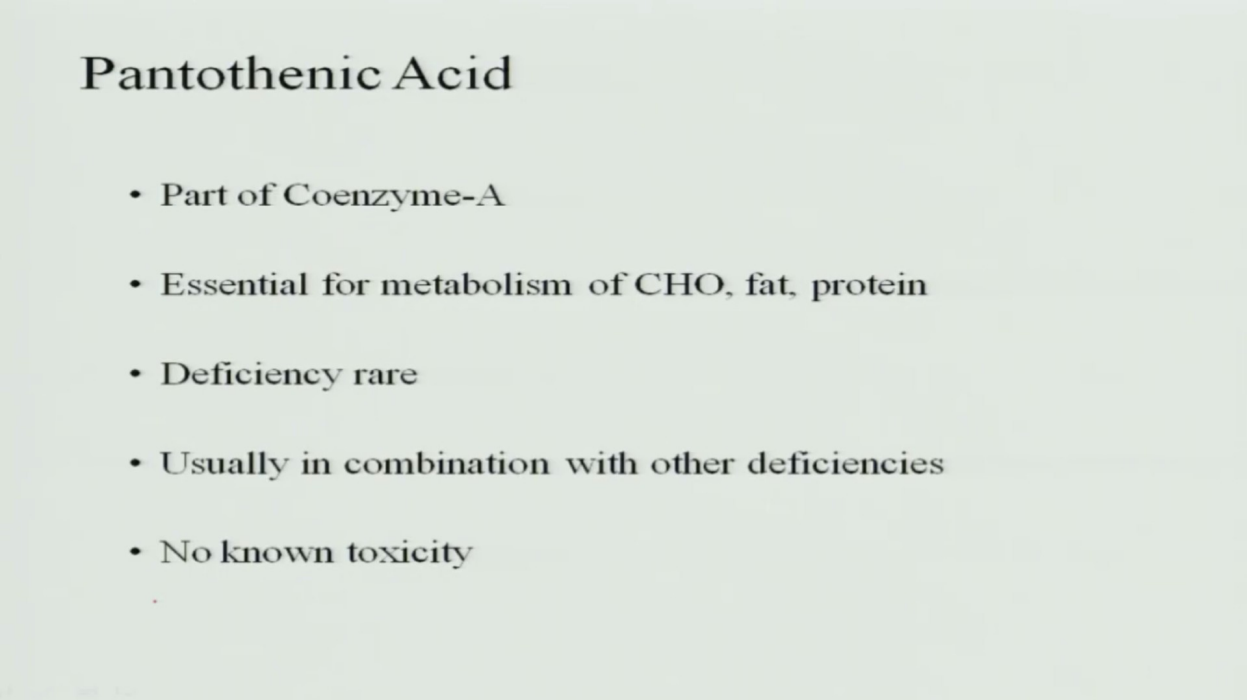
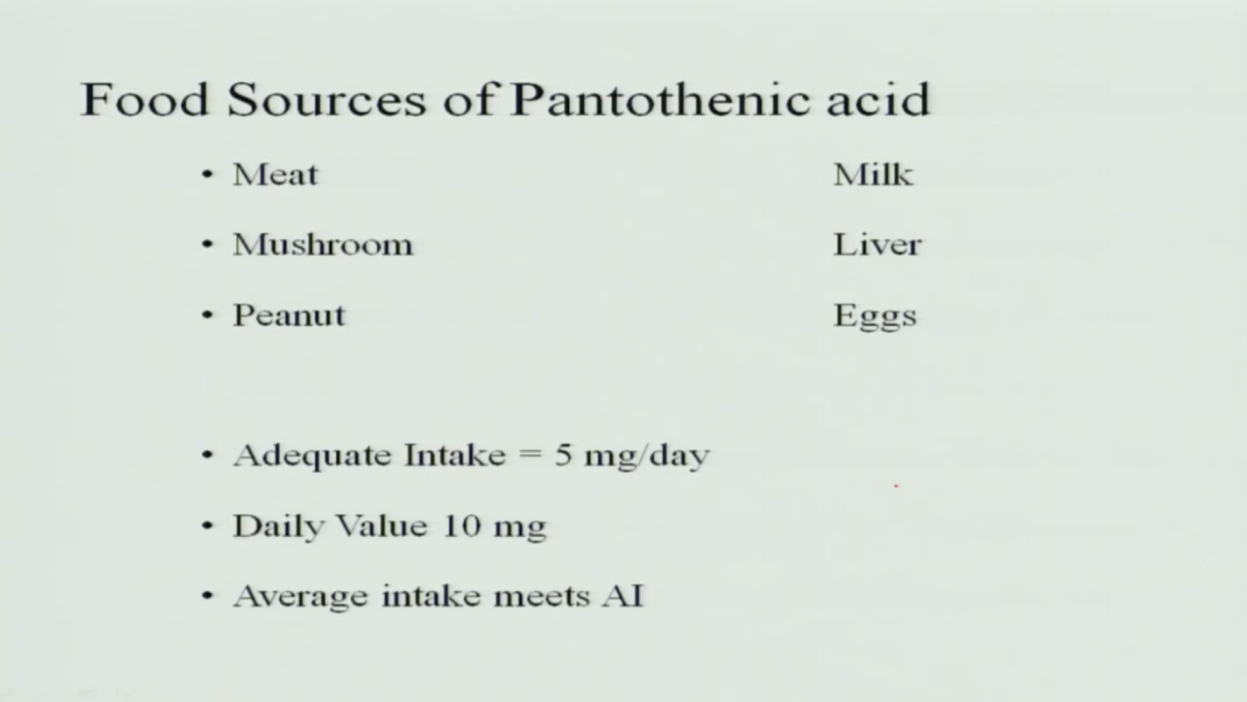
Hello welcome back to the sessions again. Last session we were seeing about the water soluble vitamins. We've spoken about the thiamine, riboflavin and niacin, the effect of their deficiencies and effect of taking excess and food sources and what are their functions. Let us continue with the topic and go to the other B vitamin called as pantothenic acid.

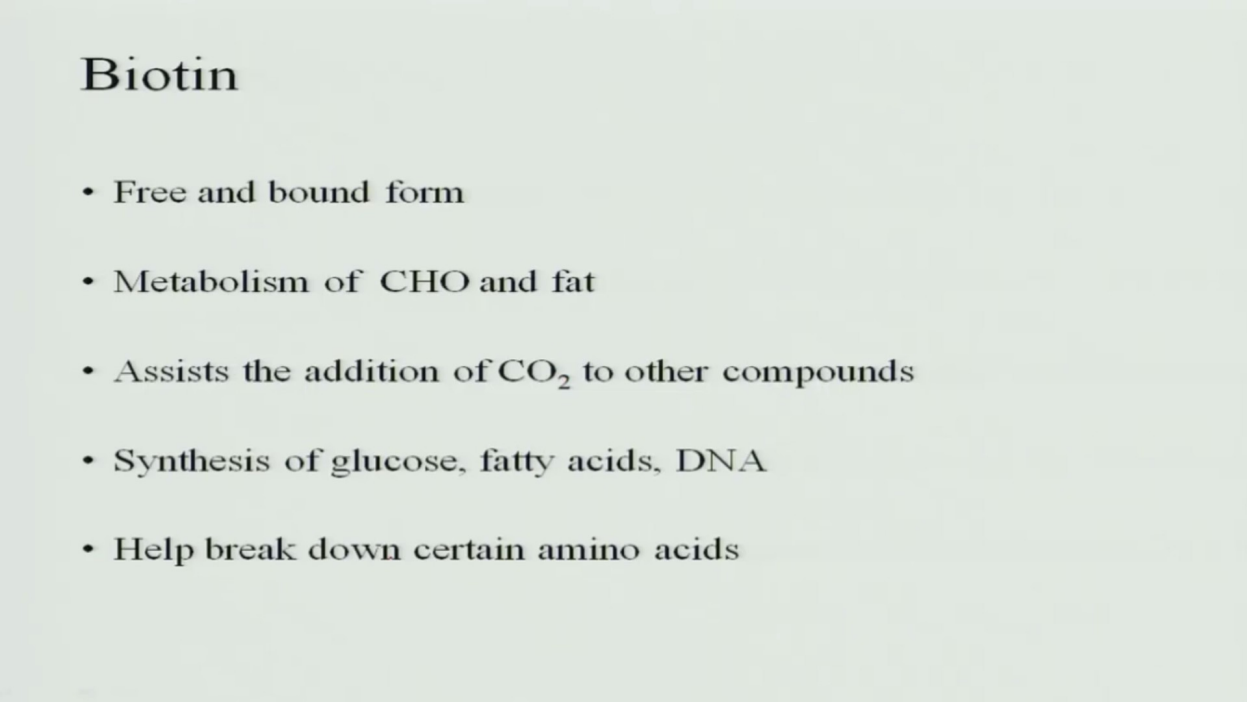


So this pantothenic acid is a very important vitamin where it plays a part of coenzyme A. So this is essential for again for the metabolism of carbohydrate, fat and protein, but the deficiency is very rare since it is a water-soluble vitamin, whatever the food is taking if it is optimum the excess is excreted and the level is maintained in the blood. Usually, in combination with other deficiency, the deficiency can occur, but there is no known toxicity about the pantothenic acid.



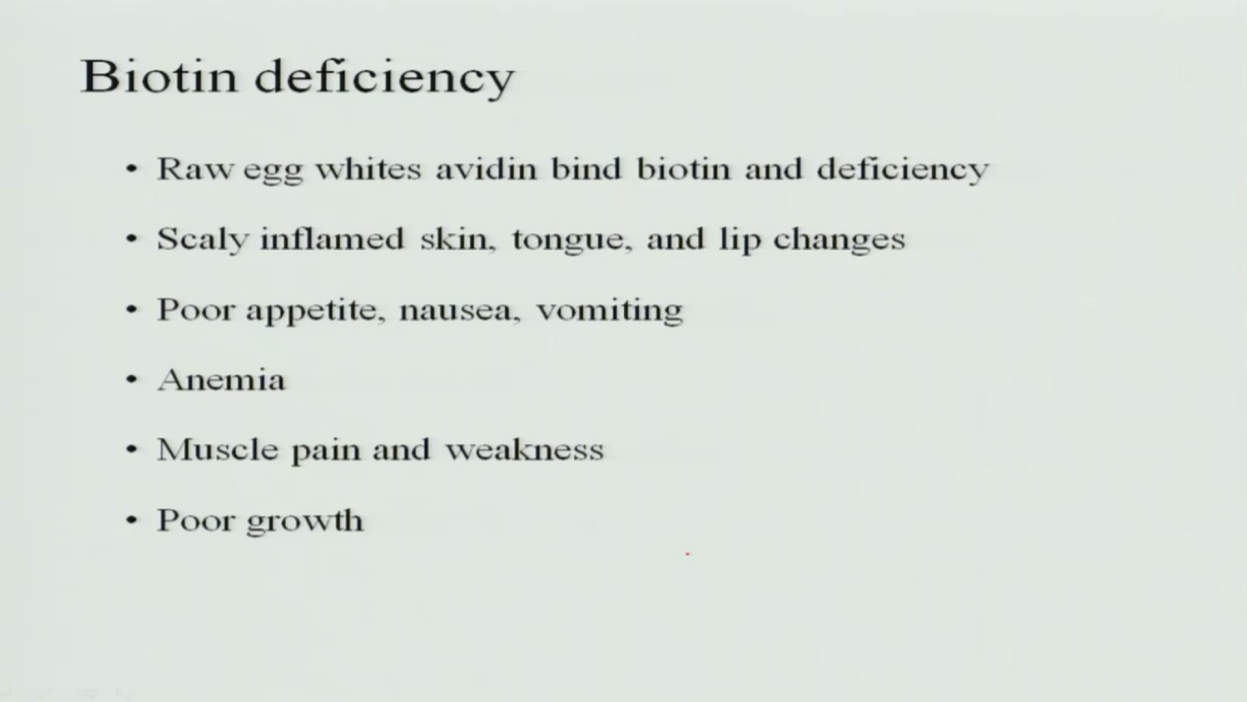
Now for sources of pantothenic acid, it is widely present in meat, mushrooms, peanut, milk, liver, and eggs. You can see it is most of the non-vegetarian food contains pantothenic acid. Now adequate intake is only 5 milligrams per day and this will suffice for the functions of pantothenic, acid and the daily value almost an average of 10 milligrams and average intake, it meets the adequate intake of the vitamin.

Now these are the sources you can see all the green leafy vegetables, the cabbage and tomatoes, and non-vegetarian, eggs, et cetera.



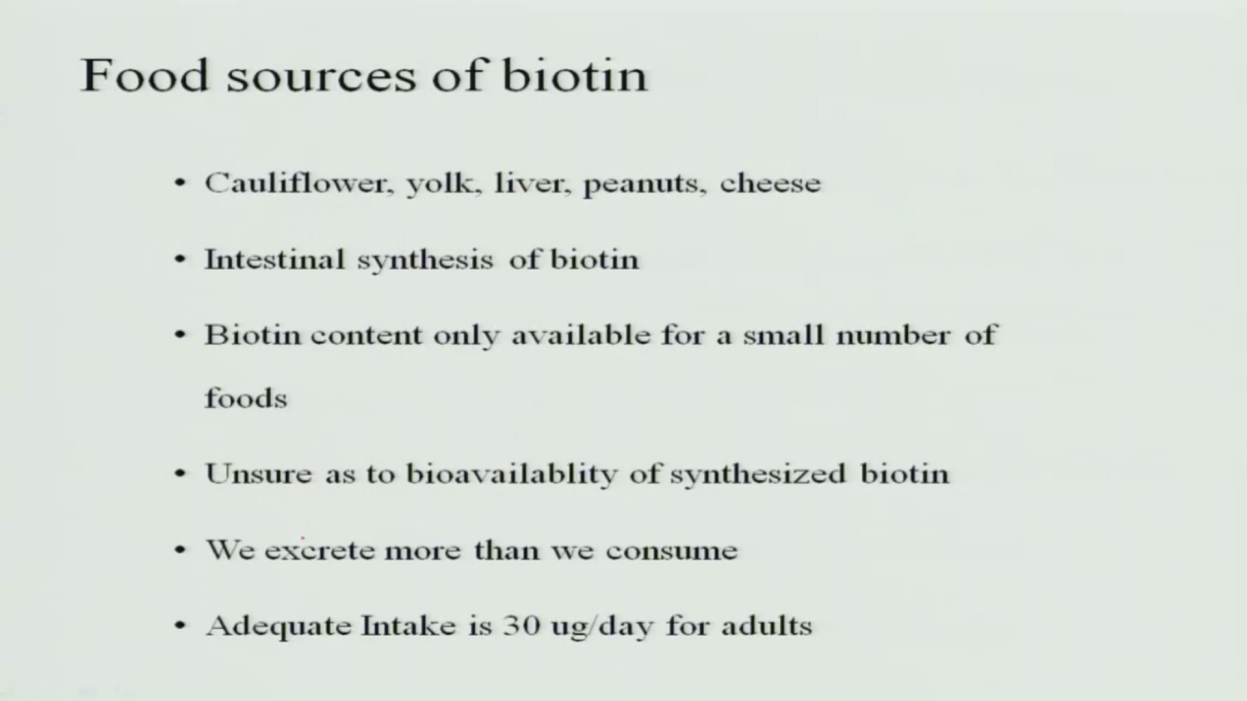
Now biotin is another B-complex vitamin, which is again form. It is found both in free form and bound form, and the metabolism for carbohydrate and fat. Again, it requires biotin as an important vitamin and it assists in addition of carbon dioxide to other compounds, and

synthesis of glucose fatty acids and DNAs in the presence of biotin, and it also helps to break down certain amino acids. So basically, it is again important for the metabolism of carbohydrates, fats and proteins.

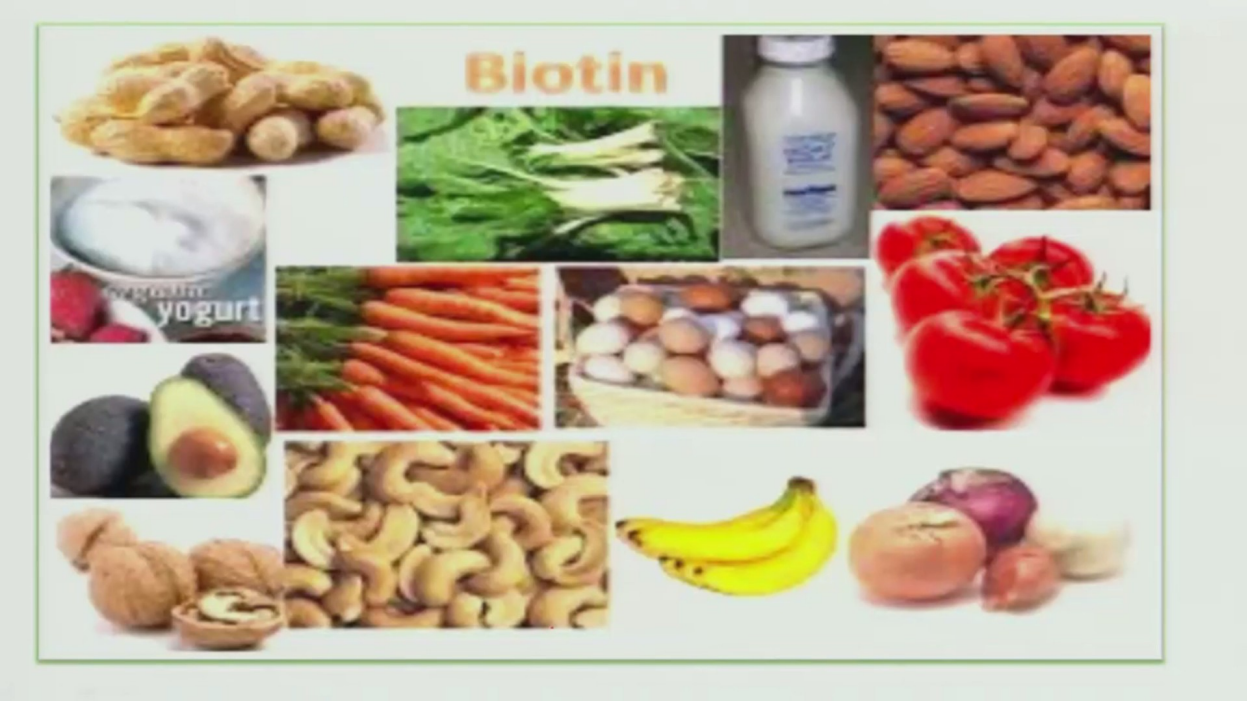


And deficiency of biotin, raw egg white, it contains a substance called avidin. So this avidin in raw egg, it binds with the biotin and makes it unavailable to the body, therefore the deficiency of biotin is caused when anyone eats raw egg, because it contains avidin, and it binds biotin and makes it unavailable, therefore deficiency is caused.

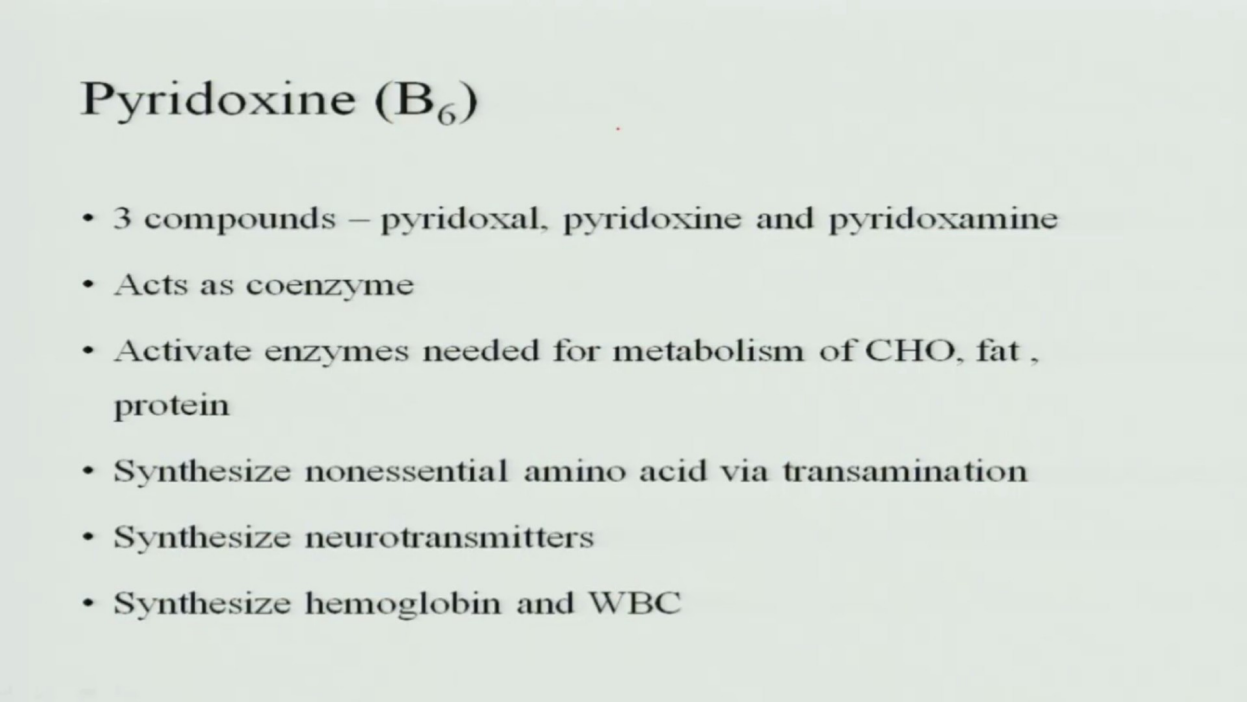
Now then the deficiency symptoms that occur are scaly inflamed skin. The tongue is inflamed and there are changes in the lips. Then anorexia or poor appetite, nausea, and vomiting are the symptoms, then it also causes anemia, because again it is involved in the protein metabolism and when protein is not there, then the hemoglobin also gets disturbed, therefore causes anemia, then muscle pain and weakness, and there is poor growth.



Now the four sources of biotin, where do we get biotin from? So it is present in cauliflower, the egg yolk, liver, peanuts, cheese. Then intestinal synthesis also is there for biotin, that means the biotin is produced by the intestines, and biotin contained only is available in small number of foods. So the limited foods contain biotin. And the bioavailability of the synthesized biotin is not very sure, because the biotin is synthesized in the large intestine, therefore what is the amount that is getting absorbed is a question mark. So we are unsure of what this emphasized biotin is available to the body, and we excrete more biotin than we consume, and adequate amount is only 30 micrograms per day for an adult.

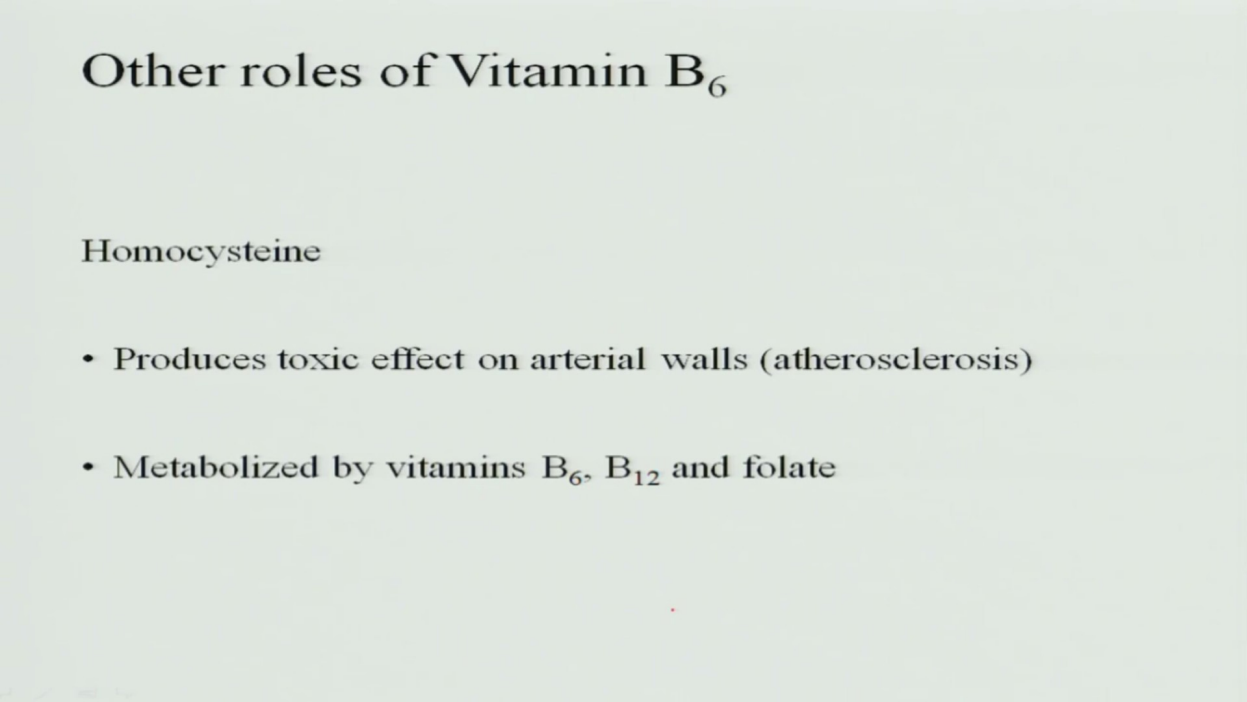


These are the food sources of biotin. You can get in nuts, avocado, then tomatoes, then the *badam*, and eggs, carrot, then leafy vegetables, et cetera.

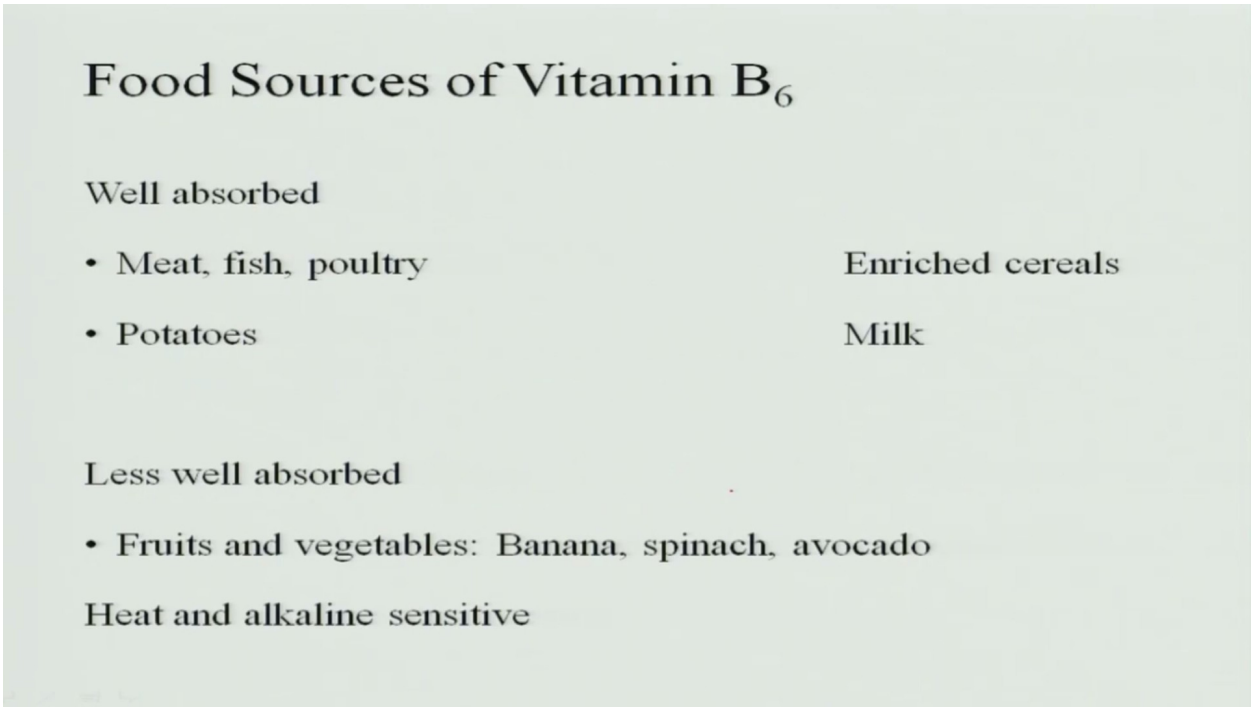


And the next vitamin is pyridoxine. Like thiamine, niacin and riboflavin are related to the energy metabolism and the intake depends upon the amount of energy that is taken in. Similarly, pyridoxine is related to the protein metabolism. So the intake, the amount of requirement of

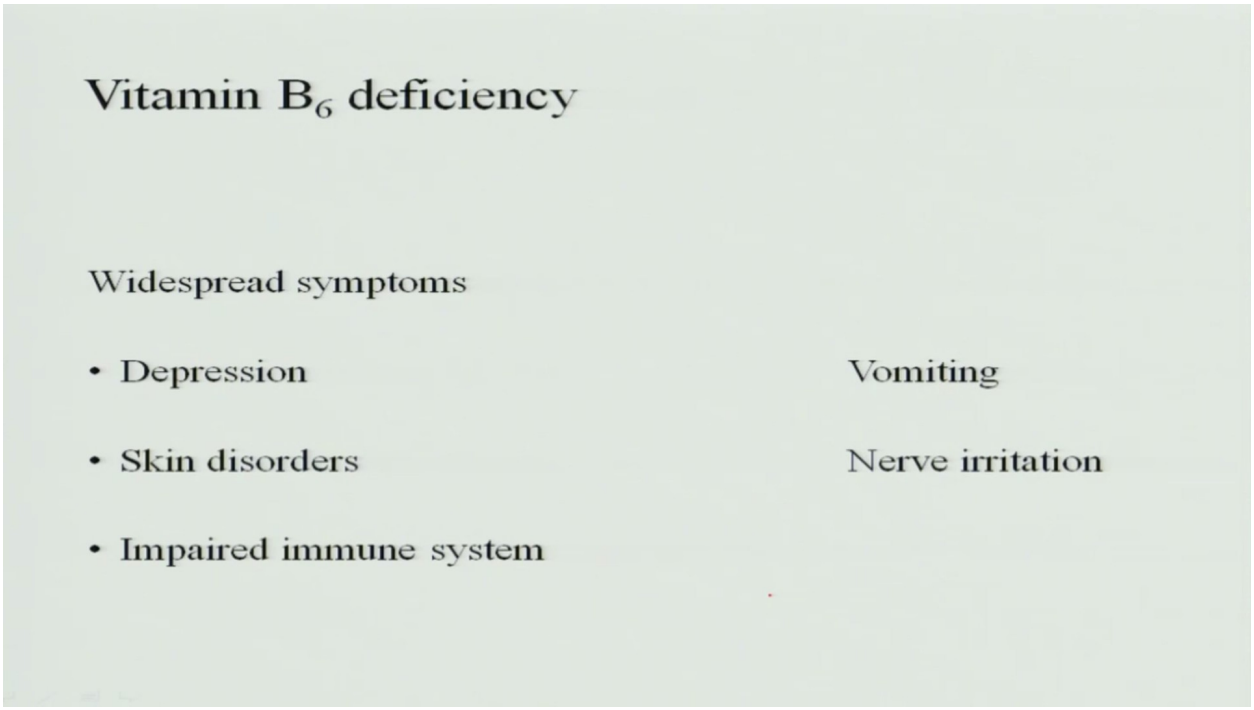
pyridoxine is dependent upon the protein intake. Now this has three compounds, pyridoxal, pyridoxine and pyridoxamine, so all these three compounds act as coenzymes in the metabolic reactions. So activate the enzymes and they are needed for metabolism of carbohydrates, fats and proteins, then they synthesize non-essential amino acids via transamination. So that is why when these amino acids are synthesized, we don't require them to be given through food. So if pyridoxine is there, there are synthesis of some non-essential amino acids. Then they synthesize neurotransmitters and synthesize hemoglobin and WBC.



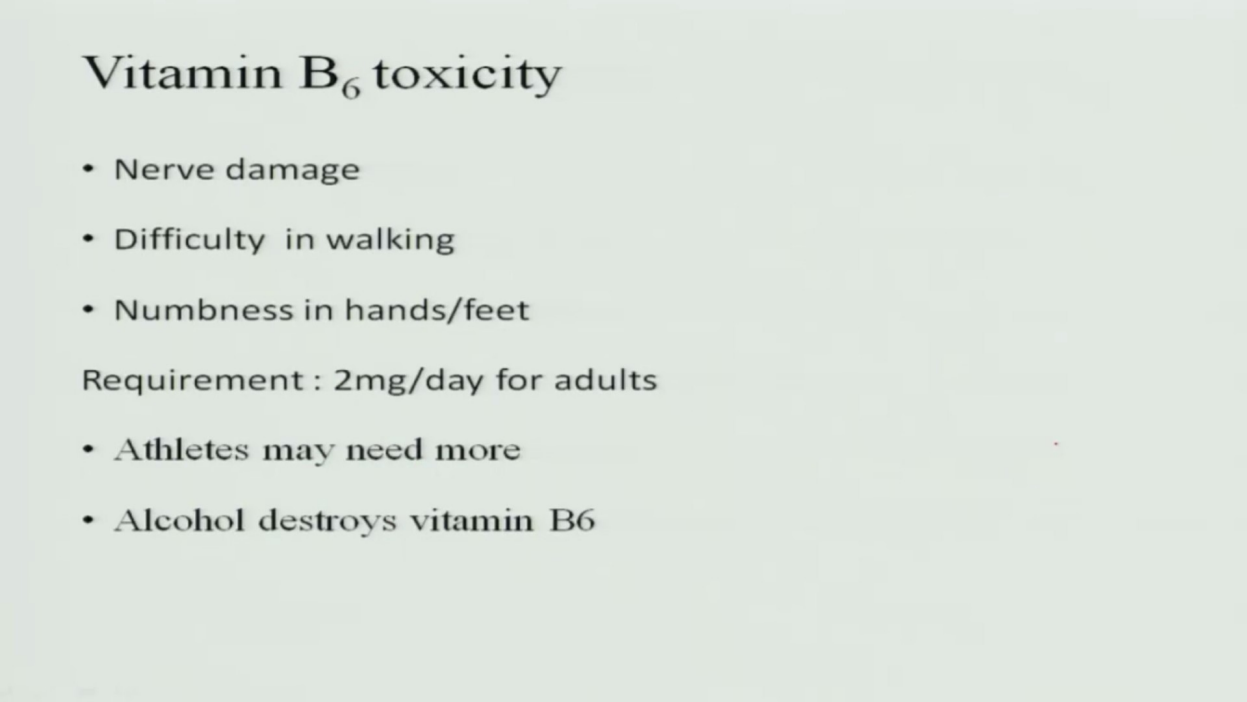
Now other roles of pyridoxine or vitamin B6 is they maintain the level of homocysteine. So homocysteine is a substance which produces toxic effect on the arterial walls. That means it causes atherosclerosis. Atherosclerosis is nothing but formation of plaques in the intima or walls of the arteries. And now metabolized by basic B12 and folic acid.



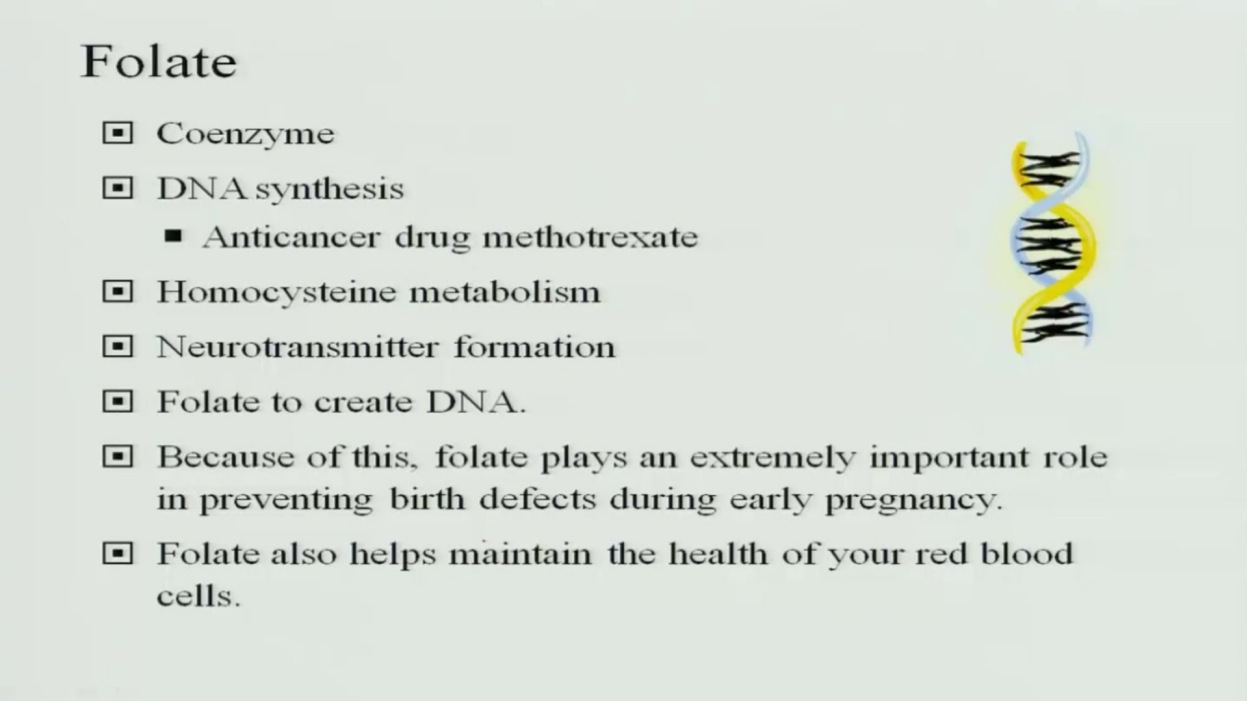
Now food sources of vitamin B6, it is well absorbed the meat, fish and poultry, and potatoes and enriched cereals and milk are very good sources of vitamin B6, but this is less well absorbed, and fruits and vegetables like bananas, spinach, green leafy vegetable, and avocado are also good sources of pyridoxine, but this is heat and alkaline sensitive. So when there is cooking process, there is loss of the pyridoxine. Now the sources are these.



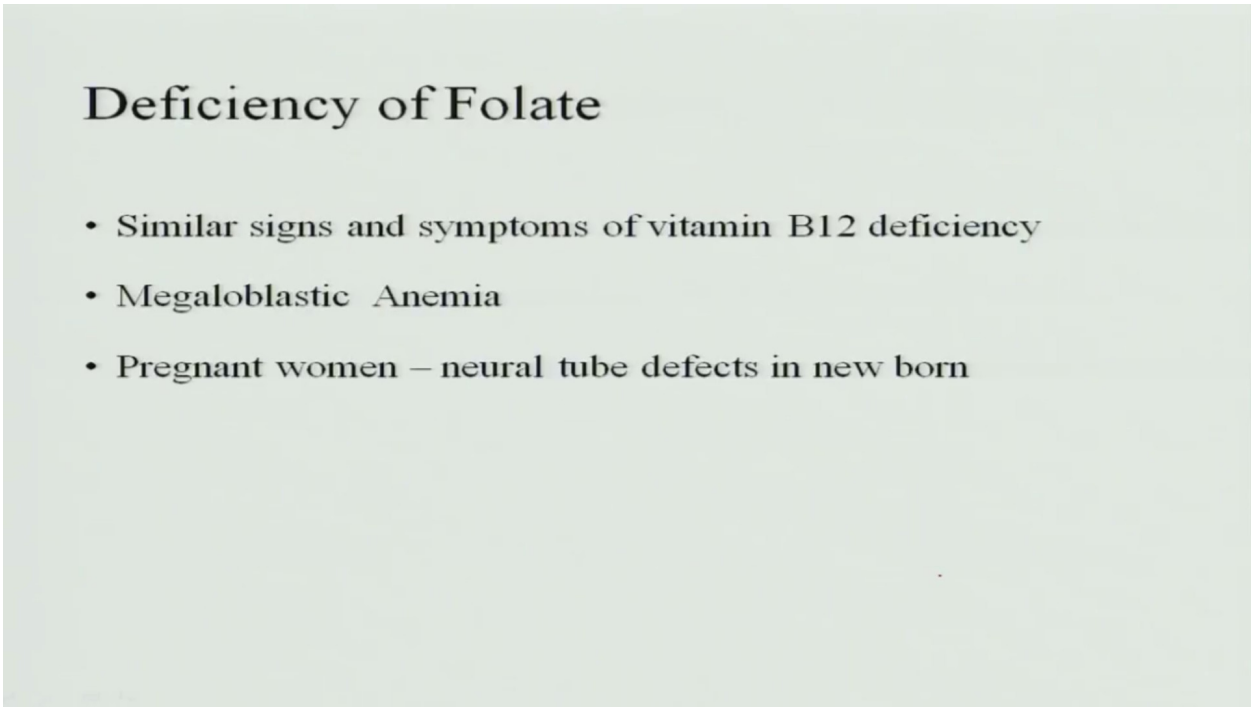
Now deficiency of pyridoxine, it gives a widespread symptom like it causes depression, because it is involved in the synthesis of neurotransmitters, and the skin disorders, impaired immune system, vomiting and nerve irritation. So all these are the deficiency symptoms of pyridoxine. So even if the pyridoxine level is a little lower than the normal, the symptoms are mild less.



And about the toxicity, there is some toxicity caused by pyridoxine like the other B-complex vitamin they are excreted, they don't cause any toxicity, but B6 causes toxicity, it causes nerve damage. Then there is difficulty in walking and numbness in hands and feet, all these are because of the nerve damage. So requirement is only 2 milligrams per day for an adult, so such small amount of pyridoxine is required for maintenance of the nerves and all, and when this is disrupted, then the deficiency symptoms occur. Athletes may need more, because they require more protein and the requirement of protein is dependent, I mean both pyridoxine and protein are dependent, therefore the pyridoxine requirement also increases, and alcohol destroys the vitamin B6.

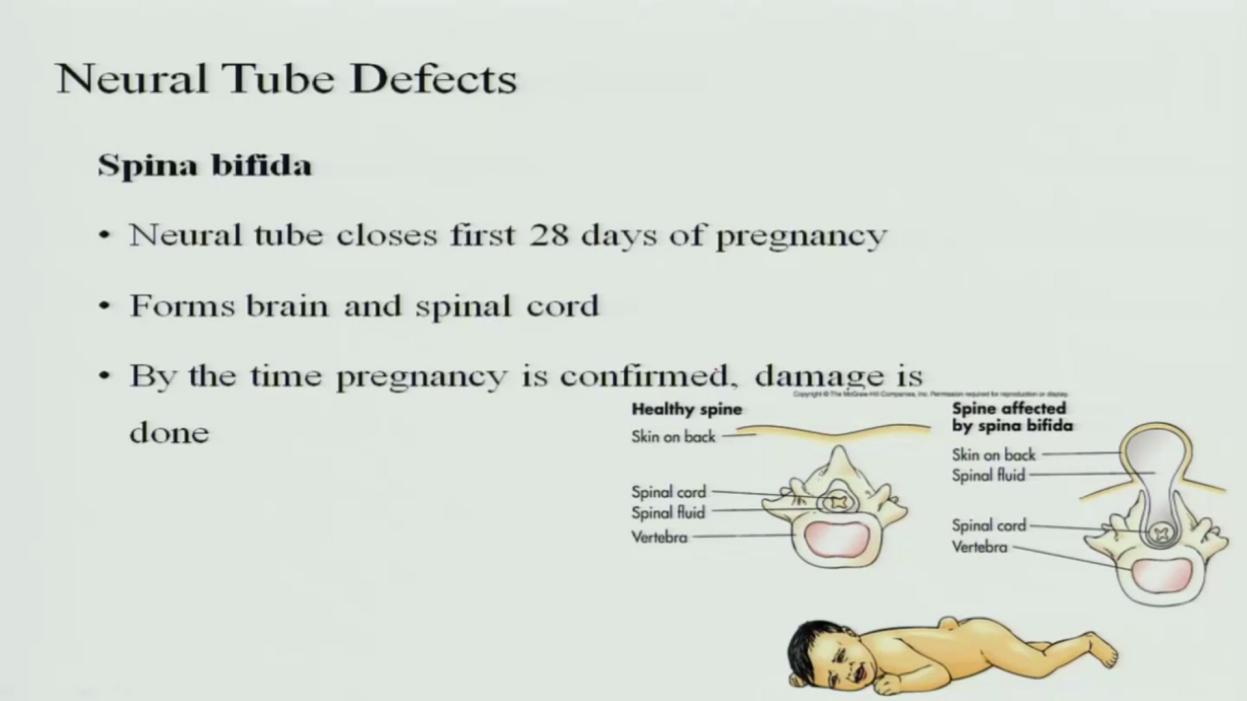


The next vitamin is the folate or folic acid. So this folic acid also acts as a coenzyme and it is involved mainly in the DNA synthesis and it is important for the anti-cancer drug and homocysteine metabolism, neurotransmitter formation, and folate, it can create the DNA, and because of this whole it plays an extremely important role in preventing the birth defects in the early pregnancy. That means it is a very important vitamin, which is important for the formation of myelin sheath in the nervous system. Therefore when the pregnant woman is deficient of folic acid, the myelin sheath is not formed and the spinal cord is, it almost comes out of the body which is called as the neural tube defect, and this happens in the first 29 days of conception after the woman becomes a pregnant. Then folate also helps to maintain the health of red blood cells, because folate is very important for the maturation of RBC's.

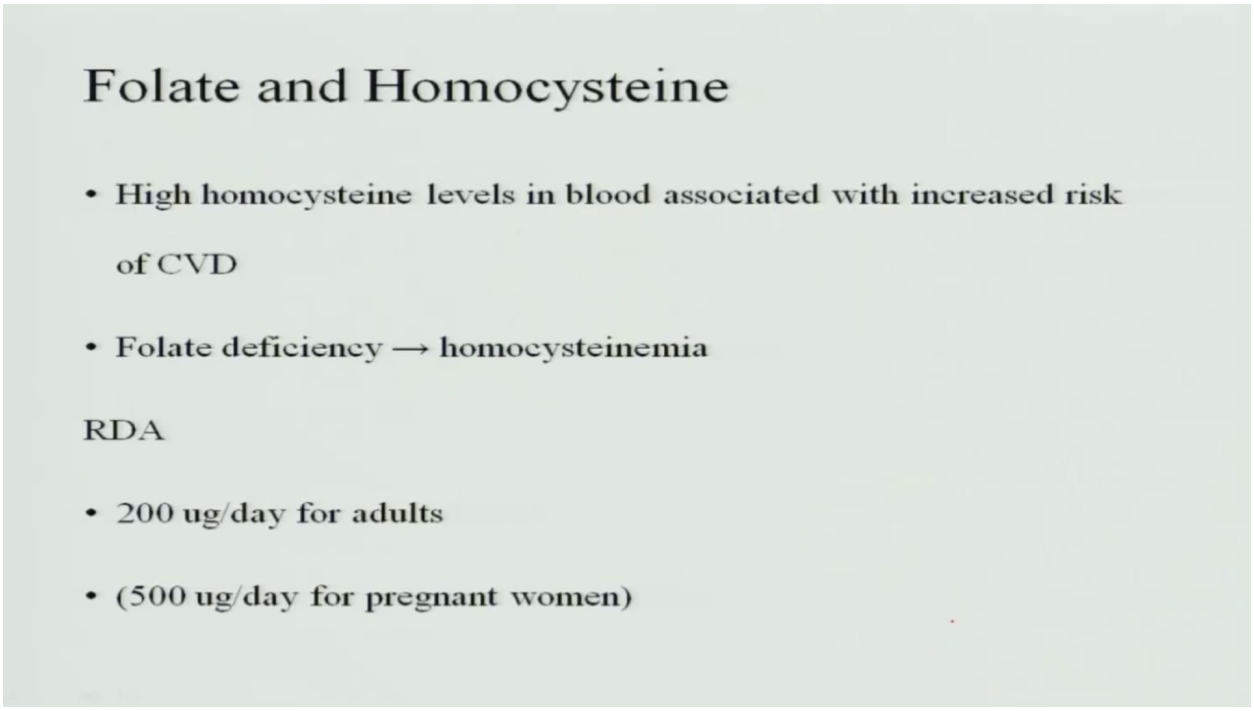


So after the RBC's mature they become smaller in size but during the stages of maturity at one stage the RBC becomes a bigger cell which is called a megaloblast, and if folic acid is deficient, the maturation stops at the megaloblast, and these megaloblast are circulated into the blood, therefore it causes anemia. By this the number of RBCs will decrease, therefore the hemoglobin carrying capacity will decrease, therefore anemia is caused because of folic acid deficiency.

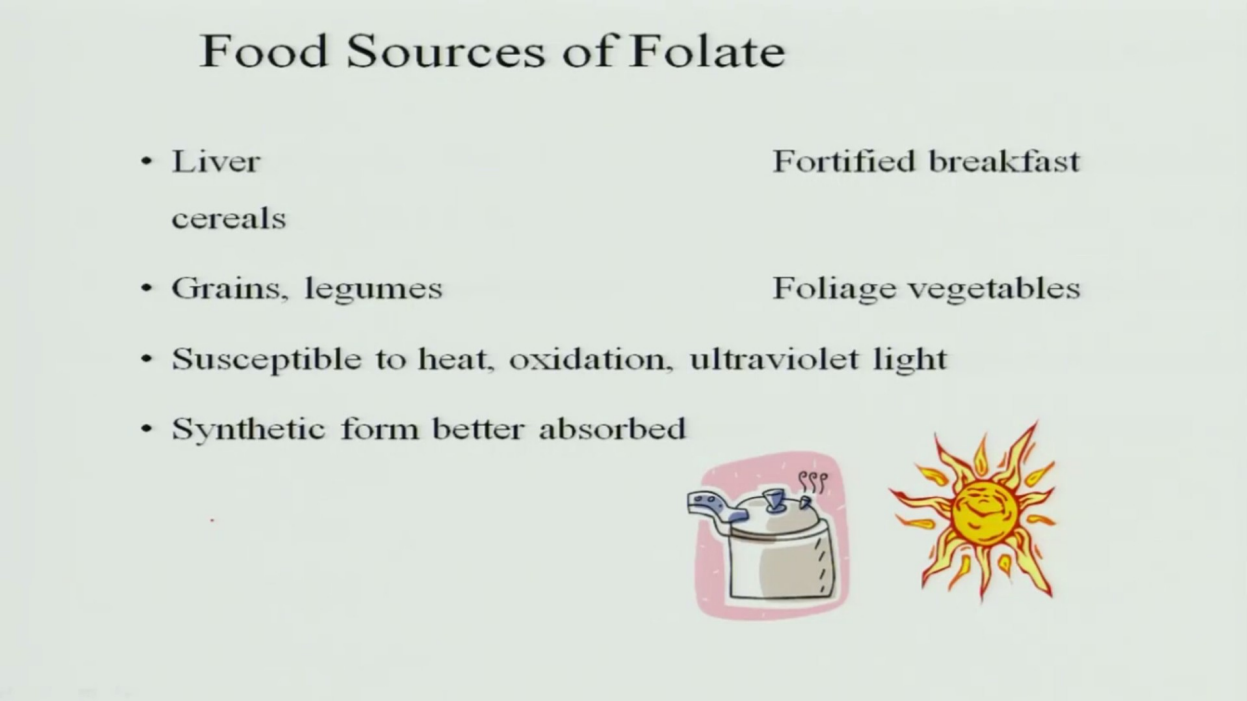
Then it also causes similar signs and symptoms of vitamin B12 deficiency and causes megaloblastic anemia, and in pregnant woman it causes neural tube defects in the newborn.



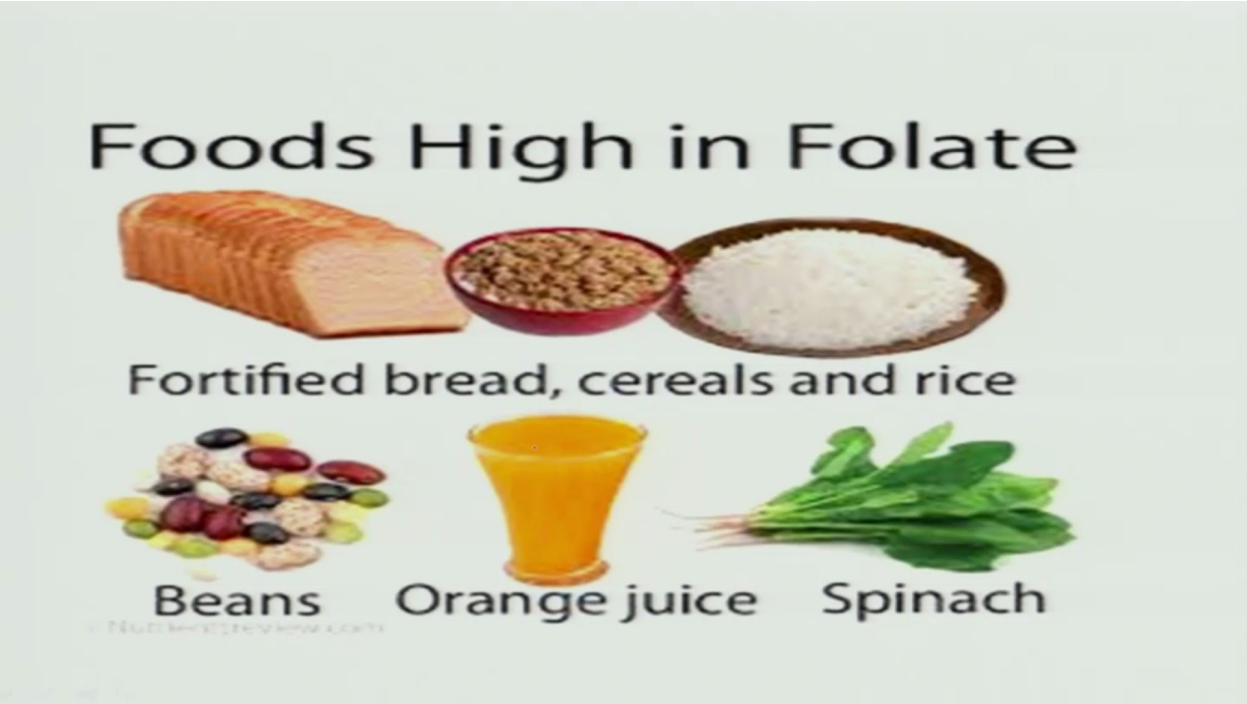
So these neural tube defects, the important one is the spina bifida. So as I told you, the neural tube it closes by the first 28 days of pregnancy. So the first initial period of pregnancy is very important, and the pregnant woman should be having sufficient amount of folic acid in her body before she starts her pregnancy. Then at this stage there is the formation of brain and spinal cord. So by the time the pregnancy is confirmed already the damage is done. You can see how the spinal cord is outside the body and the survival of this baby is very difficult. So the spinal cord, it comes out of that is there is no sheath over the spinal cord, so fluid comes out of the skin. So this is outside and in any time this can burst and the baby will die.



Now folate and homocysteine, the high homocysteine levels in the blood are associated with increased risk of cardiovascular disease. Now folate deficiency causes homocysteinemia. That means it also causes the defect of the homocysteine. Now RDA for the adults is 200 micrograms per day and for a pregnant woman, usually the folate supplementation is given of 500 micrograms per day every day for at least 100 days. So the best recommendation is from the adolescent age if the adolescent girl is given folate supplementations, then the folate deficiency, it can be avoided and healthy motherhood can be carried out.



Now for sources of folate, liver is the best source, then grains and legumes for breakfast should be fortified with folic acid, and for all the leafy vegetables are good sources of folic acid, but this is susceptible to heat, oxidation and ultraviolet rays. That means when the folic acid is exposed to light, it is oxidized, when it is heated it is destroyed, and when it is exposed to sunlight also folic acid is destroyed. That is why synthetic form is better absorbed, so folic acid is generally supplemented to the people who are deficient in folic acid.



Now foods high in folate are the fortified bread, then you have cereals, rice, and then beans, orange juice, spinach all these are very good sources of folic acid. Therefore, the folic acid is very important in maintaining the blood levels of RBCs and maintaining the body without going into a condition of anemia and very important for the neural tube defects in pregnancy. Similarly, we have seen how pyridoxine is important or pantothenic acid is important. So all these B vitamins play their own role with the limited amount that they are to be consumed, but have a great function in the body. Thank you.