agMOOCs

Water soluble Vitamins 4

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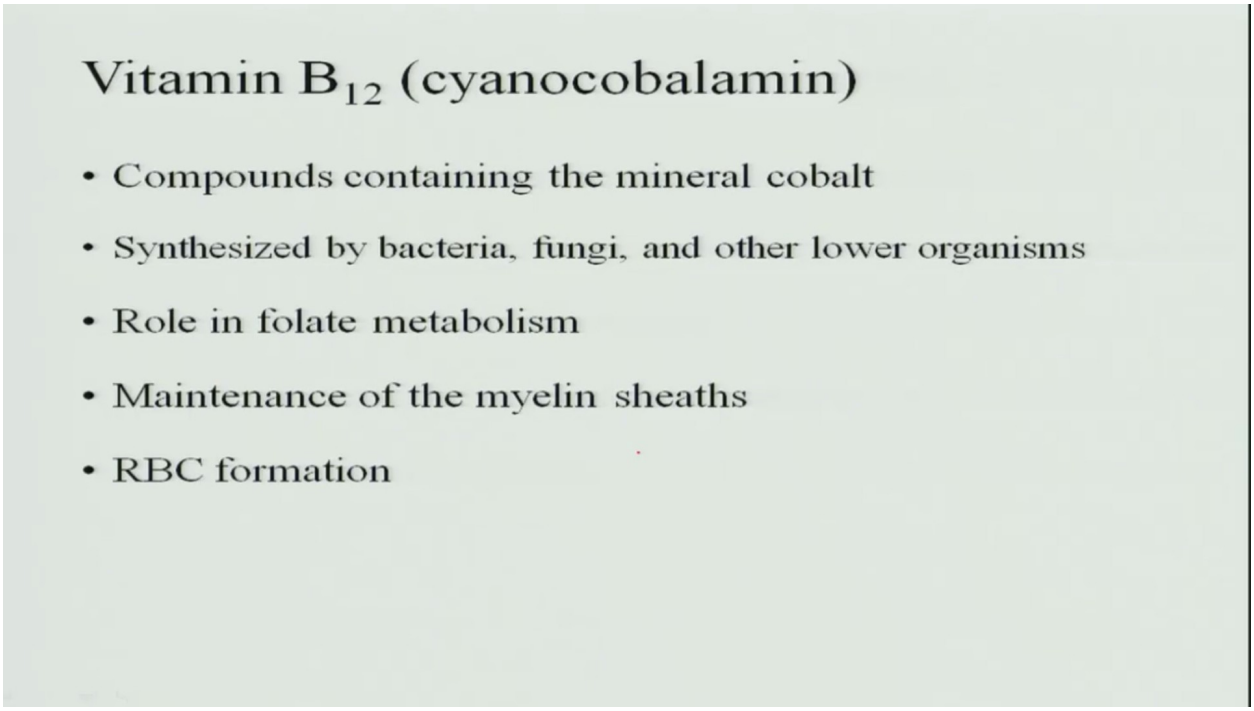
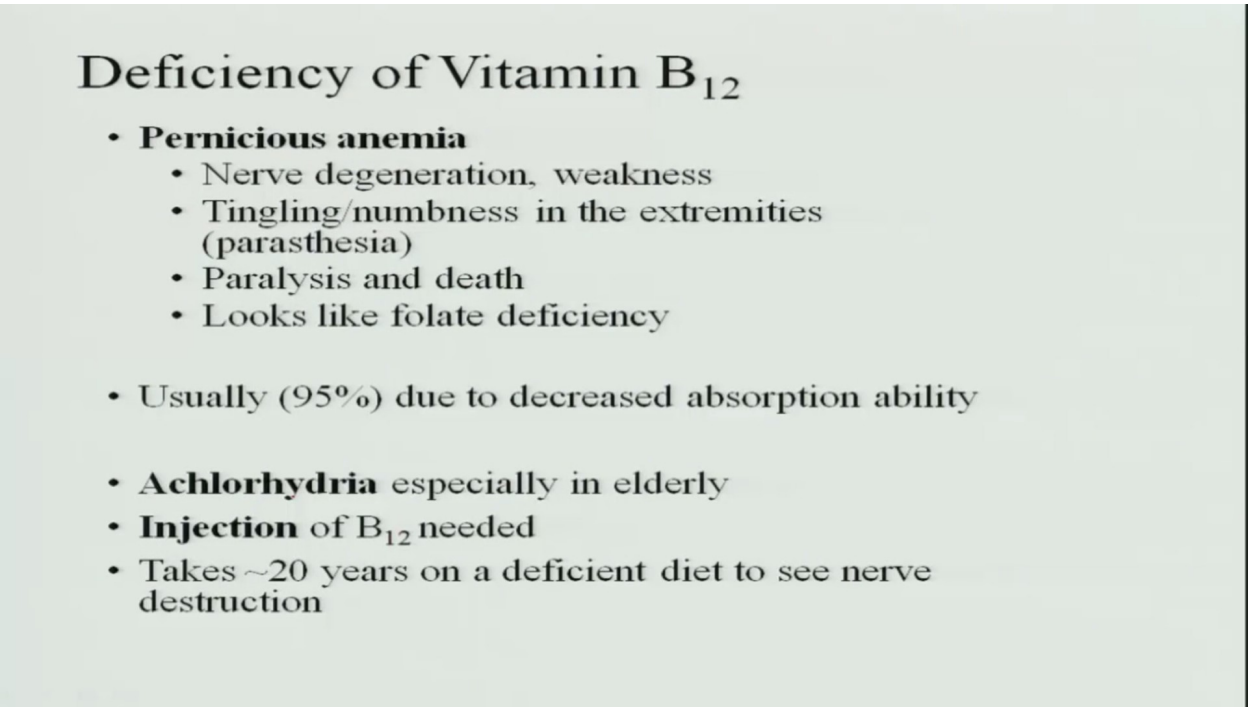
Hello everybody. Let us start our class again. Last few classes, we have been dealing with the vitamins, the fat-soluble vitamins and a few of the water-soluble vitamins and we have been seeing how they affect the body even with their small quantities, which are to be taken into our body. So let us see some more water-soluble vitamins today.



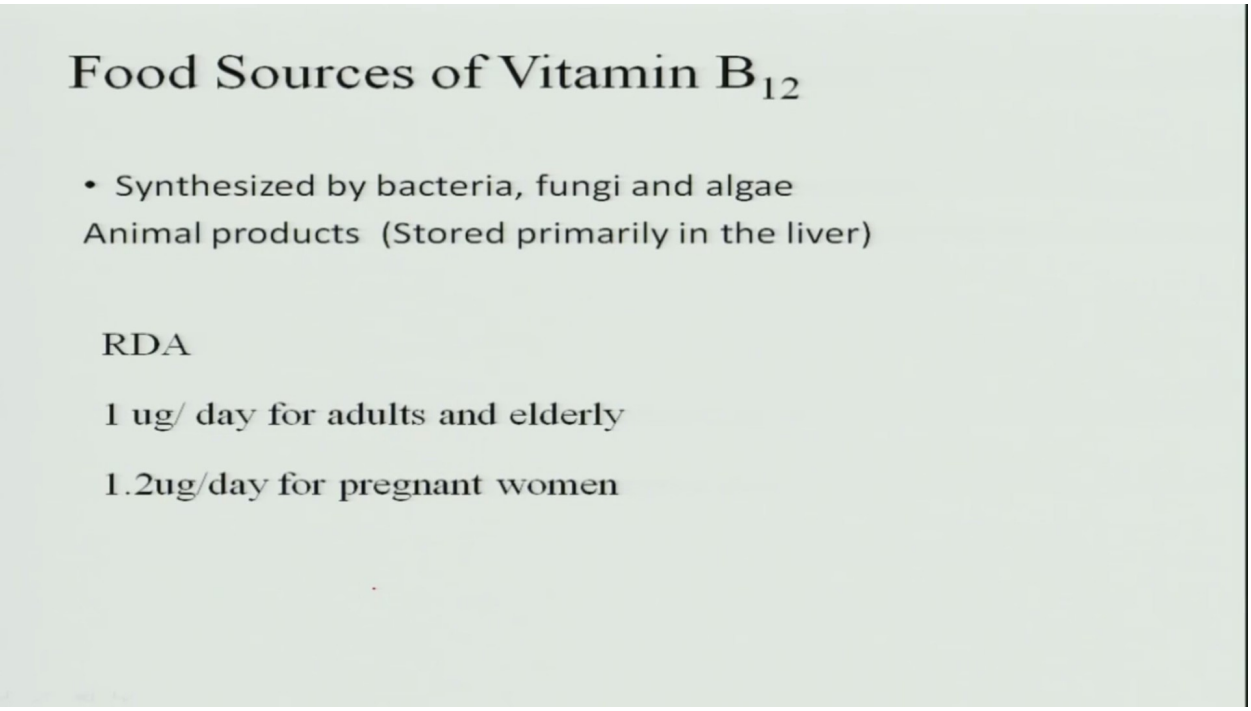
The vitamin b12 which is a very important vitamin called as cyanocobalamin, because it contains cobalt in its structure. So it is synthesize by the body, bacteria, fungi and other lower organisms, therefore it can be synthesized in the large intestine of our body. And the role of vitamin B12 is it plays an important role in folate metabolism or the folic acid metabolism, which we were talking about in the last class and maintenance of myelin sheath. Since folic acid is very important for the formation of myelin sheath, indirectly B12 also is very important for the formation of myelin sheath. This myelin sheath is present on the nerves. It is also very important for RBC formation, because vitamin B12 again is required for maturation of RBCs. So again, deficiency of my vitamin B12 will stop the maturation at the megaloblast stage, and the cells become larger, therefore the circulating number of cells will decrease. It causes anemia, which is called as pernicious anemia.



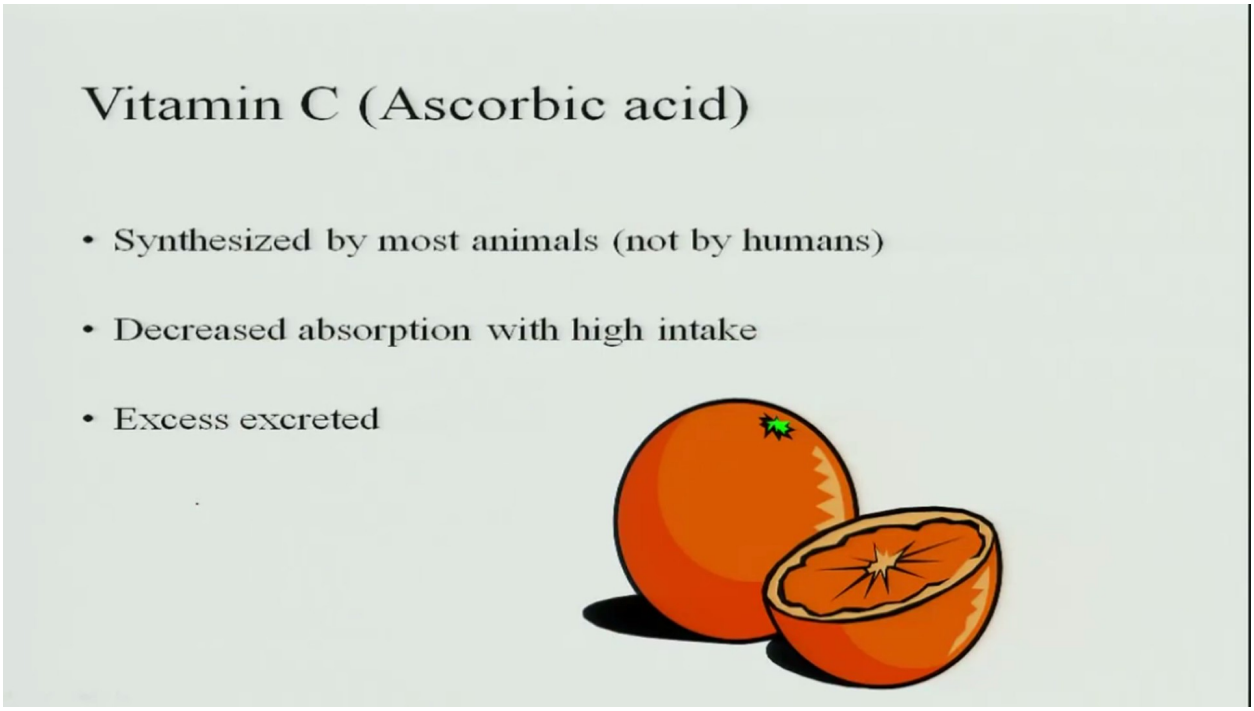
Now deficiency of vitamin B12, see this pernicious anemia. It causes now degeneration and weakness, because it is involved with the nerves, you get a tingling sensation or numbness in the extremities of the body. That means the ends of the hands and the toes, you have a tingling sensation and numbness, which is called as paresthesia. Then it may also cause paralysis and death. So the patients, it is similar to the folic acid, the symptoms also look similar to folate deficiency and you will not know whether to supplement folic acid or B12, therefore generally, both folic acid and B12 are supplemented. Usually, 95% is due to decreased absorption, because the vitamin B12 absorption requires an intrinsic factor. If you remember we were talking about it in the digestion, absorption and utilization of nutrients. So this intrinsic factor is produced in the blood, and because of the intrinsic factor, the vitamin B12 is bound. The intrinsic factor itself binds the vitamin Bb12 and takes it into the circulation. Therefore, when intrinsic factor is not produced in the stomach maybe due to some surgery of the stomach like gastrectomy or partial gastrectomy, intrinsic factor is not produced and therefore B12 is not

observed. So 95% of the deficiency is because of the deficiency of the intrinsic factor where absorption does not occur.

Then achlorhydria. Achlorhydria is when the gastric acid is not produced in the stomach. So it requires a medium of acidity also for absorption. So when gastric acid is not produced, that means not even little amount of gastric acid is produced, so this also causes B12 deficiency and this is generally seen in elderly people. So how to get the vitamin B12 into the body? So the only way is to get injections of B12 intravenously. So this is the only way to make up the B12 level in the blood. Now it takes almost 20 years for a deficient diet to see the effect on the nerves.

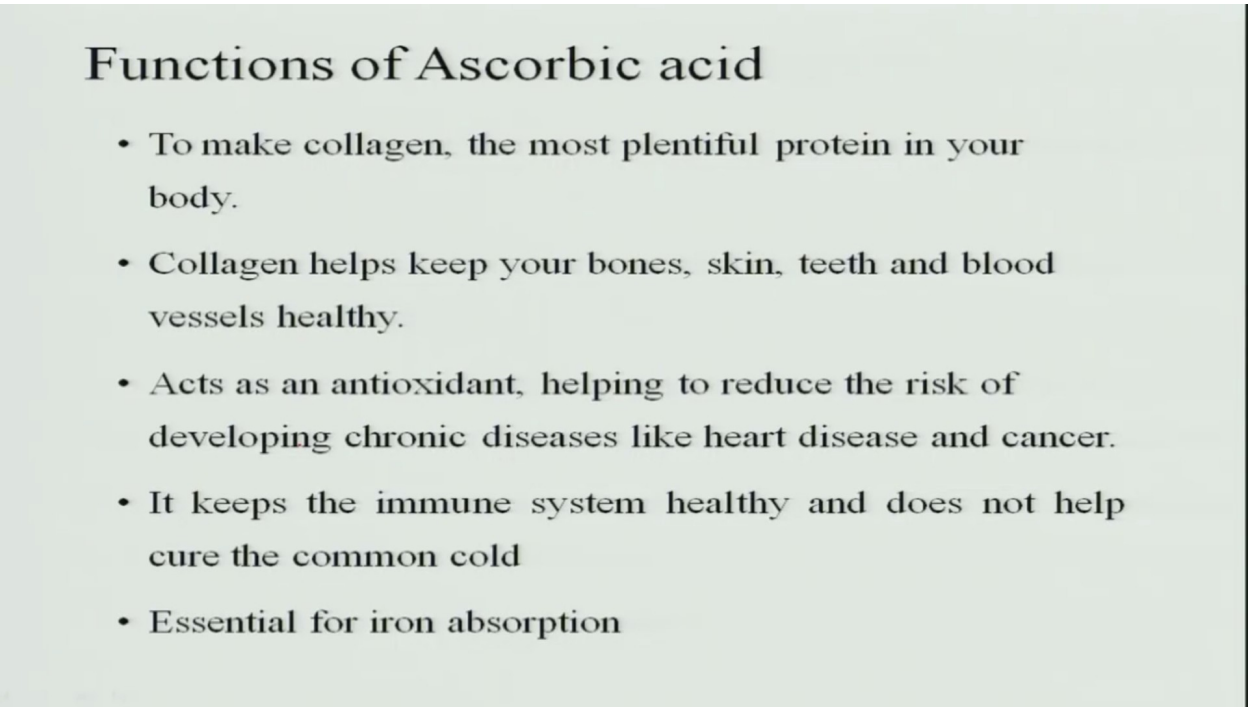


Now food sources of vitamin B12 so I this vitamin is synthesized by bacteria, fungi and algae, and since the absorption is taking place only in the stomach, though it is synthesized in the large intestine, the absorption does not occur, therefore there is no use of getting synthesized in the large intestines, and the main source of vitamin B12 is only animal products. So it is not available in the plant products. The animal products are the only source of vitamin B12. Therefore, in nonvegetarians the deficiency is very low, whereas vegetarians can find the deficiency more frequently. Now the recommended dietary allowance is 1 microgram per day for adults and elderly, and 1.2 micrograms per day in pregnant woman.



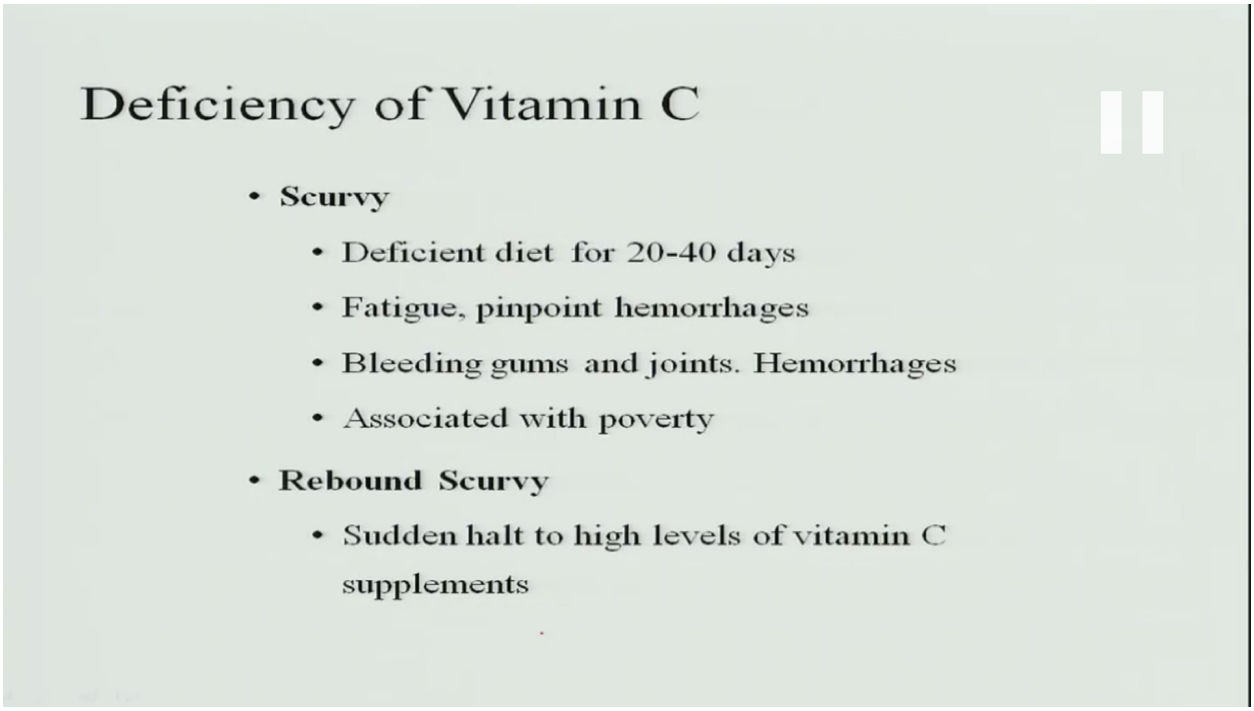
So these are the food sources of vitamin b12.

The next vitamin is vitamin C or it is also commonly called as ascorbic acid, and this vitamin is synthesized by most of the animals, but in humans it is not synthesized. So we have to supplement through diet. And decrease the absorption with high intake, so taking that vitamin D deficiency can cover you, if you take more -- the absorption will be decreased. And if it is an excess amount, since it is a water-soluble vitamin, again it gets excreted from the body.

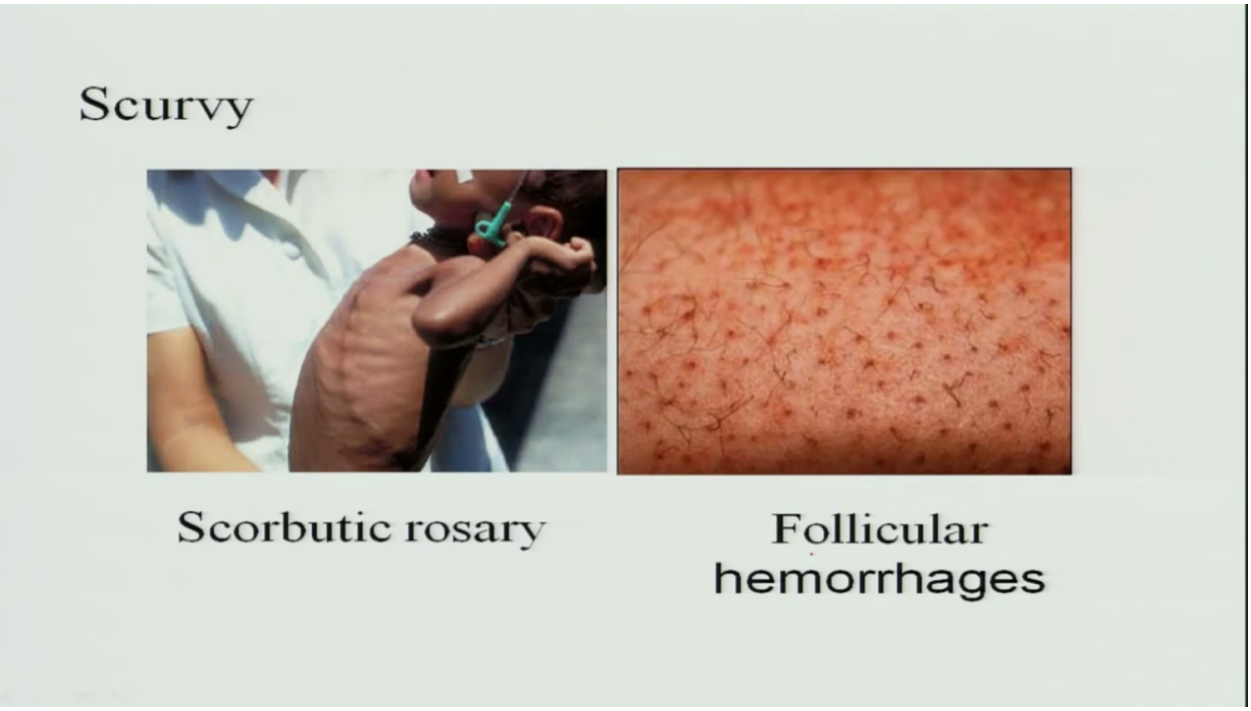


Functions of ascorbic acid, it is very important in the formation of collagen, and this collagen is the maximum amount of protein that is present in our body, and collagen helps to keep the bone, skin, teeth and blood, all blood vessels, everything, everywhere, every tissue in the body requires collagen, so to keep intact, collagen is required. Therefore, this collagen is based on the ascorbic acid and ascorbic acid is so important. And then ascorbic acid acts as an antioxidant, other than vitamin A vitamin E, ascorbic acid is another important antioxidant, so it helps to reduce the risk of chronic diseases like heart disease and cancer. And it keeps the immune system healthy, so generally what -- there is a folklore saying that you eat vitamin C, the cold will go, but the cold does not go with vitamin C intake, it happens because the resistance power is increased by taking vitamin C. That means the immunity is increased, therefore the cold producing bacteria will be inhibited.

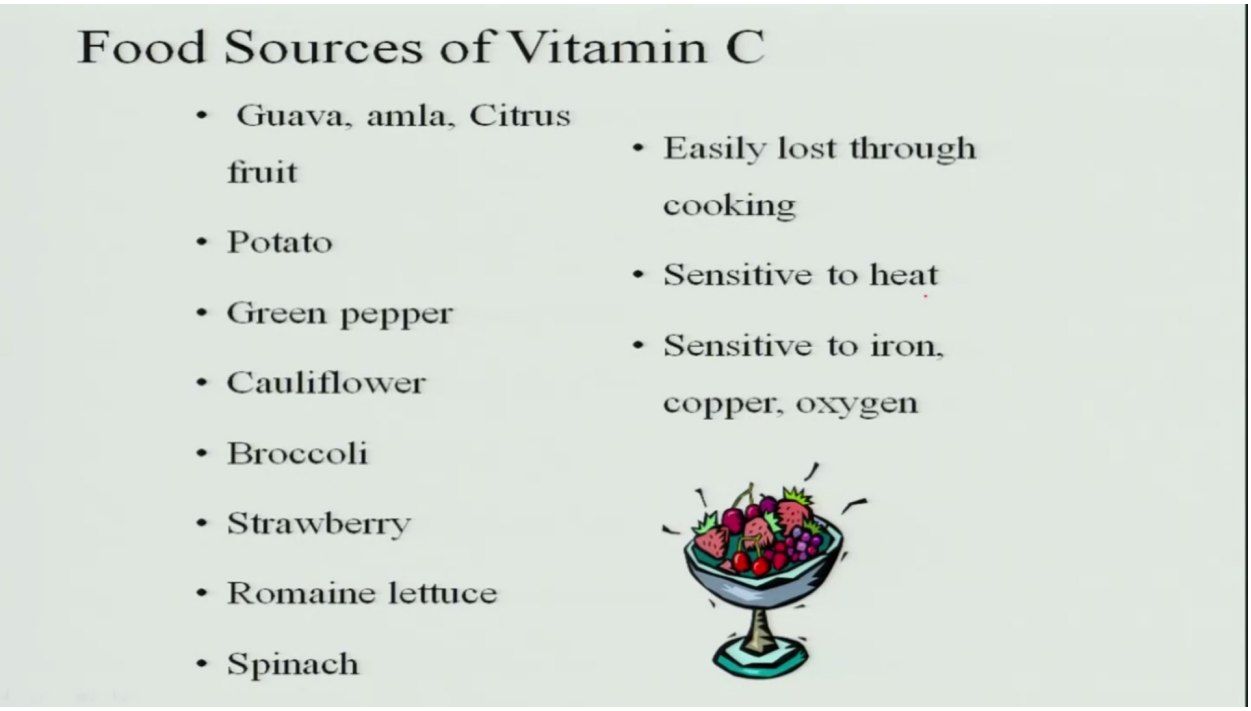
Then it is essential for iron absorption. When iron is taken alone, the absorption is very low. So iron requires an acid medium for absorption, therefore whenever a food rich in iron is taken, if you supply vitamin C along with it, the iron has to be converted from ferric to ferrous form in order to cross the boundaries of the walls of the intestines. So here vitamin C helps it to cross the layers of the intestine. So that is why vitamin C is very important in absorption of iron.



Now deficiency of vitamin C, it causes scurvy, and scurvy is very age old disease when it was recognized when during the Second World War, when all the people who were fighting have gone into a deficiency of vitamin C. Then they were just supplied with the lime and they have seen that the symptoms have gone. That means they have said that vitamin C is very important for the collagen formation and it starts bleeding if you don't provide sufficient amount of vitamin C. So deficient diet, if it is there for 20 to 40 days, then you can see the deficiency symptoms of vitamin C. So the symptoms are fatigue and pinpoint hemorrhages, pinpoint hemorrhages is you see all dot like hemorrhages, and you find red spots on the skin where there is breakage of the capillaries and the blood is seen under the skin. This is pinpoint hemorrhages. Then you have bleeding gums and joints and hemorrhages in many parts of the body, because the vitamin C is a very important nutrient for the collagen formation in the body. And I told you, collagen is present in almost every tissue of the body. Then it is this, generally this is associated with poverty. And rebound scurvy is when there is a sudden halt of vitamin C and you give a high levels of vitamin C supplements, there is -- the scurvy is again rebound. This is also an important factor that you cannot give high amounts of vitamin C for treating the scurvy.



so scurvy looks like this, it again causes beading of the ribs. So why we have seen in the vitamin D deficiency where it looks like a necklace, but here it is the opposite way where the beading is there and this is called a scorbutic rosary, whereas in vitamin D we call it as a Rickettsia rosary, and you can see the follicular hemorrhages, wherever the hair follicles are there, you can see all, the points of the blood coming out, so that is follicular hemorrhage caused because of vitamin C deficiency.



Now the food sources of vitamin C, we don't have to find out very rich sources to have vitamin C. Our simple guava and *amla* are very rich in vitamin C, so you have one guava per day, you can meet the vitamin C requirement. Then you have all the citrus fruits are rich in vitamin C and potato when you eat along with the skin, boiled potato along with the skin, then you get vitamin C, and then green pepper, cauliflower, broccoli, strawberry, then lettuce and spinach all these are good sources of vitamin C. But vitamin C is lost very easily through cooking. So it gets oxidized and it is sensitive to heat and sensitive to iron, copper and oxygen. Whenever you cook in iron vessels or copper vessels and when it is openly cooked, all these stages the vitamin C is lost.

These are the rich sources of vitamin C.

RDA for Vitamin C

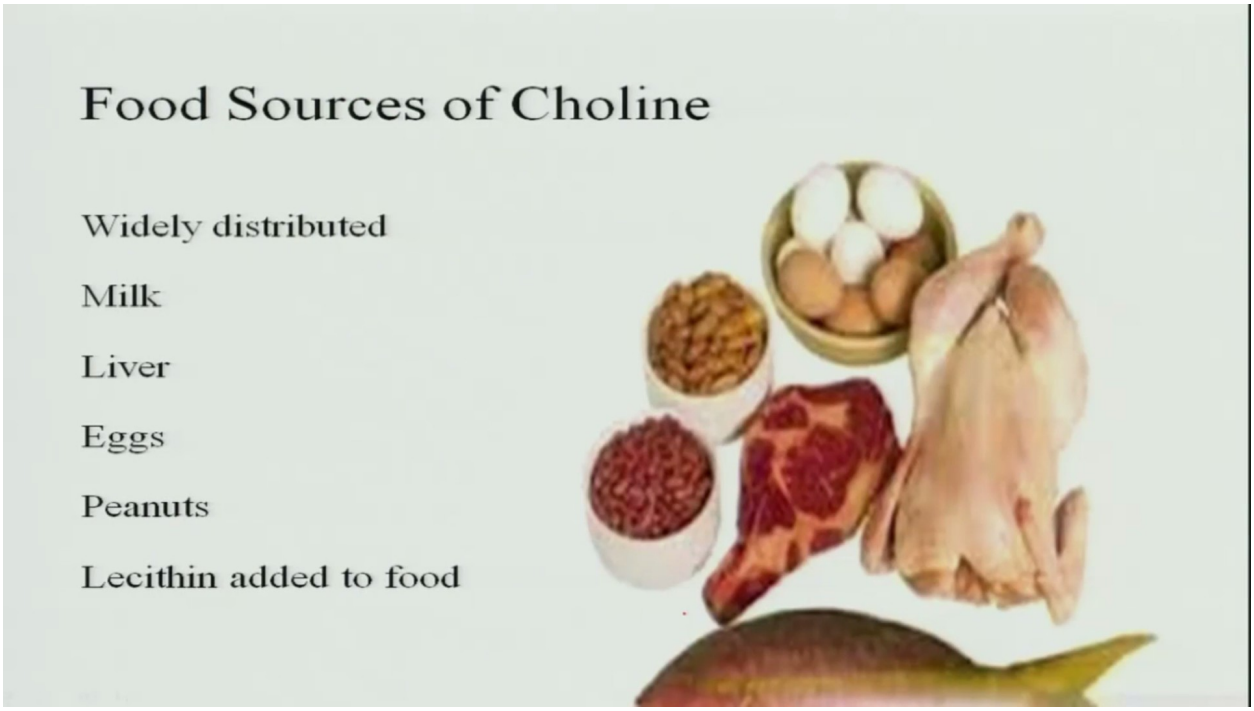
- 40 mg/day for adults
- 60mg/day for pregnant women

Now recommended dietary allowances for vitamin C, they have recommended 40 milligrams of vitamin C per day, but actually the amount that is required is very less. It is only 10 to 20 milligrams per day, but taking the cooking losses, the oxidation and all into considerations, they have given as 40 milligrams so that at least that 10 to 20 milligrams is absorbed into the body, and for a pregnant woman, it is 60 milligrams per day.

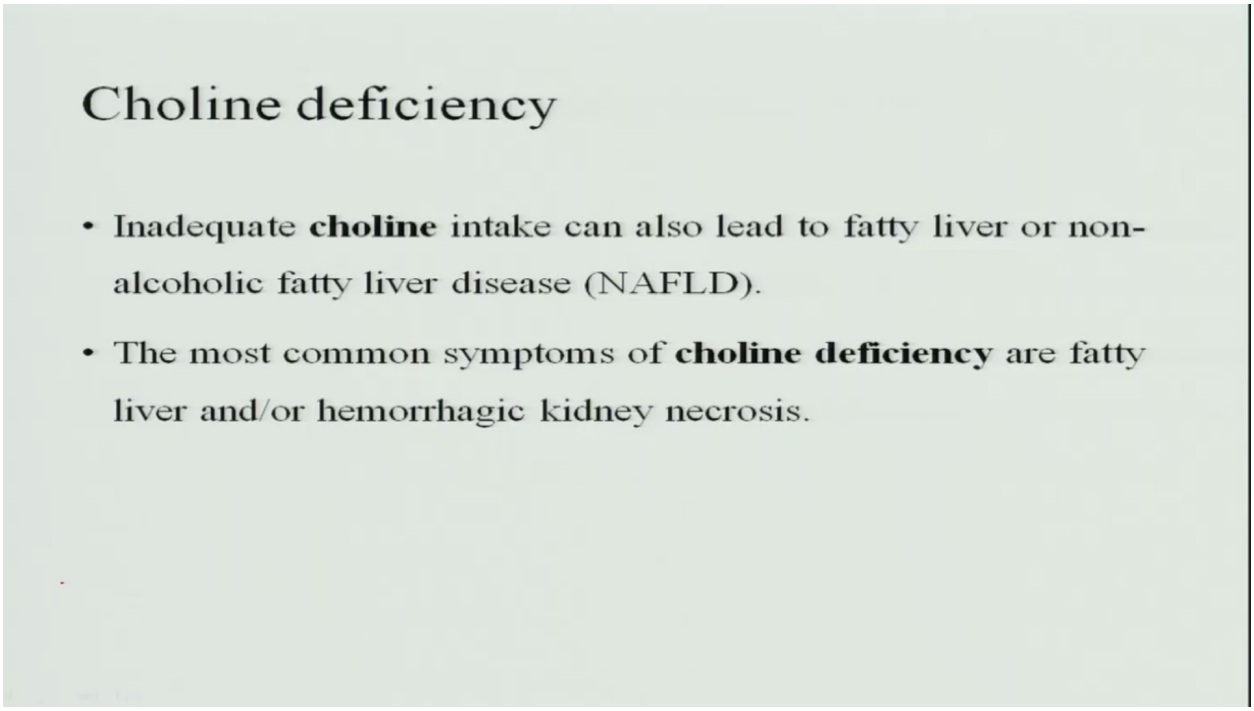
Choline

- Newest essential nutrient
- All tissues contain choline
- Precursor for acetylcholine (neurotransmitter)
- Precursor for phospholipids
- Some role in homocysteine metabolism

And the last term B complex vitamin is choline and this has got a lot of importance in the latest days. It is the newest essential nutrient. They have recognized that it is also one of the essential nutrients. All the tissues again contain choline and it is a precursor for acetylcholine. Acetylcholine is a precursor, I mean it is a neurotransmitter, which is very important for the contractions and relaxations of the sphincters and closure of the sphincters, therefore it is very important, and this is a precursor for phospholipids. Phospholipids again are present in the brain and some role in homocysteine metabolism.



Now the food sources of colon it is widely distributed present in milk, liver, eggs, peanut and lecithin that is added to food, and this lecithin is present in egg, egg yellow contains lot of lecithin. So when you add egg, you can get choline.



Now deficiency of choline. It can also lead to a fatty liver, deficiency can lead to fatty liver, and this fatty liver is called as non-alcoholic fatty liver disease, because generally when alcohol is consumed in large quantities, people have the tendency to develop fatty liver, but here with choline deficiency, you can get non-alcoholic fatty liver disease, and the most common symptoms of choline deficiency are fatty liver and hemorrhagic kidney necrosis. That means the cells of the kidney die and they have hemorrhage.

So this is about the vitamin C and the choline. Those two vitamins are very important in the body. Since vitamin C is present in all the tissues as collagen and if this is disrupted, then there is hemorrhage, and you have seen that choline also causes hemorrhage and fatty liver in the body. So we have seen all the water-soluble vitamins, starting from the vitamin B12 the choline along with the vitamin C and these are essential, whatever is the requirement the body takes up, and the excess amount is excreted from the body. Generally, there is no toxicity, but sometimes some of the B complex vitamins have toxicity, but that is very rare, and the occurrence of these B complex vitamins in food is very common, and if one has a balanced diet, one can get all the B complex vitamin in the diet without any deficiency symptoms. Thank you.