

**Course Name: Adolescent Health and Well-being: A Holistic Approach**

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Lecture 13 - Common Micronutrient Deficiency in Adolescents

Hello everyone. Let us start today's lesson that will be on Common Micronutrient Deficiency in Adolescents. In this lecture I will try to cover various micronutrient deficiencies which are very common in adolescent age group like iron, calcium, vitamin D, zinc, vitamin B12, iodine. Their function in our body, signs and symptoms of deficiency, daily requirements in adolescent age group as well as the dietary sources. There are certain keywords like anemia, osteoporosis, hypothyroidism, recurrent infections, scurvy and rickets. We will have a little bit idea which will be beneficial in our day-to-day life.

Now the first concern is why micronutrient deficiency is very common during adolescence. As I have already told that this is the phase where the physical, psychosocial and cognitive development occur. You know that final 20 percent of the height of an individual he or she gains in this age group and the 40 percent of their body weight usually nearly you can say 50 percent of their body weight they can gain during this age group. So, you can imagine that how important this phase is and how important you need to require the adequate nutrients. But many of the time there are several behavioral problems or rather you can say there are several eating habits we can see in the adolescence that hamper the nutrient intake like irregular meals and snackings, skipping meals, consumption of junk food or processed food and following the alternative dieting pattern.

It is a fashion nowadays that people think if I do dieting or if I take certain specific diet that may lead to decrease weight or maybe in that way we will be healthy. Like the keto diet, like the vegan diet many of the time it is helpful, but not in the adolescent age group. This age group is a certain age group that you require a balanced diet. And if you do not get that balanced diet then definitely there will be the deficiency of micronutrients mainly you can say those are iron, zinc, calcium, vitamin D, vitamin B 12, folate and iodine.

Now, we will see that what is the role of iron in adolescent age group. As you already know that this is a major component of hemoglobin and myoglobin. Myoglobin helps in carrying the oxygen from lungs to different parts of our body and myoglobin helps in the transports

and storage stores oxygen in the muscles and cells. And finally, it helps in growth, brain function, memory and concentration. It also help in cellular function and various hormone synthesis. So, it will be helpful in energy production and also the formation of myelin. Myelin is nothing, but the insulation layer of the nerve and it helps in strong immunity and improve the gut health. You know that 70 percent of our iron in body that we get in RBC and that is a red blood cell. And 25 percent stored as a ferritin in liver, spleen and bone marrow and 5 percent remain as the protein component. And you already know that what is the functions of the protein that it is required for the formation of a muscle mass and many other function it occurs in our body. The causes of iron deficiency that you can say that the major cause is the poor intake or poor absorption in the rapid growth phase. Worm infestation, bacterial, viral infection that is another cause. Blood loss during menstruation, it usually happens in the girl child. Lead poisoning is another cause of iron deficiency because that can decrease the production of hemoglobin. Excessive destruction of red blood cell due to malaria.

You know that iron deficient mother will give rise to iron deficient baby. Nowadays, many of the countries we have seen that adolescent girls or rather you can say we are facing the teenage pregnancy. Our body is not at all developed or our body is not very much developed to get the burden of that pregnancy. And in that stage means in the teenage, if you have less iron or you have anemia, then definitely that effect will come to your baby.

Now here are certain signs and symptoms of iron deficiency like brittle nails, spoon nails, pale skin, swelling of tongue, weakness, shortness of breath and tired. Mainly the females during this age group feel that all the time they are tired, they don't get energy to do a simple work. So do not ignore that thing, do not ignore that symptom because it may be that you are having the anemia, you are having less hemoglobin. You may have depression because in the absence of iron there may be less production of dopamine. And whenever there is less production of dopamine that may lead to depression because it is one of the hormone called happy hormone. Lack of attention, developmental delay also we will get if there is iron deficiency. And you know if you do not have the concentration in your work, then definitely it will hamper your learning and working performance.

Another symptom we get usually in the children that is the pica that is the inedible substance they use to take in case of iron deficiency like soil. In case of iron deficiency anemia, it will lead to impairment of the immune response and also it decreases the resistance to infection. Here are the pictorial presentation of signs and symptoms of iron deficiency. Try to remember those things because many of the thing you can face or maybe you are facing in your day-to-day life and you do not know that what is the reason for this.

Now here are the sources of iron. You should remember one thing that sources of iron can be of plant source or can be of animal source. But plant source iron they usually very difficult to absorb in our body. And the animal source they are very much well absorbed in our body. In some culture and customs people are vegetarian. So, you should know that what are the plant sources of iron. Here are the sources I have given, you can see that green leafy vegetables, lentils and fruits those are the very good sources of iron. But one thing you

should remember that caffeine and phytates that decrease the iron absorption. So, whenever you are taking your meal even if you are taking a large quantity of these food content what I have shown here but after that you are taking tea or coffee within half an hour or within 1 hour. Then the absorption of that iron will be less even if you are taking the adequate amount. Because this phytate and caffeine and also the tannin that actually decrease the iron absorption in our body. So, remember one thing that whenever you are taking the meal try to avoid tea and coffee 1 hour before and after of your meal consumption.

Now here are the very good sources of iron those are called the heme iron; these are the animal source iron. They are easily absorbed by our body and you can get this animal source iron in the meat, chicken, liver and kidney of the goat. These are the very good sources of iron. If anybody is suffering from iron deficiency anemia, he or she can take that and his or her iron content or hemoglobin content will be increased very easily. Now, there is certain factors which can inhibit iron absorption. But definitely there is certain thing which can increase your iron absorption like the vitamin C. Certain foods I have shown, where you will get that vitamin C like amla, cabbage, drumstick leaves, coriander leaves. If you add these things in your every meal then definitely that will be helpful to increase your iron absorption. Now, what is the requirement of iron in 10 to 15 years of boy that is 16 to 22 milligram. Whereas, in girl because of their loss in the menstruation they need more that is 16 to 30 milligrams. The adult male they require 19 milligrams and females they require 29 milligrams. If the female is lactating or pregnant, she requires more iron.

One national health program is running in our country that is the WIFS or the weekly iron folic acid supplementation. This is for the frontline health worker; they should know that every week they are providing a iron folic acid tablet that is the 100-milligram elemental iron and 500 microgram folic acid to the adolescent girl through ICDs or the Anganwadi Center. And their approach is the fixed day. It is a very important initiatives taken by our government. And another thing I have shown you that if there is worm infestation there is a chance of iron deficiency is more. So, biannual albendazole that is the 400 milligram that means, the 6 months apart albendazole to be given to the adolescent boys and girls to control of worm infestations. The information and counseling to improve the dietary intake should be given to the adolescents and also the screening of the target groups to the moderate and severe anemia. And then you should refer to the appropriate health facility. Here is how can you diagnose that what is the moderate or severe anemia according to WHO if the hemoglobin level is 12 milligram per dl means hemoglobin is less than 12 milligram per dl then we are calling it that anemia in adolescents. And if you are getting less hemoglobin in the adolescent age group then definitely you have to think of that he or she is suffering from anemia. You should send them for the proper counseling for their dietary intake and also their different dietary habits that is hampering their intake of iron or hampering their increase intake of iron.

Now, vitamin C is very important. It is coming hand in hand with the iron. what is the function of vitamin C in our body? It helps in the synthesis of collagen and you know this

collagen holds the bone muscle and skin together. It helps in the recovery after muscle and skeletal injury. It helps in healing of wounds. It is helpful to get a healthy skin, it acts as an antioxidant because it protects from free radical injury and reduce the chances of several cancer, diabetes mellitus, heart disease and cataract. So, it improves the immune system. Nothing to tell very detail because already you have an idea due to the Covid era that vitamin C you need to take more. But remember that vitamin C supplementation should not be the first choice. Because the absorption of vitamin C through the supplementation is less than the absorption you are getting from the natural food. So, try to get vitamin C from the natural food rather than the tablets or capsules like supplements. It is helpful in bone formation, also it is helpful in hormone synthesis like dopamine, adenine, noradrenaline and helpful in non-heme iron absorption.

If there is deficiency of vitamin C then definitely there will be certain symptoms or signs. In the earlier phase you will face uneasiness, fever, fatigue and further if there is more vitamin C deficiency then swelling and bleeding in the gum, loosening of teeth, poor healing of wound, bruised over skin this is nothing, but the scurvy. Also, there will be swelling and pain of joint, hair become dry and coiled, there will be mood changes, the poor immunity and the iron deficiency anemia. So, if the deficiency of the vitamin C occurs first and foremost thing you should remember that your immunity will be low, you can acquire the infections very easily and if there is prolonged vitamin C deficiency then there is a chance of scurvy in the people. The requirement of Vit c is 45 to 75 milligrams in adolescents. So, the fruits and vegetables those are guava, gooseberry, Bengal currant, Indian zucchini and the raw mango these are very good source of vitamin C or also you can get vitamin C in orange, lemon, sweet lime, leaf of drumstick, amaranth, agathi, fenugreek and vegetables like tomato, cabbage, capsicum, bitter melon and peas. So, try to have more and more of these fruits and vegetables in your meal then you will get adequate amount of vitamin C. Now you should remember that this is a very heat sensitive vitamin. So, avoid reheating, try to do the cooking like steaming, sprouting. Low flame cooking is also recommended and try to avoid loss in boiling in a large amount of water then you are draining that water then the vitamin C content will be less in your food. Try to avoid prolonged refrigeration and prolonged sunlight. So, your main aim will be to consume the raw fruits and vegetables and remember before consuming the raw fruits and vegetable just wash those fruits and vegetables under a running water. So, you will get the larger quantity of vitamin C in food.

Next comes calcium. Already you know that this is very important for the development and maintenance of our bone. It transfers the nerve signals in the body, helps in the muscle contraction and movement. Stopping of blood flow after a cut also is a major role of calcium. It helps in the secretion of some hormones like insulin and adrenaline and finally, it is helpful for maintaining our body weight, our blood pressure and to maintain a good or healthy heart. And you know 99 percent of our calcium remains in the bone and teeth and 1 percent in the blood. Now, if there is deficiency then what will happen? It will hamper our physical and cognitive development. You will face the muscle cramps, numbness and tingling in fingers. There will be mental confusion, irritability, dry skin, brittle nails and tooth decay and children they will suffer from rickets. Because in if there is the calcium and vitamin D

deficiency then we get rickets in children like sunken ribs, protruding forehead, bow shaped and bent leg, short height, burdening of wrist, elbow and ankle joint, muscle pain, irritability, increased sweating etc. All these symptoms will be found in the children. And if there is prolonged calcium deficiency then definitely in case of adult, we will get osteoporosis that is the decreased bone density. Bones become fragile and prone to fracture, there will be stooped posture, loss of height and back pain. So, you can see that for our normal development even if we do not have any mental problem, we do not have any difficulty in our bone, we need to take calcium in our diet adequately.

So, what are the sources of calcium? Milk and milk products are the best source of calcium like you can take cheese, curd, paneer and khoya. Daily requirement is 800 milligrams. And many of the time doctors can advise more amount of calcium depending on the requirement. And the dried shrimp, Bombay duck, lobsters, these will also give you a good amount of calcium. Then if you come to the vegetable sources like flax seeds, thill seeds, sesame seeds, poppy seeds, almond, walnut, can give you some amount of the calcium. Now, the leafy vegetables like amaranth, drumstick, fenugreek, radish leaf; they can also provide you the calcium. And here also you need to remember that our consumption of tea, coffee and cola hampers the calcium absorption because the caffeine in this tea, coffee and cola that increase the calcium secretion through kidney. So, the availability of the calcium in the body will be less. There are certain cooking method that increase the absorption of calcium in our body like soaking, sprouting, boiling, roasting, fermentation. So, you can practice these while you are cooking then it will be helpful to increase the amount of the calcium intake through the diet.

Now, comes vitamin D. Vitamin D is very important for controlling the respiratory tract infections and reducing the inflammation. It is helpful because it increases the insulin sensitivity, it maintains a good heart health, helps in cell division and also helpful in the brain development. You should remember that not only the growth and development, it also helps in the prevention of some cancers like colon, prostate and breast. Now, if there is deficiency in the diet then what we will face or what the symptoms or signs you will find? Multiple sclerosis it is a condition where there are the disruptions of the nerve covering. It will hamper the communication between the brain and the body, it affects the brain, spinal cord and optic nerve. Again, like calcium if there is vitamin D deficiency the children will face the signs and symptoms of rickets and in the adolescents and adults Osteomalacia occurs. Osteomalacia that means, the weakening and softening of the bones and the bones become prone to fractures, pain in the back, hips and legs, muscle weakness and spasms. And there will be mood swing and you will face that all the time you will feel weak and tired. Vitamin D deficiency is very much common in the pregnancy, if occurs then you then the low-birth-weight baby will be borne.

Now, here are the sources of vitamin D. You should remember that our body can produce vitamin D through the sunlight if you are getting the adequate sunlight. So, what is the meaning of this adequate sunlight? The UVB rays of the sunlight that can generate vitamin D in our body. So, how will you get that UVB rays? Exposure to 15 to 20 minutes at midday

sunlight preferable 11 am to 2 pm and that is adequate to produce the vitamin D in our body. But the dark skin people they need to require to stay in the sunlight for 3 to 5 minutes more. And you remember one thing that if you are staying indoor then the glass blocks the UVB rays and your body will not produce vitamin D. Daily requirement of vitamin D is 600 international unit or 15 micrograms. The best source is the fish that is the sardine, herring, pongfret, salmon and cod, prawn, egg yolk, chicken liver also give you the adequate amount of vitamin D. There are certain foods as vegetable sources like mushrooms, soyabean, finger millet, sesame seeds that can also give you vitamin D in diet.

Next comes the role of zinc. Zinc is an essential component of metabolic functions means it is a component of some of the key cell enzymes. It plays an important role in the immune system, growth and sexual maturation that is important in this adolescent age group. But why we get zinc deficiency because of our inadequate intake, malabsorption, increased requirement, losses and impaired utilization. Here are the certain food sources. The dietary zinc will get in meat, poultry, fish, nuts, seeds, legumes and whole grain cereals. Whereas, the animal sources they have higher bioavailability than the plant source and the plant source contain fiber and phytate that actually inhibit the zinc uptake by the intestine.

Vitamin B12 is very important in adolescents. Role of vitamin B12 is proper red cell formation, DNA synthesis, prevent neural tube defect along with folate and choline, brain development that is for memory and learning ability, growth repair and production of new cells. And why there is vitamin B12 deficiency? Because there may be that you are suffering from pernicious anemia. In case of pernicious anemia there is lack of intrinsic factor. This intrinsic factor is required for the absorption of vitamin B12 in our intestine. If there is inflammation of the intestine, if there is gastric bypass surgery, intestinal worm or insufficient intake; all these things lead to deficiency of vitamin B12 in our body. Now, there are certain signs and symptoms you may be facing or even the parents can look for that your child is suffering from these signs and symptoms or not. Like soreness of tongue, mouth ulcers, inflammation of stomach, megaloblastic anemia that means, the pallor, fatigue, shortness of breath, reduced appetite, diarrhea, jaundice, severe deficiency can lead to damage of the neuron sheath and that ultimately affect the nervous system, delay the mental and physical development, difficulty in learning and attention, lack of concentration and the person may suffer from depression and there is a risk of heart disease in the later life.

Now, here are the sources of vitamin B12. You should remember the daily requirement is 2.2 microgram and it increased in pregnancy and the lactation. Mainly the animal source like fish, chicken, egg, meat, shellfish, milk and milk product and here you should remember that the people who are vegetarian they many of the time they are suffering from vitamin B12 deficiency. Because there is very little source of vitamin B12 based on the plant. Some vegetables like lentils or chana may provide little amount of Vit B12. There are certain cooking method by which the content of the vitamin B12 increased in the vegetable diet like sprouting, fermentation, soaking and roasting, but you should remember the people who are vegetarian they have a more chance of having vitamin B12 deficiency and the doctors or

the practitioners they will get the megaloblastic anemia if they see the blood picture of them.

Now, another important nutrient that is the iodine and it is essential for growth and development. It is stored in the thyroid gland where it is used for the synthesis of thyroid hormones. Thyroid hormones actually is very useful to regulate the protein synthesis, enzyme activities in the muscles, brain, heart, kidney and the pituitary gland and iodine deficiency causes mental retardation and hypothyroidism. There are certain sources of iodine like iodized salt and fish are the richest source and the eggs, meat, milk and milk products, cereal grains, dried foods also give iodine through your diet, but here also I want to tell you some tips of cooking. Iodine is another micronutrient that can evaporize during the time of heating. So, whenever you are mixing salt to your food then try to mix the salt at the end of your cooking. It will retain the iodine content in your food. If you put the salt at the initial phase of the cooking then the most of the iodine will be evaporated when you will finish your cooking. Try to remember these small tips when you are cooking.

Here are my references and with this I want to conclude this session.

Thank you all and happy learning.