

Sports And Performance Nutrition

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Lecture-12: Water soluble vitamins

After understanding macronutrients which are foods that we eat in larger portions which is carbohydrates, proteins and fats we come to the next major sub topic which is micronutrients. As the name suggests micronutrients are those nutrients needed in smaller amounts but nonetheless they have a very big role to play for not just being healthy for those individuals who are physically active they can be very very important to support their exercise capacity. Which are these vitamins? What is their role to support exercise? From where can athletes get them in their food? And in case there is an inadequacy of these micronutrients what implications can it have around athletic performance? I will be covering these aspects in this lecture. Vitamins are protective nutrients they have a very important role to play in supporting the immune function. Vitamins are mainly divided into two water soluble and fat soluble. As the name depicts water soluble vitamins do not get stored in the body and they get washed out in the urine on a daily basis.

Hence as they do not get stored in the body and are needed for the daily metabolic reactions one needs to ensure that they are taken from food like we come across in our practice it is not about consuming it once or twice in a week but to make a deliberate planned effort to consume these vitamins in all your meals. In the water soluble vitamins there are two B vitamin and vitamin C. Let us start with B vitamins. There are several B vitamins.

What is common about these vitamins is for that food that we eat for it to be broken down and for you to get the end product which is glucose you need these B vitamins at every step to aid and support that breakdown and we call this function as being coenzyme and cofactors in chemical reactions or the metabolic pathways. We are going to be talking in detail on energy metabolism in understanding how different sports uses different metabolic pathways. So you can imagine if a normal healthy individual will need the B vitamins to just digest the food for it to be used as energy for an athlete who could train 6 to 8 hours a day and these are average numbers that the athletes I work with spend time in exercise and other training. So for an athlete who has prolonged hours of exercise, sports specific training, gym or strength training the requirement of B vitamins can be manifold. The vitamin B1 is a coenzyme that supports where the glucose is broken down and is being converted to the end product pyruvate.

For the pyruvate to enter the tricarboxylic acid cycle the coenzyme supports this conversion. Similarly vitamin B2 which is riboflavin, vitamin B3 which is niacin are coenzymes and cofactors once the food is entered the tricarboxylic acid cycle for the ATP or the energy to be released. All these 3 vitamins the B1, B2, B3 are called B complex vitamins. Of them also very important vitamin of the B vitamins family another very important vitamin pyridoxan which is B6 is very important for protein metabolism of a breaking down the proteins in the diet. So obviously athletes will have a high demand for vitamin B6.

Let us understand vitamin B1. We already just visited the overview of how thiamine is important for energy metabolism for the glucose to be broken down and for it to move further for it to release ATP. In addition to that vitamin D is also extremely important for the function of the central nervous system or the way the nerve impulses are transmitted. The thumb rule of a healthy living is to just ensure you have a very diverse and a varied diet and that way you can ensure the most important nutrients can be adequately met. The guidelines are you choose half your grain intake as whole which means if you had to eat 2 cups of rice 50% in the entire day 1 cup of that rice should be unpolished.

So the hand pounded rice, the Rajmudi rice, whole wheat atta, millets like ragi, joaar, bajra are all unpolished and unprocessed grains. So the more outer coating that it contains including the red rice which has the highest amount of vitamin B1. Thiamine is also found in vegetarian diets if you eat a variety of not just dals but pulses with the skin on and for those who consume foods from animal origin poultry which is eggs and chicken, meat and fish can be a good source. So we already know that sports persons even recreational athletes or somebody who is into fitness obviously consume a lot more calories and for that energy conversion the requirement of these B vitamins is higher. So if an athlete has a higher demand and perhaps does not take care to consume these vitamins automatically there is a deficit.

Interestingly vitamin B6 is predominantly got from foods that come from animal origin be it the dairy which is milk and milk products, the dahi, the buttermilk, paneer or any other milk product with the other non-veg choice be it the mutton, chicken, eggs and so on. So if you do not take care to ensure your food intake of these food sources including the whole grains, pulses and ensuring higher quality proteins. So if you can recollect the protein chapter the high biological value protein HBB proteins which come from mainly the non-vegetarian sources or dairy and of course in vegetarian diet sometimes the defatted soya products. If you do not take care then automatically you are going to be fatigued or tired and an athlete will have high energy need and there is poor conversion of that energy so automatically there is going to be tiredness. Now who can be challenged with inadequate levels? Going back to what we have discussed even in the previous chapters, females for that matter even males, athletes who are restricting their calorie intake, sometimes growing children and if you are prone to being fussy and are a poor eater.

We move on to the next important vitamin for athletes, vitamin B12. For an athlete particularly those who are in sports which require to be very agile with high intensity exercise or very swift movements they have a very high need of B12 apart supporting the nerve function if you recollect the chapter of iron. The fine delicate of how these nutrients work together B12 is an absolute essential for synthesis of red blood cells which is the iron found in the RBCs in hemoglobin. Also it is required to lower one amino acid called homocysteine. Homocysteine is one biomarker or depicted from a blood test which can be a red flag as it increases the risk of heart disease and homocysteine can also be formed by the breakdown of the other amino acids where the B12 can support the lowering of homocysteine.

As I just mentioned just a few minutes ago the commonality of vitamin B6 and B12 is that they come from high biological value source of protein. Do note one very crucial point of vitamin B12 that it is not available in vegetarian foods. So, milk and milk products in vegetarians can be a good choice for those vegetarians who consume eggs that is an advantage and of course the ones that can consume foods from the other animal sources the red meat, the

chicken and seafood they obviously can get higher B12. So, that leaves us with what does this vegetarian do to get B12. Nutritional yeast is one way you can ensure the intake of B12.

However it can get very expensive and also to meet larger requirement of B12 can be very challenging consuming a lot of nutritional yeast. I would like to use this analogy or an example of money. For me to get from Bangalore to IIT Madras obviously there was money spent for a flight. If I had to spend money for my day to day requirement and I only had rupees 500 the more money I spend on my needs from basic to what I desire the money is getting used up. In a way B12 is just that the currency of energy.

Since athletes have higher amount of training and they spend longer hours exercising the amount of B12 expended also goes up. So, which means that it is getting exhausted. One is to ensure you have to take care to take enough quantity of B12 from the right food choices. But the absorption itself is again complicated because you need the intrinsic factor which is produced by the cells of your stomach wall to absorb B12. So, that means, athletes have to make sure that this B12 is topped up regularly.

So, what happens if an athlete is unable to make sure that there is this recharge of the B12 either unable to consume foods rich in B12 or sometimes with the gut health if there are other challenges where the intrinsic factor in the stomach is not being formed that can obviously lead to a deficiency. So, the athlete is tired, fatigued and inadequate B12 can also impact the iron absorption unfavourably and that can lead to anaemia or low iron store in the body. We already know it is the iron that carries the oxygen in the blood and that can further exacerbate or make the exhaustion worse for an athlete. Who are the individuals who need to take care of B12? Those athletes who are vegetarian or the ones who are vegan who do not consume any food from animal origin. In my practice I have seen athletes with 100 MCG of B12 while the requirement can be something close to 700 MCG.

Sometimes in female athletes since there is an intricate balance of the iron and the B12 we can see this deficiency. Also in master athletes as you age the levels of B12 drop and those individuals who have elevated blood sugars either pre diabetics or diabetics they can also have a higher need for B12 and if they do not take care the levels fall. So in our lengthy consultations where we discuss what are the symptoms of athletes and if you remember the very first chapter on how the tools of nutritional assessments are used to evaluate athletes nutritional status discussing the symptoms or the clinical condition of that athlete can really help us pick up some cues and arrive at some prognosis or how you want to plan for that athlete and I have been very fortunate that in these discussions just hearing to the clinical symptoms we can pick up certain deficiencies just in that interaction. To name a few tingling sensation of fingertips sometimes even mouth ulcers in elderly and of course tiredness, weakness these come under a very broad theme. Interestingly low levels of B12 can have overlapping similarities of iron deficiency.

What sets it apart characteristically is the tingling sensation of the fingertips or the mouth ulcers from the lack of interest apathy feeling weak and severe exhaustion fatigue you wake up tired based on how low your levels are the symptoms can be exaggerated. So the first thing we do is request the client or the athlete for a blood evaluation. So these biochemistry tests are the gold standard to evaluate what is the deficiency level and that is the right protocol to follow. Once we have the diagnostic results then we set up a plan of action what are the foods that the athlete can consume and what is possible or what is not possible likes, dislikes sometimes most

importantly the budget what the athlete can afford and what the athlete will find it expensive because B12 is interestingly one nutrient that can take a very long time to increase. Food is going to take substantially longer and that is where the dietary supplements can be a important addition.

There are several doses of the vitamin B12 that can be available for a medical grade use based on the age and also the levels of the blood you can choose from 100 MCG all the way to 1500 and in some cases where the levels of B12 is so alarmingly low the nutritional supplement can be a very slow process. In those cases we request them to get the B12 jabs or injections under medical supervision. Of course apart the minor discomfort of the jab or the injection itself one thing about the B12 injection is the soreness that can be the after effect of taking the jab. But of course in my opinion you have to weigh the minor discomfort to what can be the benefit of adequate B12 levels. We as dieticians are there to facilitate educate and guide the athletes and at all given time it is the consent of the athlete and the comfort of with what approach they would like to go with.

At no given time is there a pressure or instructions on what they need to do. That way the interaction is very egalitarian and the athlete is the one who takes the call. So whichever approach the athlete adapts orally the nutritional supplement as I said will take some time for the athlete to notice the change in the energy levels. Of course similarly adding high quality protein foods that can increase the B12 in due course of few weeks and perhaps even 2-3 months the athlete starts observing better energy which is better stamina is able to sustain endurance activity with ease. If you recollect to begin with the challenge was tiredness and fatigue.

So that dies down and along with that because B12 can also support the iron metabolism more iron in the body more oxygen carrying capacity so obviously better cardiac output. The next B vitamin is folate and I recollect this association of folate from the days I was a student in college where folate originates from the word flora meaning folate or greenery greens folate if you recollect the iron chapter is also needed for the formation of red blood cells and along with B6, B12 folate or the synthetic form called folic acid which is poorly absorbed of course can help lower homocysteine and reduce the risk of heart disease. So ensure that you consume dark green leafy vegetables as often as you can and that way you can take care of your folate intake. Folate is also available other than in green leafy vegetables in certain other foods such as broccoli and so on. Very rarely have I seen a deficiency of folate but yes in one particular case of an athlete who was living in a hostel I was allowed to see that his folate levels were so low and surprisingly in the dietary evaluation I could correlate that he was not consuming even vegetables forget green leafy vegetables.

So automatically with understanding the functions of folate there can be the deficiency symptoms can be seen perhaps in chronic lack of consumption of these foods. Vitamin C is the next water soluble vitamin. For those of you who are worried about good skin ensuring adequate intake of fresh produce such as fruit and vegetables particularly in the raw form can be very useful to help you keep your collagen high. Vitamin C helps collagen formation. Interesting thing about vitamin C and for those of you who drink the packaged orange juice thinking that it helps you meet your vitamin C requirement daily there is bad news.

Vitamin C is the most sensitive nutrient just like even B vitamins especially the B2 found in milk on exposure to the light the vitamin gets destroyed. Similarly vitamin C once it is exposed

to light and air it perishes. Similarly cooking these vitamins also reduces the value or they are killed meaning destroyed. So now you know what happens to that orange juice if you have prepared that orange juice fresh and consume it immediately then there is hope to have got that vitamin C from that food. But if you leave that orange juice out for some time the vitamin C is getting degraded the longer you leave it is as good as drinking just either some liquid and if there is added sugar in it a sugar water you can forget about the vitamin C.

So since vitamin C has a role in collagen it obviously helps wound healing say an athlete is hurt or injured the healing process requires vitamin C and we know by data that vitamin C can lower the symptoms of cold. Cold is caused by virus it will take its own duration of a few days for the body to fight the virus and thereby you can slowly not have symptoms of cold. But taking vitamin C when you are down with cold can just make those symptoms better meaning if you are sneezing if you have a runny nose then perhaps they can be subdued. If you remember the chapter antioxidants where we talked of the ace vitamins, vitamin C is a very powerful antioxidant so it lowers the free radicals that can be formed due to prolonged exercise and also the long term or the chronic hormone called cortisol which can be seen in athletes in peak season when the training load is very high. So vitamin C can help blunt the cortisol effect and as a reminder vitamin C can help absorb the iron from plant foods the non-heme iron thereby vitamin C has a direct role on iron metabolism.

So what are the best sources of vitamin C? As I already called out cooking with foods which in vitamin C or keeping them open to light and air destroys vitamin C. So consume freshly cut fruits for the maximum gain. I do not think there is any fruit that is devoid of vitamin C. Most fruits from the strawberry to the pineapple to the citrus fruits the oranges name of fruit it contains vitamin C and I urge for you to make an effort to eat the fruit juicing already as I explained not only kills the vitamin C if it is left without consuming for a few minutes to it also pulls out all the fiber and soluble fiber which is found in the fruits can be an advantage for you. I would like to focus on some indigenous fruits that are available in India seasonal and have the maximum bang for buck.

Papaya is a great source of vitamin C and of course vitamin A because of the beta carotene or the orange color. In fact you would have had to eat many oranges to get the vitamin C that you can get by just eating one small amla. So amla is the richest source of vitamin C. In fact what is interesting about gooseberry or amla is that it has such high concentrated amounts of vitamin C that even if you cooked it in spite of some of the vitamin C being destroyed it still has so much more vitamin C because it is so concentrated. So for the ones who enjoy some amla pickle or a murabba vitamin C can be a good addition.

Similarly the traditionally made recipe of chawanprash has a lot of amla added in it and that can be also a good source of vitamin C for athletes in peak season. The next in line is guava. Guava also is an excellent source of vitamin C. Even vegetables such as capsicum and tomatoes remember to eat them raw not cook can be a source of vitamin C. The tomato when cooked especially with some oil can improve certain other powerful antioxidant pigments like lycopene which absorbs only on cooking.

However the focus being vitamin C if you consume a salad of tomato or just an athlete who short of time and cannot cook just eat a few slices of tomato and you can get your vitamin C. So athletes who do not take care to eat fresh fruits and vegetables obviously in long term can have low levels of vitamin C and remember vitamin C you need to consume every day perhaps

ideally in every meal or in a snack whenever possible. So that can leave the athlete very tired or perhaps because of low iron or the inflammation due to the exercise induced free radicals. The lower intake of these vitamins can make the athlete recover poorly after intense or long exercise routines. So to summarize B vitamins are needed for energy and for nerve conduction.

Water soluble vitamins such as B and C cannot get stored in our body because they are water soluble and get washed out in urine. So athletes do ensure you consume water soluble vitamin rich foods in your daily diet and of course in context to B12 if your levels of blood is low you can augment that with a nutritional supplement under the guidance of a qualified sports nutritionist or a sports dietitian and of course you need to periodically evaluate the blood parameters after this intervention.

I hope you enjoyed this lecture. Thank you for listening.