Sports And Performance Nutrition

Prof: Geetha Ghaliyavar

Department Of Sports Nutrition

IIT Madras

Week-01

Lecture-03: Fundamentals of Carbohydrates

We will dwell on understanding carbohydrates in detail. What are carbohydrates? What is their function in athletic performance? What are the different types of carbohydrate foods that are available and where do they come from? Can empower an athlete choose the right carbohydrate for exercise? The most important understanding for an athlete in exercise is to know that carbohydrates form the base of a pyramid or they form a large chunk of the macronutrient intake for an athlete. Carbohydrates give you a lot of energy for exercise. As the saying goes, carbohydrate is king. We talked at length of what is energy availability and how important it is to consume enough calories of food to support physical activity or exercise. Carbohydrates itself forms the chunk of that calorie intake.

If you want to improve your performance, the thumb rule is that you need to consume enough of this food group. As we discussed previously, not consuming enough calories or adequate energy availability, particularly lowered carbohydrate intake can lower exercise performance. An athlete who does not consume enough rice, roti or any other carbohydrate form can feel very exhausted and tired, particularly if they are in higher intensity training or longer duration of exercise. With prolonged workout, there is definitely an increased rate of perceived exertion.

What we call as the macronutrients, which are foods which we typically consume in larger portions, carbohydrates, proteins and fats, which is your vegetables, your potatoes or your dal, chawal, the protein foods is dairy or non-vegetarian foods such as chicken, which come on the protein foods and the oils, the ghee, the nuts which become the fat portion of the macronutrients. Carbohydrates foods offer 4 kilocalories per gram of intake. The major function and the most important one for an athlete, the carbohydrate foods are energy givers or energy yielders. Consuming enough of this itself is very crucial so that the next macronutrient which is protein is mainly used for the muscle maintenance function. So, carbohydrates support proteins so that proteins are then used mainly for the muscle function, whereas carbohydrates get used for the energy.

Carbohydrates are like the fuel for a working muscle. Not only that, apart fuelling the working muscle, carbohydrates are also the source of fuel for your brain and what has come into prominence through the pandemic and COVID, the gut and the brain axis, carbohydrates offer fibres and there are 2 types. One can be an indigestible form that helps you clear your bowels

and the other type of the fiber is the soluble fiber which feeds the gut bacteria which increases the good microbes which thereby influence several other functions including not only the brain function but today we are aware of even the gut and the lung axis. Having a good microbiota of the gut itself can be vital for an athlete to improve their respiratory health and apart these functions, carbohydrates also get stored in the liver and in the muscle and that is called the glycogen that can give you energy beyond 1 and a half 2 hours of exercise. So, carbohydrates do have a very important function other than offering energy.

They ensure the other macronutrient protein rich foods which come from non-veg as chicken and eggs which is poultry, be it dals or dairy such as milk or dahi gets used only for muscle building maintenance and the repair work thereby ensuring that the proteins do not get used up for providing the energy for exercise. So where do we get these carbohydrates? There are several food options. The easy to digest carbohydrates are simple carbohydrates. Among the options they are easily available from fruits. Even in fruits it is interesting to learn there are some fruits that have more carbohydrate content and some that have more water content as depicted between this banana and the watermelon.

An unripe banana or a plantain can have more starch content and as the process of ripening takes place the fructose or the fruit sugar increases thereby making it the athlete's best fruit option and of course the watermelon is predominantly 90% water, can be very low in calories, offers fiber and the watermelon is a low carbohydrate option and if you thought milk is a protein food if you are not aware it also harbours a sugar called as lactose which is the milk sugar. Every glass of milk offers 15 grams of carbohydrate. Starchy vegetables are also a source of carbohydrates. An athlete's favourite choice is also potato and sweet potato which can offer carbohydrates. Potatoes can be a fast-digesting option of a carbohydrate; sweet potato can be the slower version of the root vegetable.

Let us talk about how carbohydrate gets stored in the body. It is like a saving of a fund. Whenever we consume extra carbohydrates there is a way the body optimizes that. The first option where the carbohydrates get siphoned off is into the liver. On an average about 100 grams of carbohydrates is stored when we commence exercise and the blood glucose starts getting lowered after a few minutes of workout.

The liver glycogen is then getting broken down to convert it back into the sugar so that it can fuel your exercise and this can support anywhere from one and a half to two hours of exercise. Thus it is interesting to learn that the liver glycogen is broken down back to glucose and it gets supplied to various parts of the body when the exercising muscle needs extra glucose. When athletes have higher demands of a glucose on match days, on important events where they need to sustain activities for more than two hours. So what happens then? That is when you want to optimize your glycogen store beyond the liver consuming a surplus of carbohydrates thus gets pushed into the muscles and the carbohydrates are stored as muscle glycogen. This stored muscle glycogen supports only that particular working muscle during the physical activity.

It supports anywhere between 60 to 70% of the aerobic capacity of workout. Vivo2 max is a measure of the aerobic workouts. So what happens in a scenario where an athlete is working beyond 70% of Vivo2 max at a higher intensity where the oxygen supply falls short of the demand. There is good news that even for such high intensity workouts carbohydrates can support the exercise performance. Even in a situation of higher intensity workout when less oxygen is available carbohydrates are still oxidized to give you energy for your workouts.

So who needs an extra carbohydrate intake? It is a given understanding that all athletes and sports persons who go through hours of training by default require larger amounts of carbohydrate intake. Particularly if you are a young growing child and adolescent or someone who is in higher intensity workout for athletes who are in the peak competition cycle and for those athletes who have to maintain their weight so that they do not lose their body mass or a muscle mass have to ensure they consume larger amounts of carbohydrate. We discussed about simple sugars. Now understanding what are the slower digesting forms of carbohydrates. Apart the root vegetables such as sweet potato you also get these complex carbohydrates from whole grains, from unpolished varieties of rice which were typically used traditionally the Rajmudi rice or the hand pounded grains which typically is what our ancestors ate.

Millets have really come to the fore in the recent times and these are all complex carbohydrates which take much longer to digest because they have a lot more fiber in them. What characteristically makes the polished grain as white rice different from say a Rajmudi rice is the way it is processed. The bran remains intact and thus the fiber content the B vitamins are higher in unpolished grains as these red or unpolished rice. Similarly the commonality between white rice or corn flakes which is quite popular are again fast digesting options which can be giving you energy when you have a quick requirement and smaller duration between your eating and your training. Sugar typically receives a bad rap.

Most sugars be it palm jaggery, jaggery, honey or any other sweetener typically will have a similar calorific value. One teaspoon of sugar or any sweetener on an average gives about 20 kilo calories. For an excising athlete sugars can become the best form of energy especially after 45 minutes when the liver glycogen is dipping and there is a need for sustained fuel for the working muscle. So yes any sweetener or sugar can be consumed particularly if athletes are exercising beyond 60 minutes. But let me warn you not all carbohydrates are the same.

Even a sugar when made into a muffin or a bread converted to a baked good or a bakery item once there is extra added fat in it the whole dynamics will change. Fats obviously have over double the amount of calorie intake and a slowdown digestion thereby delaying the whole process of absorption of that simpler sugar or the carbohydrate. In prolonged exercise consuming carbohydrates even during exercise which we call as intra workout can support muscle contraction because they help in the release of calcium ions thereby the prevent tiredness or can help an athlete to sustain the exercise. Do note whenever you are adapting to

consume more carbohydrate foods around your training it requires a bit of practice for an athlete and this is typically called as train the gut where you have to make a conscious deliberate effort to consume an extra cutlery of rice or be it roti sustained over a few days and weeks for the stomach to get used to larger portions of carbohydrate either before or even when you consume carbohydrate foods even as a banana or dates during your workout you need to practice that in your training. Make sure that when you consume carbohydrate foods too close to the workout try and choose options that have low fiber.

So white rice is a good option if your training is too close from the time of your food consumption eating extra carbohydrates also holds water and hence you may notice a change in your weight but there is nothing to be alarmed about apart the food choices if your training takes a bit of a travel time to the academy from your home or if it is a competition day and if you don't have access to foods there is good news as per the IOC consensus statement or the Australian Institute of Sport even an energy bar or sports food can be a vital addition for athletes from rice krispies to oat krispies to rolled oats or a granola bar an energy bar can be a value addition based on the need to fit in the nutrient intake. I would like to spend a few minutes discussing a case study of how important carbohydrate is for an endurance athlete. This is the case of a master athlete who participated in an ultra-endurance event as an ultra-marathon. These events can last for the entire day from eating your rice kanji to your porridges you need to focus on consuming extra carbohydrate rich foods even two days prior to the event to maximize your liver and muscle glycogen. What was educated to this athlete was to keep the fiber intake very low otherwise it can lead to bloating and flavors also ensuring that a day closer to the event you want to keep your proteins to modest intake and definitely keep also fat intake to lowest possible.

In these kind of sports where it is a matter of mind over the body it is always best to offer familiar foods particularly in the initial hours of exercise from your puff rice ladoos to rice cakes from energy bars when the eating is possible in the initial few hours of exercise is very helpful to sustain such long day of a workout to sustain a full day of physical activity. In addition to the food it is very important to also take care of carbohydrates also as sports food from the isotonic electrolyte drinks or the sports drinks the carbohydrate gels that can give you calculated amounts of energy by the hour you can sustain endurance activity after the first 3 to 4 hours of running when the gut is quite sensitive that is when you introduce multiple carbohydrate transporters which are a combination of 2 sugars and that can be maltodextrin along with fructose. The endurance athlete could complete the event with the support of food and sports foods. To conclude choosing the right carbohydrate foods be it a fruit or a katori of dahi or even a slice of bread before your workout can fuel high intensity workout during the workout you could still consume a fruit or curd or dates and inter workout carbohydrate intake especially if you are exercising beyond 45 minutes to 60 minutes can really be useful to sustain prolonged workouts consuming adequate amount of carbohydrates post your exercise be it in the form of chapatis or pasta or rice ensures replenishing of the lost glycogen so that you can maximize recovery particularly if you are an athlete who needs to bounce back and has training consecutively the next day ensuring adequate food intake with macronutrients such as carbohydrate can really boost your recovery process thereby ensuring that you are prepared for

the next physical activity again. Thank you for listening and if you have any queries please do leave a message and we will come back to assist you.

Nutritional strategies and dietary patterns may predict the nutrient requirements of athletes and play significant role in the adaptations and performance of endurance runners while the consumption of high carbohydrate meals has been recommended to endurance runners on pre-event or hours within the carbohydrate loading times but as far as tapering strategies their advice to avoid high fat high protein and high fiber foods during pre-competition hours nutritional strategies of distance runners should not only support the higher rate of energy expenditure but are also crucial to cover the greater exercise induced thermoregulatory demands and the increased resting metabolic rate of endurance runners compared to those of a general population compared to a general population endurance athletes are reported to have a higher frequency diversity and quantity of food intake despite this fact it has been documented that both recreational and elite endurance athletes seem to be at a risk of sparse viability of energy which can be caused by poor dietary patterns while the increased duration and frequency of training running sessions can expand the risk of caloric under supply this caloric imbalance can deteriorate further when accompanied by sport specific challenges such as difficulty matching meal frequencies with training and or gastrointestinal distress which are prevalent among athletes inadequate or imbalanced dietary intake can lead to clinical and non-clinical nutrient deficiencies in endurance athletes that could result in adverse health effects and unfavorable consequences for performance including muscle catabolism diminished bone mineral density increased risk of injury and immune function abnormalities and much more.