

Sports And Performance Nutrition

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Week-01

Lecture-02: Introduction to Energy Availability

We are going to be discussing what energy means for an athlete, what is energy or how do you know how much energy or calorie you need to consume, what are athlete's goals of his body composition changes and how do you adjust those calories, understanding the energy balance and what it could mean if you eat too much calories or you under eat food and also most importantly understanding the tools of nutritional assessment for athletes which can help us arrive at certain calculations and understanding how the athlete portfolio can be managed. What is energy? Energy is itself the source of life. The unit of energy is calories and how did these calories even come into existence. Here are certain experiments that were done which is the calorimetry and food was burnt and the amount of oxygen used was calculated and certain caloric value was given to every food component and where does this energy or calories come from? It is nothing but the food that we consume that gives us this energy. Energy or calories are interchangeably used. It is nothing but the currency of the cell, the way the body uses these calories for our basic existence, for my brain to function, for my digestion to take place, for me to even move my arm where calories are being burnt and more importantly for an athlete or somebody in physical activity who is spending a lot of calories for that physical activity.

Some children and adolescents have a larger demand for these calories just for their growth and to sustain day to day activities and in addition also for exercise or physical activity. So, among the other several aspects that influence how much calories or how much energy one needs itself is other than the growth factor, it is also the number of hours that you spend in a physical activity particularly if you play a sport. Also based on how much the athlete or an individual weighs and what are the recommended guidelines? Are you looking to lower your body weight or are you also looking to maintain your weight or increase your muscle mass and increase weight? So, the calorie value or the consumption of the food can be influenced by just what your goals of body composition are. Also, if you are an athlete and you spend several hours in the day exercising apart your strength training and pursuing a specific sport adequate food itself is very important to prevent injury and definitely keep your nutritional status optimal so that you do not fall sick.

For an athlete who is also in a certain competition cycle be it the peak season or on competition days optimal amounts of food is extremely important in order to be prepared for that physical activity or the sport also to beef his glycogen and also recover from that activity. So apart the training the type, the competition season or the training cycle you are on in addition to the body composition transformation goals the energy intake can influence if you are meeting your set

objectives. As I mentioned calories comes from the food that we eat be it the rice roti or the dal or the oils we use for cooking and each of these main food groups is allotted or they have determined amounts of calories that they contribute and carbohydrate which is your rice roti also that can give you 4 kilo calories for every gram protein similarly be it egg milk or dals also gives you 4 kilo calorie oil, ghee, butter or any other source of a fat even in the hidden form in the food gives us over double the amount of calories which is 9 calories per gram. The body maintains a very fine balance of energy or calorie balance the amount of food that we consume at the amount of energy or the calories that is spent through the day for just your basic existence which is the basic metabolic rate and the body expense a certain amount of calories for the basic existence known as the basal metabolic rate for the brain to function for the kidneys to filter the urine and all those involuntary body actions or functions that is taking place in terms of the chemical or the metabolic reactions apart that if you are also involved in a physical activity be it exercise or sports that becomes an additional expenditure of the calories also. Different amount of food or energy intake known as energy availability itself is very important to have optimal performance if you consume lesser amounts of food that can lead to other challenges and lower amount of energy or the energy balance in the body is known as low energy availability.

First and foremost, when you consume lesser calories or energy the body's metabolic rate itself can slow down and if you consume lesser calories of food for a longer duration that can also increase your risk of nutritional deficiencies be it iron, vitamin D, B12 and other several micronutrients which can impact your performance and lower your exercise capacity. Adequate carbohydrate intake itself is extremely important for muscle function and it influences the release of calcium for that working muscle if inadequate calories of food is consumed. Since calcium itself is required for several functions from just the beating of the heart the muscle contraction there is but a need for the calcium reabsorption for the bone and a chronic inadequate amount of food intake can lead to lower bone mineral density too. Now coming to understanding body frames and how you can also determine that understanding also a body type is crucial to plan the amount of calories that you need to consume. Ectomorphs are individuals with a large body frame if they need to be in a certain category of weight related sports, they may have to cut the calorie intake especially off season and that can be important to determine their body mass goals.

Ectomorphs are individuals with a medium skeletal structure. Ectomorphs are individuals who are on the thin side and very lean skeletal structures these individuals typically have to maintain or sometimes even increase their calorie intake in order to maintain their weight and keep their muscle mass high. Calorie mass index is height to weight ratio and about 18 to 22 is a given average up to 25 is also considered okay but if sometimes you are beyond that then the calorie intake can directly impact whether you lose weight or you gain weight. Interestingly many people don't focus on height to waist ratio which gives you markers of central adiposity and ideally half your height should be the size of your waist but if you are beyond 50% that means there is a scope for you to lower your body weight in order to come below 50% so that you can focus on lowering inches around your abdomen Unlike the previous guidelines where a certain recommended dietary allowance was given for an entire day in sports nutrition we offer a

different perspective on how do you arrive at calculating calories or determining energy for an athlete. It is ideal for an athlete to stay within the range of 30 to 45 kilocalories per kg of lean body mass.

How do you now arrive at lean body mass? Body weight minus the fat percentage is lean body mass. Lean body mass is made up of organ weight, bone weight, water weight and also the muscle mass. Children and younger children can in fact use up double the calorie amount because they also need to compensate for their growth in addition for the physical activity. So, what happens if an individual is consuming very low amount of food or there is lower energy availability. A new term has been coined for that and that is called as RED which is relative energy deficiency in sports.

Relative energy deficiency in sport has several repercussions and can negatively impact an individual's health status. The onset of menarche itself can be delayed in young children and girls apart from missing menstrual cycles month on month leading to amenorrhea. Similarly, in boys if you are not consuming adequate calories of food that can lower your testosterone which is the male sexual hormone and lower testosterone itself can lead to lowering of muscle mass and it goes without saying that when you consume less calories obviously your performance in sports also comes down and apart that I have already mentioned that with chronic energy deficiency or less calories since there is lowered bone mineral density there can be a risk of stress fracture sometimes even joint injuries and also your immunity is lowered and when the training load can be high automatically an athlete can be susceptible to a lot more infections. Not only that there are other implications to lowered food intake apart disruption of the sexual hormones there can also be an elevation of long term stress hormone called cortisol and that itself can lead to a breakdown of the muscle mass and that can lead to increased ammonia build up and that can lead to inflammation adequate carbohydrates itself is very important for the brain chemical and the neurotransmitter serotonin and if you are consuming lesser food intake that can also lead to disturb sleep. There are several equations that we can use to also determine energy availability and one is Cunningham equation you determine the resting metabolic rate and multiply that with the activity factor.

Once you arrive at calculating of the energy metabolic rate which is $500 + 22$ multiplied by lean body mass there are standard activity levels that we can use to multiply and for athletes typically it is 2.2. Once you calculate the resting metabolic rate using Cunningham equation you further calculate the energy availability by subtracting the activity energy expenditure which is the amount of energy that is determined for a certain sports activity and divide by the fat free mass. The food exchange list gives a certain amount of calorie for a standard serving size for example a raw weight of rice of 30 grams could on an average give you 100 kilo calories. Similarly, dals of 30 grams of raw weight can also give you 100 calorie an egg of an average size of 50 grams can give you 85 calories and chicken of 100 grams can give you 100 calories.

A 100 ml milk can give you on an average of 70 to 100 calories the root vegetables like the beetroot carrot and potatoes have slightly more calories on an average about 80 whereas green leafy vegetables and other non-starchy vegetables have very low calorie content. A medium sized fruit can be roughly 40 calories 5 grams of sugar can be 20 calories a teaspoon of oil roughly is about 45 calories. Now what is the ideal scenario for an athlete? Obviously the goals are to increase or maintain a higher muscle mass while keeping the fat percentage low other than just taking care of the calorie intake and keeping mostly the macronutrient of protein intake very high one needs to also take care of strength training in order to keep that higher muscle mass. The amount of calories or the energy availability itself is also determined not only by the type of training that an athlete is in easy doing a cardio or a running activity for that training session or easy looking at strength training. The intensity of the exercise easy training just for about 45 minutes in the gym or easy going to be training for about 2 to 3 hours be it on the court or on field and of course if it is a non-training day what should his calorie intake be obviously much lesser for that day.

The investment of maintaining a higher muscle mass is imperative for an athlete the power and the stamina that is required for a certain sport itself is governed by the strength that comes from the muscle. Now getting into the tools of the assessments which can help understand the athlete's nutritional status from the basics of height to weight to doing the blood test and understanding clinical symptoms to the food intake or the food culture of that athlete can give us insights into the whole portfolio of that individual. The athlete assessments are important when you do them periodically and most important being the baseline when you onboard an athlete and then you do them periodically month on month or at prescribed timelines. This continuous follow up helps us track the progress of that athlete about taking the height and weight what is the most important way to understand the other different aspects which influence the weight of that athlete. The weight of an athlete can change through the day from on rising to after consuming the food even after an intense training session where an athlete has lost a lot of water there can be weight loss.

Similarly if an athlete is in the pre competition season or in the competition season on a high carbohydrate diet which holds water or has been carb loading one day before an event there is going to be an increase in body weight. How does one track these changes ideally focusing on the muscle mass fat percentage and sometimes even lean body mass. So what is the best way to track the changes in the muscle mass and fat percentage and sometimes most importantly even the bone mineral density. So there are many ways of doing this. The bot pod is a machine where you need to be encapsulated and sit inside the machine when you have to hold your breath for some time.

Then you have the skin fold calipers where you take the measurements of your subcutaneous fat at several different points and then you calculate them using an equation. Dual energy X-ray absorptometry is the gold standard but can be expensive and since the machines are very large and bulky they are not mobile and hence you also have to keep visiting to the facility to get them done. And the last one which is quite convenient in the practical setup of moving it

around is the bioelectrical impedance machine which tracks the muscle mass and fat percentage but however it also gives a deviation of 10 to 20 percent but if done periodically and month on month it can give us the trajectory of the progress that the athlete is making in terms of the muscle mass and the fat percentage changes. Blood tests can be a great insight to the athlete's metabolism and physiology inside. Blood tests can guide us if the athlete has any nutritional challenges.

Are there nutritional deficiencies or sometimes even if the athlete is overusing certain nutrients and is there toxicity. So regularly conducting these blood tests in athletes can really help us understand the nutritional status of that athlete. We can address nutritional deficiency and simultaneously we can adjust the dosages of the nutritional supplements to avoid toxicity. Discussing the clinical symptoms of how the athlete feels on a day to day basis be it the training or the recovery period. Is the athlete fatigued? Is the athlete sleeping well? Has the athlete not attained menarche? What are the traditional practices followed at home? Is the athlete a vegetarian, non-vegetarian? So the details of which sport the athlete plays and how or what are the demands of that particular sport can really help understand that particular athlete.

Understanding the food habits of the athlete can be very important to give the correct sports nutritional advice. Typically there was a practice of getting a seven days of food history but that had its own challenges of non-compliance where athletes would not record the full spectrum of seven days of food. Getting a food recall or a 24 hours of history is a lot more practical way to get insights to the food habits of them. Getting a 24 hour recall which is the food history typically for a full day can give insights also to the practices of the athlete where the athlete does not have to go through laborious documentation. Using the food exchange group which I discussed in the previous slides can be also another way to collate the food history data.

The food frequency questionnaire also collect data around food groups where you can assess and pick up red flags if the athlete is leaving out one food group be it fruits or vegetables which typically is seen in our practice. Reviewing food journal is another easy way to get a bird's eye view of what are the food habits of an athlete that can help us make observations of the athletes likes dislikes or understand their cultural food habits also the practical challenges that an athlete can endure on a typical training or a competition day. Smartphones have also made assessments of food intake very easy just to assess photos of plated meals is also a very easy way to track the food intake of an athlete for a typical day. This food evaluation can help us not only understand the typical food habits of that athlete this can help us pick up any glaring conspicuous issues this way we can address any nutrition related problems and that can help us reiterate the food first approach and if there are any practical challenges or food intolerances we can bridge that gap by adding the right nutritional supplementation and also in the peak competition cycle we can add performance supplements or ergogenic aids to optimize athletic ability through this dietary evaluation we can make the right corrections prioritizing the food first approach and ensuring the intake of the whole spectrum of food groups so there are no exclusions which can lead to other challenges. So to conclude athletes must ensure adequate

calorie or food intake in order to optimize their athletic performance adjusting your calorie intake and food can help you meet your set objectives adjust your body composition you can either lose your body weight and lower your body mass or if you intend to gain weight and your muscle mass adequate calorie intake can prevent relative energy deficiency in sport and thereby prevent illnesses and injury assessing anthropometry the blood tests discussing the symptoms of that athlete and also understanding the dietary practices this can help sports dietitians and nutritionists to offer well planned scientific guidelines for optimizing athletic performance practicing the right assessment tools as anthropometry assessing blood tests discussing these clinical symptoms and looking at the dietary practices of athletes can help dietitians offer scientific programs and optimize performance. Thank you.