Sports And Performance Nutrition

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Lecture-37: Nutrigenomics

A warm hello again. In today's chapter, we're going to talk a very complicated topic, and I hope I can simplify this for you as much as possible. Nutrigenomics, tech innovation, and the future trends in sports nutrition, especially in context to Indian athletes. Let us dwell in understanding what do these genes mean for our athletic performance? How do they respond to the food and environmental conditions? What are metabolomics? And what is artificial intelligence and data tracking in athletic performance? And what are some of the hot topics that we want to look forward in sports nutrition? Each of us is born with a genetic code and blueprint. How our DNA and these genes will reflect is quite intriguing. Nutrigenomics is a very niche and a relatively new field.

It brings a vast scope for diagnostic and therapeutic applications in nutrition and sports performance. Understanding our genes can help us formulate certain exercise and recovery protocols which can be personalized. One of the fascinating aspects of genetic testing is also understanding the type of muscle fibers that an athlete can have which he is born with. Slow twitch fibers have more mitochondria and they are slow to fatigue and this is typically what helps an athlete sustain endurance training.

Just the contrast of that is the fast twitch muscle fiber and they are prone to fatigue and fast twitch muscle fibers are typically used in sprint type of physical exercise. Understanding the genetic endowment can perhaps be very useful in understanding why some athletes always complain of prolonged fatigue and the need for longer recovery protocol and why their delayed onset muscle soreness does not die down faster. So, in these kind of athletes perhaps knowing their genetic type can help tailor a training load that can be personalized to their genetic endowment. So, in this context looking at the quality of the training over the quantity and giving them heavier training or exercise loads beats the purpose. Our DNA's also can predict the way we respond to certain nutrients.

These can be very useful biomarkers particularly when you want to track the performance outcomes in athletes. Please do note that one aspect is the DNA material that we are born with. What is more fascinating is how these genes can respond to the food that we consume and how that can percolate to the athletic performance. That aspect is epigenetics. How our genes respond to the food environment and the lifestyle that an athlete adapts to? The ideal recommended intakes of nutrients can have an influence on their genetic expressions.

Their genes determine the specific metabolism of that nutrient and the efficiency of their uptake. So, epigenetics is the influence of food on our genetic blueprint the way we not only metabolize, but the way we absorb utilize these nutrients. Interestingly, we can correlate epigenetics and gene expression for athletic performance. This can help plan the dietary intake

in terms of the macro and micronutrient consumption and help make action plans based on the way the athlete can respond to these nutrients either for better outcomes or if there's a tendency for them to have a nutritional deficiency, we could augment them by the use of nutritional supplements. Nutrigenetics and epigenetics can have a direct link to disease prediction and thereby we can also lower the risk by upholding the health status.

By tracking the nutritional parameters, epigenetics can help us predict these physiological changes and these biomarkers can be very useful in predicting injuries and thereby we can address them and preempt these injuries. Like the saying goes, a stitch in time saves nine. An injury can set an athlete back by several steps and it can directly thwart his athletic performance. So, by paying attention to these aspects, we can take care to ensure an athlete's training and recovery protocol. Here is an example of a gene that can predict the way an individual can respond to fat metabolism and perhaps this can explain why some individuals are always challenged with maintaining the ideal body composition or body weight.

Understanding this can be useful particularly for those athletes who are participating in weight category sports and we have discussed this in detail in the high performance module. Some individuals and athletes can be predisposed to vitamin D deficiency due to their genetic endowment. A particular gene can push an athlete to have a tendency towards a low vitamin D level and in the vitamins chapter, we have discussed how vitamin D is extremely important not just for musculoskeletal function but also for cognition to the way your brain functions to immune response. So, individuals with this gene that can make the vitamin D deficient, it is best for them to augment their low levels with a recommended vitamin D supplement. In the ergogenic aids chapter, we have discussed at length of how caffeine is important to enhance performance from improving focus to preventing fatigue being a central nervous system stimulant.

In endurance exercise, it also enhances the uptake of fatty acids thereby increasing fat metabolism. So, it also spares glycogen by increasing certain neurotransmitters. In the very recent module of food intolerance, I did touch upon this aspect of caffeine intolerance or sensitivity where we have individuals who are slow metabolizers and they often face the side effects of dittiness, headache and other unfavorable attributes of consuming caffeine. However, for those who are fast metabolizers, caffeine intake always enhances athletic performance and if you recollect, I did mention that this caffeine response is also predetermined by a specific gene. So, genetic tests can have some practical attributes and are useful for disease prediction and thereby also preventing certain conditions and in athletes, they can be useful in determining the muscle fiber type or even the response to nutrients thereby helping preempt injury.

However, it is very important to note genetic tests are expensive and cost a lot of money. As I mentioned, this is still a niche subject and is not fully understood and may require an expert review to decipher this complicated data. On that note, the genes that we are born with is only one aspect and there is limited validation to only understanding just the genes that we are born with and these gene expressions can be influenced by several other parameters. Another new aspect of tracking the metabolites is called metabolomics. From the carbohydrates, proteins to the fats, the way the cell metabolizes them and how these smaller molecules are derived as a process of these metabolic pathways can become important biomarkers which can be tracked for health and athletic performance.

Tracking these metabolites can mean better hydration and better planning for the calories, carbohydrates and proteins to improve the health status of an athlete. So, with a better action plan to enhance training outcomes and also augment the recovery in addition to the meal plans, these metabolites can be also good indicators to direct the need for the intake of supplements. Thus, we can plan a very scientific nutritional and performance supplements when there is a need based scenario. We have also discussed athlete monitoring in the previous chapter. In one of the chapters, we have also discussed wellness monitoring, the use of technology to track which can help us track the recovery of the athlete, improve the performance, help him in tournaments and also the data can help us align the health.

And we have touched upon wearable technology and how it can track certain parameters which helps us monitor the athlete's training and recovery protocol. Today, it is not uncommon for us to see several individuals wear smart watches of wristbands just to track their well-being. This also applies to athletes. These wearable technologies give us simple data of step counts to heart rate to the amount of calories an individual is spending through the day and also the type of activity that and also the type of physical activity one was involved in. Please do bear in mind that the energy expenditure that is predicted by these wearables is often an overestimation and cannot be taken at face value.

And with the innovation in technology and data tracking with these simple wristbands, we have evolved two vests and T-shirt sensors which is now typically used in several team sports to track the data. Apart the heart rate heart rate variation, movement load can give concrete data on how demanding the activity has been for that individual and this data can be used to personalize the nutrient and the hydration requirement for that athlete. Also, with this report analysis, when there are red flags, we can use technology to also preempt injuries. When used right, these performance trackers which are either sensors or even chips that can be inserted in shoes can become very useful tools for tracking. What are some of the future trends in sports nutrition? With a lot of awareness and sensitization around the environment and with the intent to lower carbon footprint, plant-based food options and alternative proteins are definitely the way forward.

And if you remember in several chapters where we have talked about the microbiome and its influence on the gut, brain and lungs of how 90 percent of the serotonin or the neurotransmitter that makes one feel good is synthesized and absorbed in the gut. The bacteria in the gastrointestinal tract has immense and profound impact on one's health and even athletic performance. So, definitely the future research topics could explore gut health in Indian athletes and look at performance outcomes. We already know the evidence-based supplements that can be useful as ergogenic aids to enhance performance. Looking forward, there is a scope to study individual supplement use which is scientifically planned for our Indian community and establish conclusive data how our athletes respond to these supplements and ergogenic aids.

And most importantly, the safety of these supplements which can then help us alienate the side effects and also study the safety aspect of these supplements either for the adulteration free use of ingredients or the outcomes in terms of side effects and other concerns. About the sustainable practices which are environment friendly, today's topic of Nitrogenomics and with the tech innovation which helps track data which can help personalize and tailor the meal plans

and supplements is definitely something that is going to be the way forward. The future research studies cannot sideline technology and data-driven predictions in offering personalized nutrition for athletic performance. Thankfully, we have arrived at understanding that female athletes are an entity on their own and we are fortunate that female athletes have come to the fore and some research is already offering guidelines and suggestions that are individualized only for this gender. So, going forward even in our Indian communities, there is immense need for research studies that will target purely females and athletic performance.

So, to summarize, Nitrogenomics can help us understand our genetic tool and that can help us improve health and athletic performance. However, please do note it is the four habits and the environmental and lifestyle practices that has a more profound influence on gene expression. With innovation and technology, data tracking can offer insights into training and predict recovery protocols and prevent injuries in athletes. Sustainable and planet friendly food habits, gut microbiota and research specifically on female athletes are definitely the future research trends. I hope this complicated topic has left you intrigued and I hope I could make this simple for you.

Thank you for your patience and listening to this lecture. Hi, I am Dr. Bharat and I am a sports medicine doctor and the medical director of Zeeatlon, a multidisciplinary sports clinic based in Bangalore. I have been the team doctor of the Indian boxing team and I am also the current team doctor of the Delhi FC and the Minerva FC. I have been routinely using genomics in my practice since a decade to scientifically enhance performance of athletes at all levels.

To begin with, let us understand what Nutrigenomics means. Nutrigenomics is the science of how food affects a person's genes and how a person's genes also affect the way body responds to food. A simple example that I can quote is how the athlete responds if you switch them from a balanced diet to a low carbohydrate diet. As a doctor, I would use genomics to prescribe more than just food. Let me tell you the number one question only genomics can answer.

Now, is an athlete a carrier for some sort of a genetic disease? Now, in the sporting world, it is not uncommon for the athletes to present with unexplained fatigue. When we do the blood work, the hemoglobin is decreased for sure, but at the same time, the iron levels are high to normal. Then they have normal levels of vitamin B12 and folate. So this sure is not iron deficiency anemia. So now what genomics points towards here is a G6PD deficiency.

Now, so there are certain drugs like aspirin that the athletes routinely use for headache that needs to be avoided to prevent hemolysis because it precipitates hemolysis. The second most important decision genomics helps us with is the disease risk estimation. Now, is my athlete at risk of developing atrial fibrillation? Is my athlete at risk of developing a sudden cardiac arrest or does he have hypertrophic obstructive cardiomyopathy? Now, these are things that can be fatal on the field. There are some of the questions that are not answered by any other test until the event actually happens. Similarly, we also get to know the risk of developing hypertension, diabetes, asthma so that we can take preventive measures.

Once we know the disease risk, the major factor is treatment. What genomics tells us is how the drug is metabolized by the body, which is basically drug response profile. There are genes that indicate the expression of enzymes like cytochrome oxidase that can influence how a drug is metabolized. For example, if a life-saving drug like clopidogrel is poorly metabolized, then

we really need to switch over to another drug with a similar profile. Otherwise, it will simply not respond.

Now, as nutritionists, genomics can be an amazing tool to understand food sensitivities. For example, a gene called MCM6 codes for the enzyme lactase, which is responsible for lactose intolerance. If you know that, on the prior hand, I am sure you would all agree that we need to avoid milk, whey or anything that contains lactose. Not just that, if you can also know about the nutrient deficiencies the athlete is prone to, for example, a gene called FUT2 is responsible for the regulation and absorption of vitamin B12. If there is a defect there, you might want to add extra supplements or even consider a parental supplement, for example, an injection of vitamin B12 to bypass the intestinal barrier.

Now, this being said, there are some limitations of genomics as well. The concept of genomics works well if there is absence of genes. Now, let me explain that. What if the genes are present, but it is switched off by the environmental triggers like stress? This is something that we need to consider while making the decisions. Also, from the client's perspective, their expectations from you skyrockets.

The reason being, you have the deepest level of information about them that anyone can actually get their hands on. So, they will expect you to give them the best possible nutrition plan that will take them to Olympics. But is it really practical? Let me conclude by saying this, genomics is an amazing tool, but use it as one of the diagnostic investigations and do not base all your prescriptions only on genomics. So use your knowledge of epigenetics as well, which is basically how the environmental triggers and behavior change the expression of genes. Now, that is important and that is the other end of genomics.

Thank you all for your patience and good luck.