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Nutrition for Enhancing Endurance in a Sportsperson

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Abstract

There is a definite role of nutrition in enhancing Sports performance in endurance dominating activities. This is the investigation of sustenance's and supplements and their impact on health, development, in advancement of the sports persons. For endurance exercise lasting 30 min or more, the most likely contributors to fatigue are dehydration and carbohydrate depletion, and high muscle glycogen concentrations. At the start it may be beneficial for endurance exercise. An individualized nutritional strategy can be developed that aims to deliver carbohydrate to the working muscle at a rate that is dependent on the absolute exercise intensity as well as the duration of the event. The aerobic energy systems play an important role in endurance dominating activities.

Keywords: *Sports Performance, Supplements, Glycogen, Endurance*

Introduction:

Nutrition for enhancing Endurance in Sports isan essential component to get a good performance for an athlete. It is concerned with the type and quantity of food taken by an athlete, and deals with nutrients such as vitamins, minerals, supplements and organic substances such as carbohydrates, proteins and fats. Food is an important

part of many sports training regimens; it is most popular in certain sports such as weight lifting and body-building and endurance sports e.g.cycling, running, swimming, rowing. All athletes consider taking dietary supplements because they are looking for the "magic ingredient" to increase performance.

In sports, eating for endurance is an art and a science also. Nutrition for enhancing enduranceis the main goal to provide calories for daily activity and those expanded through exercise in addition to replenishing glycogen (energy) stores and repairing lean muscle mass. To achieve an optimal level of performance one must be focus on eating as well as its nutritional values of food during training, competition and recovery.

Meaning of Nutrition:

WHO defines "Nutrition is the intake of food considered in relation to the body's dietary need." Taber's Medical Dictionarystates that 'Nutrition is the internal processing of the food and beverages, such as ingestion, digestion, absorption, assimilation, distribution and elimination (i.e. metabolism)."

Nutrition is the science that interprets the interaction of nutrients and other substances in food (e.g. phytonutrients, anthocyanins, tannins etc.) in relation to maintenance of growth, reproduction health and diseases of an organism.

Sports nutrition:

Sports nutrition is a specialization within the field of nutrition that partners closely with the study of the human body and exercise. Sports Nutrition can be defined as the application of nutrition knowledge to a practical daily eating plan to provide the fuel for physical activity; facilitating the repair and building process following hard physical work and achieve athletic performance in competitive events, further also promoting overall health and wellness. The basic concept for sports nutrition for athletes requires proper eating strategies and need to have a command of general nutrition as well as exercise science. The second step is to gain the knowledge of how nutrition and exercise science are intertwined, emphasize that physical training and dietary habits are reliant on each other in order to produce optimal performance. The final step is the applied application of sport nutrition knowledge on the individual sports person who is participating in any sport or physical activity.

Components of Nutrition:

There are six nutrients which are classified as essential nutrients. They are carbohydrates, proteins, fats, vitamins, minerals and water. The body requires these nutrients to function properly, however the body is unable to endogenously manufacture them in the quantities needed on a daily basis:

Carbohydrates:

In our diet generally there are two key forms of carbohydrates – starchy or complex, and simple sugars. Simple sugars are carbohydrates which are found in refined sugars and provide a sweet taste. Simple sugars are naturally found in milk products, fruit and vegetables but can also be added to foods using white sugar, brown sugar, honey, molasses and maple syrup etc. Though all of the sugars which consumed whether they occur naturally or are added, are used by the body in the same way, it is better to get simple sugars from foods in which they are naturally occur as these foods also contain fibre and important nutrients.

Complex carbohydrates, also known as starches, made of grains such as bread, pasta and rice etc. Similarly to simple sugars there are some complex carbohydrates, which are better than others. The processed refined grains such as white rice and white flour are being less friendly as they possess less nutrients and fibre. Hence nutritionistsare recommended that wherever possiblethe individuals to opt for unrefined grains which are packed full of vitamins, minerals and fibre.The carbohydrates which are consumed converted into glucose, a form of sugar, is carried in the blood and delivered to the cells for energy. Then this glucose has broken into water and carbon dioxide and ATP and glycogen.Glycogen is another form of carbohydrate that is stowed away in the muscles and liver. The body is unable to hold more than around 350 grams of glycogen at a given point, and once it has reached full capacity any excess glucose will be converted into fat.

Fat:

Fat is an essential component of any diet as it helps the body to absorb nutrients as well as being a great source of energy and provides the body with essential fatty acids those are unable to manufacture independently. However, these fats are important but one should monitor how much of fat to intake, as large amounts could lead to excess weight gain and could subsequently resulting in an increased risk of serious health concerns such as heart disease and high blood pressure. Generally the fat contains both saturated and unsaturated fatty acids are usually referred to either 'saturated' or 'unsaturated' depending on the percentage of fatty acids present in them.

Saturated fats are commonly found in animal products and processed foods such as meat, dairy and chips, and the unsaturated fats are found in foods such as avocados, olives, nuts and oily fish. The structure of saturated and unsaturated fat is very different. Saturated fat, which is solid at room temperature, is saturatedwith hydrogen atoms and does not contain double bondsbetween carbon atoms. This type of fat is not considered to behealthy for the heart and is known to raise LDL (bad)cholesterol levels.

Unsaturated fats on the other hand are considered to be healthy to heart, and can actually work to lower LDL cholesterollevels as well as raising HDL (good) cholesterol levels. Contrastingly to saturated fat, unsaturated fats are liquid atroom temperature and contain double bonds.

Protein:

Protein is present in every cell of the body and is important for helping to build and repair tissues. It's also used to make enzymes, hormones and a variety of additional body chemicals as well as forming the building blocks of bones, muscles, cartilage, skin and blood.

Similar to carbohydrates and fats, protein is a macronutrient and the body requires a large amount of it. Unlikefat and carbohydrates, the body has nowhere to store protein, and when it requires a new supply is essential. Protein foods include meat, fish, eggs, pulses, nuts, seeds and soya products.

Vitamin and Minerals:

Vitamins are required in wide variety of bodily functions and operations which helps to sustain the body healthy and disease free. The function of minerals is for structural development of tissues as well as the regulation of bodily process.

Water:

The human body can survive for a long duration without any of the micro and macro nutrients but not without water. The body is made of 55-60% water, representing a nearly ubiquitous presence in bodily tissues and fluids. In athletics, water is important for temperature regulation, lubrication of joints and the transport of the nutrients to active tissues. It regulates the body's temperature and protects vital organs, aids the digestive system, acts within each cell to transport nutrients and dispel waste.

Basic requirement of Nutritional components:

Athletes need a balanced diet that includes a variety of foods. This is important to improve athletic performance and maintain a healthy body. The daily training diet should include thefollowing amounts of these types of foods:

Carbohydrates: Carbohydrates include foods such as breads, cereals, grains, pastas, vegetables, and fruits and provides 4 calories per gram. In total required energy (calories) the Carbohydrates should share 55% to 75%.

Fats: Fat is also in many protein-rich foods. Common fats include oils, butter, and margarine and provide 9 calories per gram. In total required energy fats should share 25% to 30% of total energy (calories).

Proteins: Protein-rich foodsinclude meats, fish, poultry, tofu, dairy foods, legumes, eggs, and nuts and provide 4 calories per gram.Sports diet should provide 15% to 20% of proteins of total energy (calories).

Endurance:

Harre (1986)defines "Endurance as the ability to resist fatigue" and Thesis and Schnabel (1987), "Endurance is the resistance ability to fatigue". Martin (1979) and Matweyew (1981) defined that "Endurance is the ability to do sports movements, with the desired quality and speed, under conditions of fatigue."

Energy system for Endurance:

There are three separate energy systems through which ATP can be produced. A number of factors determine which of these energy systems is chosen, for example intensive exercise.

The ATP-PCr System:

ATP and creatine phosphate (also called phosphor creatine or PCr) make up the ATP-PCr system. PCr is broken down to release a phosphate and energy, which is then used to rebuild ATP. ATP is built by adding a phosphate to ADP in a process called phosphorylation. The enzyme that controls the breakdown of PCr is called creatine kinase.

The glycolytic System:

Glycolysis means the breakdown of glucose and consists of a series of enzymatic reactions. The carbohydrates which supplied to the body can be stored as glycogen in the muscles or liver for later use.The end product of glycolysis is pyruvic acid. Pyruvic acid can then be either funnelled through a process called the Krebs cycle or converted into lactic acid. If the final product was lactic acid, the process called anaerobic glycolysis and if the final product remained as pyruvate the process known as aerobic glycolysis.

The Oxidation System:

The oxidative energy system is the primary source of ATP by utilising fats and carbohydrates as main substancesat rest and during low intensity exercise. After 90 seconds of continuous physical exertion like running, swimming, biking, or walking long distances,this energy system starts functioning. The other energy systems (ATP-PC and Glycolysis) provide energy for shorter duration and higher intensity exercise.
The oxidative energysystem consists of four processes to produce ATP:

Slow glycolysis: In this like as similar series of reactions of fast glycolysis, that metabolise glucose to form two ATPs. The end product pyruvic acid is converted into a substance called **acetyl coenzyme A** rather than lactic acid. Following glycolysis, further ATP can be produced by funnelling acetyl coenzyme A.

Krebs cycle:A complex series of chemical reactions that continues the oxidization of glucose that was started during glycolysis. Acetyl coenzyme A enters the Krebs cycle and is broken down in to carbon dioxide and hydrogen allowing more two more ATPs to be formed. However, the hydrogen produced in the Krebs cycle plus the hydrogen produced during glycolysis, left unchecked would cause cells to become too acidic.

Electron Transport Chain: Hydrogen is carried to the electron transport chain, another series of chemical reactions, and here it combines with oxygen to form water thus preventing acidification. This chain, which requires the presence of oxygen, also results in 34 ATPs being, formed.

Beta Oxidation: Unlike glycolysis, the Krebs cycle and electron transport chain can metabolise fat as well as carbohydrate to produce ATP. Lipolysis is the term used to describe the breakdown of fat (triglycerides) into the more basic units of glycerol and free fatty acids[8].Before these free fatty acids can enter the Krebs cycle they must undergo a process of beta oxidation, a series of reactions to further reduce free fatty acids to acetyl coenzyme A and hydrogen. Acetyl coenzyme A can now enter the Krebs cycle and from this point on, fat metabolism follows the same pathway as carbohydrate metabolism.

Energy Produces by the Nutritional Substance:

From Carbohydrates:

The aerobic production of energy from carbohydrate begins with 'slow' or 'aerobic' glycolysis. The enzymes and intermediate compounds of glycolysis are simply dissolved in the sarcoplasm (fluid portion) of the muscle cell. Although they are not physically arranged in any particular order, the compounds react in the specific sequence described previously. The muscle cell is also composed of sub cellular (within the cell) structures called mitochondria. The mitochondria are oval-shaped structures, existing separately or possibly in 'networks' that contain the enzymes associated with the Krebs cycle and electron transport system (ETS).

It is within the mitochondria that most of the ATP is produced aerobically. The difference between 'fast' and 'slow' glycolysis is the utilization of the electrons and pyruvates produced. If the activity of the mitochondria (which relies in part on the supply of oxygen and the rate at which energy is being produced) is sufficient, the electrons and pyruvates formed enter the mitochondria. The electrons flow directly to the ETS, while the pyruvates are oxidized (lose electrons) and decarboxylated (lose $C0_2$) forming acetyl groups that enter the Krebs cycle.

From Fat:

Fats are stored in the body in adipose tissue and within skeletal muscle in the form of triglycerides. For fat stored in adipose tissue to be used for exercise, it must first be mobilized and transported to the muscle. The fats must then be converted into a form that the muscle can use as fuel. This usable form of fat is called a free fatty acid. A fatty acid is a molecule much longer than glucose that can contain as many as 26 carbons in a long chain. Typical fatty acids used by humans for energy production include the saturated fats-stearic acid (18 carbons) and palmitic acid (16 carbons), and the unsaturated fats-oleic acid and linoleic acid (each possessing 18 carbons). The utilization of fat as a fuel begins with a cyclical process called the fat oxidation cycle, which occurs within the mitochondria. The fatty acid is first 'activated' through a priming step involving the input of 1 mole of ATP. This priming step is not required for every revolution of the cycle, only for the initial entry of the fatty acid into the cycle. Three significant reactions occur during fatty acid oxidation. Two oxidations occur feeding electrons into the electron transport system, and the third involves the cleaving of an acetyl group from the carbon chain of the fatty acid.

The fatty acid (less two carbons) then revolves a second time through the cycle. This process will continue until only two carbons remain in the skeleton of the fatty

acid. At this point, the two-carbon remnant (an acetyl group) enters the Krebs cycle leaving nothing of the fatty acid. It has been completely oxidized to carbon dioxide and water through the aerobic system with a considerable amount of ATP-energy produced in the process. When stearic acid (an 18-carbon fatty acid) is used as a source of fuel, the combination of eight full revolutions of the fat oxidation cycle and the remaining acetyl group remnant results in the production of nearly 150 moles of ATP (or nearly 1,500 kcal of energy). A fatty acid with a longer carbon chain (> 18 carbons) results in greater energy production; while a shorter carbon chain (< 18 carbons) produces less energy.

From Protein:

Protein usually does not provide more than 10-15% of the total energy requirement of an activity. As such, protein does not play any significant role as carbohydrate or fat as a fuel for exercise. The main source of stored protein in the body is muscle. It is obviously not advantageous to use this source for fuel during exercise. Some dietary protein (from animal or vegetable origin) is used for fuel. It must first be broken down into amino acids its simpler, more usable form. Typically, amino acids consumed through the diet include alanine, leucine, valine, and tryptophan. One mole of alanine, metabolized aerobically, produces one acetyl group and one pair of electrons, which result in the production of 15 ATP.

Conclusion:

Endurance in Sports is an important constituent to get a good enactment to an athlete. It depends on the type and quantity of food taken. This food should contain carbohydrates, proteins and fats and with nutrients such as vitamins, minerals, supplements. Food is an important part of many sports training regimens. It is most popular in certain sports such as weight lifting and body-building and endurance sports. Sports nutrition is a specialization within the field of nutrition that partners closely with the study of the human body and exercise. ATP is the major source of energy systems and ATP produced from carbohydrates, proteins and fats through different mechanisms. A mole of carbohydrate (glucose) produces 38 ATP, a mole of fat (stearic acid) produces 147, and a mole of protein (alanine) produces 15 ATP when combusted by the aerobic system.

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