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Abstract
A healthy and adequate diet is very essential for athletes in order to meet their increased energy and nutrient demands. Hence, sports nutrition is gaining importance in today's context. On sport performance nutrition has a vital role. Carbohydrates should comprise 45 to 65% of an athlete's diet to meet their energy requirements. 10 to 30% of proteins are required for muscle building and strength. Adequate fat (25-35%) is required for insulation and energy. Among micronutrients, calcium, vitamin D and iron are essential for bone health. Many foods of functional importance are recently gaining attention in sports nutrition. These foods have many health benefits to cater for the physiological changes that occur during physical activity and exercise. For athletes adequate hydration is very much important two cups of fluids are recommended for athletes prior to exercise. This article gives an overview of the relationship of various functional foods with physical activity and sports.

INTRODUCTION
Physical fitness is developed by consistent training and better athletic performance can be increased by regular physical performance. Sleep is a performance booster. For better athletic performance sleep is very important. Nine hours of sleep at night is essential for athletes for better workout. Athletes try to train themselves in order to achieve optimal or best performance in a certain sport by increasing their training stimulating factors, adapting and fine tuning their skills [1].

The nutritional requirement for top most athletic presentations involves adequate consumption of calorie, energy, hydration and consideration of meal timings. The mentors of young student athletes are very much mislead or mistaken regarding the nutrition of sport. For young student athletes correct nutrition is serious for not only their athletic accomplishment, but for also their progress, evolution, improvement, development and in general their overall wellbeing [2].

For sport performance appropriate nutrition is very essential. To provide something extra to daily allowance athletes widely use nutritional products such as proteins, carbohydrates, minerals and vitamins. The main fuel of athletes is carbohydrates and in body carbohydrate is converted into glucose and in the form of glycogen it is stored in body. During intense exercise this glycogen provides energy to the body. Now days many athletes are interested in physiologically active isolated foods components than macronutrients and fluids. Many of these isolated food components improve the performance. Alcohol is not a macronutrient and it leads to unwanted weight gain so athletes should avoid it [3].

Functional foods are defined as “food or food components that provide health benefits beyond basic nutrition” [4]. They are consumed as a part of the normal diet in regular quantities. They contain certain physiologically active compounds. Probiotics, antioxidants, phytochemicals, plant sterols and stanols are some examples of bioactive compounds of functional foods. Although there is now an increased awareness about functional foods, very little research is available on their use in sports nutrition. More research is required on this aspect. After physical exercise, the body comes under stress. Oxidation occurs which causes inflammatory responses, lipid oxidation, and cell damage. Hence, the immune system is suppressed. These adverse effects of exercise must be countered. This can be achieved by probiotics that are strains of Bifidobacterium and Lactobacillus. The intestinal flora can be enhanced by the ingestion of prebiotics (inulin or oligo-fructose). Phytochemicals have additional benefits than pre- and probiotics. Hence, the diet should be rich in fruits and vegetables which are a good source of fiber [4].

Iron is also very necessary to maintain energy especially for female athletes because they prone more to iron deficiency than men. Non-haem iron does not absorb readily in body as compared to haem iron which absorbs fastly. If a person is vegetarian then he can increase the iron absorption by vitamin C enriched foods such as kiwi, citrus fruit etc. During intense exercise, the capacity of physical and mental performance is influenced in individuals. An appropriate nutrition is very important for better performance and for athletes to recover from fatigue and injury. Vitamin D, calcium both are very important for athletes because they provide muscular strength bone health and energy. The physiological functions and metabolism of the body are
influenced by the use of specific nutritional substances. Food components which have physiological functions are termed as functional foods. Hence, they enhance performance and improve the recovery from exhaustive exercise [5].

IMPROVEMENT OF ENDURANCE

Carbohydrates and lipids are the main source of energy during exercise. Hence, the diet should be rich in them to improve endurance. When continued exercise is performed for example marathon taking carbohydrates is very effective especially before and during exercise. It is very important to digest oligosaccharides and monosaccharides because it is transported to peripheral tissues. The glycogen stores of the body must be increased in the liver and skeletal muscles. In case of depletion of these stores in tissues, the activity of glycogen synthetase is increased which increases storage of glycogen from carbohydrate conversion. For next training session or competition, athletes require rapid replenishment of glycogen stores. This can be achieved through a high carbohydrate diet. For the rapid replenishment of muscles intake of both carbohydrate and protein is very essential. For fatty acid transport across the mitochondrial membrane an enzyme Carnitine is required which increases the β-oxidation of fatty acids. Consumption of 2-4 g carnitine before or on regular basis was reported to enhance the oxygen consumption in persons who perform aerobic training [5].

ENHANCEMENT OF MUSCLE STRENGTH

Muscle strength is related to muscle area. Hence, muscle bulk must be increased through protein consumption as muscles are made of proteins i.e. actin and myosin. For this purpose, resistance exercise is beneficial. It enhances growth hormones and growth factors by increasing their secretion and production. It promotes protein synthesis. Positive nitrogen balance must be increased. Protein requirements for athletes are around 1.4-1.8 g/kg body weight. This requirement can also be fulfilled from supplements than diet alone. Whey protein is very beneficial. It is ideal for muscle building as it is easily digested and absorbed. Whey proteins contain glutamine and branched chain amino acids in high content which enhances muscle protein. The intake of peptides and free amino acids is also beneficial. Free amino acids and peptides do not digest rapidly but they are absorbed after ingestion [5].

Bone mineral density is affected by great intensity exercises and it is stated further that osteoporosis is less in dances than normal population, regardless of their menstrual and intake difficulties [6].

PREVENTION OF INJURY AND FATIGUE

Muscle injury and pain are caused by strenuous exercise. This is caused by inflammatory reactions in response to mechanical and oxidative stress. This can be prevented through the intake of antioxidants like carotenoids, vitamins C and E, polyphenols etc [5].

Supplementation of glucosamine and chondroitin is seen to be effective in the recovery against osteoarthritis that usually occurs due to exercise and aging. Glucosamine is an amino acid which forms the tendons, ligaments and synovial fluid in joints. Chondroitin is found in connective tissues of the skin, tendons and cartilage. It acts as a shock absorber [7].

MAINTENANCE OF IMMUNITY

Mild exercise is beneficial for our body as it prevents cancer, infection and inflammatory diseases. On the other hand, excessive exercise can cause allergic and inflammatory disorders. This happens due to the increased number of immunosuppressive factors e.g. anti-inflammatory cytokines and adrenocortical hormones. They decrease the production of T cells and natural killer cells [8].

Hence, athletes who undergo high intensity workout have increased chances for the risk of impaired immuno-competence. Carbohydrate intake during intense exercise increases the plasma cortisol and cytokine levels which tend to inhibit immunosuppression. Vitamin C and E promote immune function and are required for the maintenance and functioning of T cells. Glutamine (an essential amino acid) works as an energy source for neutrophils, macrophages and lymphocytes. During intense exercise, glutamine concentration is decreased causing immunosuppression. It inhibits cytokine production which causes inflammation and immunosuppression [9].

SUPPLEMENTS AND ATHLETE

Nowadays the current focus or the current need is mostly based on protein Shakes and protein drinks or sports drinks. Because of the role or functional properties of protein, their building blocks, the amino acids as well as their property of repairing muscle tissue That breaks down or breaks apart during hard or weight lifting exercises, the athletes and the professional sports man they prefer to take protein based shakes or drinks more than the carbohydrate based ones. An athlete tries to take protein based So that he can improve his muscle mass. Major or large varieties of sports drinks or protein based drinks are based on animal sources now days. More importantly the proteins that are obtained from milk for instance, whey protein and casein are used. Animal based proteins are used now a days but their effect or they impose more stress on the kidneys of human being than plants based proteins, But the animal based proteins have high protein efficiency ratio (PER) than plant proteins. But according to the current trend the athletes are the professional sports men now prefer plant based protein more than the animal one, and on the top of that they are referring organic plant proteins for their drinks [10].

According to the new studies, it is suggested that high intake of protein along with the help of vigorous workout can help to increase the process of weight loss as well as it can reduce the loss of body lean mass in obese or overweight people. It is noticed that high levels of essential amino acids present in the body can be responsible to preserve the lean mass of the body, such amino acids can be leucine, taken through protein. Loosen is responsible to stimulate the translation process and it is also responsible to increase the process of protein synthesis. This might be the factor to stop or to reduce the loss of muscle protein. There is little or very insignificant information present among athletes but it is present evidently that for amelioration of lean body mass throughout the weight loss of hypo energetic
activities in overweight and obese population. And it is very clearly known that the metabolism or the metabolic activity in an athlete’s body is quite different with that of a person having sedentary lifestyle. The preliminary diseases that can be often seen in obese people, as well as some metabolic diseases, such diseases are not seen in healthy athletic individuals. So, it can be assumed that the metabolic state of an athlete is quite different from other sedentary people that it may put an impact due to the effect of high hypo energetic foods. However, the initiation of any kind of training regime may affect the response to search diet, this might not be the same for the people who are already training or working out. However according to one research done by Walburg, it was shown that negative nitrogen balance is ameliorated if a high protein diet is taken as compared to a diet with average protein intake in a situation like hypo energetic situation in weight trainers. These researchers can support the fact that high levels of protein consumption may be responsible for amelioration of the net protein balance as well as reduce lean body mass loss in during hypo energetic weight loss in athletes. Nevertheless, in one research which is quite recent, it was noticed that in athletes during the condition of hypo energetic weight loss, there was no effect of high protein intake or branched chain amino acid intake on the lean body mass loss [10].

SUPPLEMENTS AND ATHLETES

The principal term used for vitamins home remedies as well as minerals and other substances that are taken orally is ‘supplement’. In the United Kingdom, it is considered that the supplement should only be taken if they contain medical benefits or claims and don’t fall outside the regulations made for food. In the previous researchers there have been many disagreements between the choices of supplements used by the trainers or athletes and the reason of need. Athletes that were taking supplements or using supplement for the purpose of enhancing their performance was different from the choices that were made based on scientific data. If a comparison is made between an adult trainers and young athletes, the young trainers/sportsman they are taking into consideration such kind of nutritional requirements to fulfill from supplements that can sustain their requirements to fulfill from supplements that can sustain their needs. These were the main reason that was found in Developing sportsman or athletes [11].

Since the nutrition is conventionally thought to be such an important and fundamental part of improving our physical performance and fitness. However, in the past few years, it has been noticed that the field of nutrition has grown and now people are making wise choices as well as doing wise management in terms of their intake of food and performance of sports. A global survey has shown the supplements that are being used by the athletes’ ranges from 40% to 80% with more than 30,000 supplements being present in the markets of United States. So many people approximately 3 million in the United States are using supplements that increase or improve their strength as well as the physical condition and those supplements are ergogenic supplements. Such kinds of supplements are also popular among the high school and college students. There is vast variety of reasons that a person can have in order to take supplements. For instance, people are taking supplements in order to improve their strength and to improve their physical condition and to avoid any kind of future illness and to improve their performance in the field of sport. Many studies have shown that people from all around the world have different views and opinions regarding the use of supplements. It might depend on such factors like culture the type and kind of training they are doing and the types of supplements they want to consume. And author Khaustman et al., Stated that people who have aged are more likely to take multi vitamins All Mendel supplement where is the people who are younger they are more likely or it is more possible to take getting supplements. Such people who are now young they possibly try to supplements containing creatine. However, the consumption of supplements only depends on the kind of exercise the person is doing and the type of sports he is into. Supplementation of glucose has profound effect on the activity of athletes. It improves the efficiency during exercise [12].

Over the past few years the increasing interest about fitness related sports and consumption of nutritional supplements has increased among athletes [13].

All around the world, commonly people consume supplements that help them lose weight and burn fat. Normally athletes don’t have the required ample knowledge that will enable them to take the right kind of supplements. One of the most beneficial type of supplements are diet substitutes with greater content of fiber and protein and lesser content of fat and carbohydrate.

Supplements like thermogenics are considered to arouse breakdown and absorption of nutrients thus raising energy spending and stimulate mass loss. These supplements consist of e.g. extract of green-tea (1500mg two spells a day) and caffeine (300mg 30 minutes preceding to workout) and helpful properties of conjugated linoleic acid (CLA) are also observed in some studies s and food greater in dietary fiber in mass loss [14].

MACRONUTRIENTS

There are some Macronutrients that provide us with energy and fuel for carrying out our physical activity and things like sports participation [15].

Carbohydrates

Optimal diets provide benefits to athletes such as enhanced performance, helps in maintain ideal body weight and composition. For exercise carbohydrates are very important they are preferred by athletes and it is digested rapidly than protein. Carbohydrates are known to provide you with the best source of energy and fuel for athletes and sports trainers because they are able to provide you with glucose. Carbohydrates are not only limited to the body. The glucose which is provided from carbohydrates is very important because it provide energy to the brain cells. Glucose is the substance that is stored in the muscles as well as the liver in the form of glycogen. So glycogen is the most readily present energy or fuel source that is needed by the muscles. The intake of carbohydrate is based on depletion of glycogen and physical activity. Carbohydrates are able to give or provide you with 45% to 65% of total or net caloric intake in the people ranging from 4 to 18 years old and the good sources
include whole grains vegetables, fruit, milk and yogurt. When it comes to athletic performance carbohydrates is very essential glycogen store is very important because it provides muscle strength. The primary fuel of the body is muscle glycogen which is used by body during exercise, when glycogen stores become low body becomes unable to complete its task and unable to complete high intensity exercise and leads to muscle fatigue. During recovery from exercise when protein is added to carbohydrate it improves the glycogen re-synthesis and enhances exercise capacity too [16].

**Protein**

Since proteins are required for the building and for the development and repair of human skin, hair, nails and muscles also it is needed for muscle growth and development. For the purpose of doing less intensity exercise as well as the exercise having short period of time, proteins becomes the primary or the initial source of fuel. As the exercise exceeds up, protein is responsible for maintaining blood glucose by liver gluconeogenesis. Proteins provide people aging from 4 to 18 years old with the energy 10% to 30% approximately and the main sources of proteins are lean meat, poultry, eggs, Dairy products, beans and nuts, peanuts. During endurance exercise protein is provided by amino acids these happens mostly due to protein breakdown or protein production or sometimes decrease in both components. During endurance exercise liver provide amino acids for use in skeletal muscles. The increase in production of protein occurs during weight-lifting exercise the need of amino acid and protein increase in this type of exercise and athletes as well. Athletes need more protein in their diet. 12-15% protein should maintain in diet for athletes, the deficiency of protein effects badly on performance. To increase muscle mass and strength athletes need high amount of protein is required [17].

When diet and exercise combine muscle growth occurs. Muscle repair and growth enhances when high quality protein is consumed with carbohydrate. The protein needs of athletes are always more than non-athletes. Power and endurance athletes enhance their protein intake, proteins are formed by amino acids and they are nitrogen containing substances. In several anabolic processes of body protein plays important role. Therefore, high intensity exercise requires more protein intake. The influence of various proteins is so different because of their different composition. Due to loss of lean tissue damaging effects on endurance performance occur. Protein can be derived from animal and plant sources athletes can obtain protein from both sources. In athletes consumption of protein is very common and in the population of United States high protein and low carbohydrate diet is promoted [18].

**Fats**

Fats are needed or significant in order to absorb those vitamins that are fat soluble in nature including vitamin A, D, E and K, does providing you with the essential fatty acids that give a person protection and insulation around vital organs along with the sensation of satiety. It gives a person with 25%-35% in 4-18 year olds and Saturated fats 10%. The best sources of that involves lean meat seeds, olive and canola oil. Several lipid based dietary supplements are used by athletes to increase the athletic performance. CLA also known as Conjugated linoleic acid is consumed by many athletes which improves the body composition [10].

The circulation of testosterone levels increases due to high fat intake than low fat intake. Athletes should consume 30% fat daily and for the physiological functions moderate amount of fat is recommended. Due to exercise muscles damage and inflammation occurs and omega-3 fatty acids are very important because it prevents inflammation of muscles. The adequate amount of polysaturated fatty acids is recommended for athletes. For athletes the recommended fat intake is high than non-athletes [14].

**Micronutrients**

Since micronutrients are needed for good and better health, nowadays special attention is being given to athletes nutrition in terms of the proper amount or consumption of calcium vitamin D & Iron. Go to miss being required for the betterment and the development of over bones, activity of the enzymes, and for the muscles to contract properly. 1000mg/day is the daily suggested or recommended intake or consumption of calcium in people ranging from 4 to 18 years of age. The mineral calcium is present in such food sources like dairy products including milk, yogurt, and cheese as well as non-dairy products like spinach broccoli and fortified grain product. The vitamin D is very much needed for the proper development and betterment of our bones and it is strongly involved in the regulation, absorption of the mineral calcium. The present studies suggest that people ranging between the ages of 4 to 18 years must take vitamin D in the amount of 600IU/per day. People that live in such areas where there is less sunlight like the northern latitude or those who train indoors for example, figure skaters, gymnast, and dancers are very much likely to get or have vitamin D deficiency. Sources of vitamin D fortified foods such as milk and sun exposure. Iron is needed for the blood to carry oxygen towards the body tissues. For adolescents, iron is needed for physical growth, and increase in muscle mass, and people of 4-18 years of age should take 8mg/day iron. Athletes become iron deficient easily and trainers who are vegetarian, females having menstrual cycle, or distant runners, should consume food at least especially females shoot guns in foods that are iron bridge example green leafy vegetables for the filed whole grains and lean meat [15].

**Fluids**

In order to maintain steady glucose level while doing exercise and improving the performance and recovery time during the exercise, it is important to have adequate food and fluid consumption during and after exercise. Athletes must remain hydrated by consuming fluids and thus preventing fluid loss also. Sports drinks with good balance of carbohydrates and electrolytes also help out in preventing fluid loss and act as a source of energy for the muscles to work properly. Consumption of vitamin and mineral supplements are not required for the athletes if they consume good diet, rich in all essential nutrients. Although supplementation becomes important for those athletes who use extensive workout to reduce weight, are more particular in their diet consumption or have high carbohydrate diet with very low density of micronutrients, thus restricting their total.
energy intake. Only then should be the nutritional ergogenic aids should be consumed once it is confirmed that they do not have any illegal substance in it or its efficacy and potential effect on athlete performance and health. A qualified nutritionist should give nutritional advice once after analyzing an athlete’s health, diet or supplement consumption, drug usage and energy requirement [5].

Due to dehydration mental and physical performance decreases. During and after exercise endurance athletes should drink beverages containing electrolytes and carbohydrates. 500 ml of fluid is recommended for athletes. Athletes should avoid sports drinks because they contain added sugar and sodium which is harmful for health. During exercise the body temperature rises up and then sweating removes excess heat and prevents body from overheating. Body undergoes physiological changes during exercise and leads to decrease stroke volume and increases heart rate. When blood volume decreases heart rate rises to sustain other substances and cardiovascular drift is aggravate. During heat there is increased demand of blood flow to both skin and muscle to maintain the function of the body [19].

**Importance of fluids and electrolytes balance**

Sweating during exercise is the sole reason behind the cause of water and electrolyte loss and thus resulting in water and electrolyte imbalance. In first few hours after exercise such changes may decreases whereas at the same time urinary excretion of electrolyte especially of potassium and magnesium increases. In some studies evidence of decreased urinary excretion of sodium as well as chloride, magnesium and calcium have been reported after first few hours of exercise as compared to their urinary excretion before contrast to that urinary excretion of potassium is increased after exercise. Consuming considerable amount of water causes decrease in plasma osmolality and plasma sodium concentration, both of which stimulate urine production. In resting conditions caffeine can cause diuresis. So, there would be loss of electrolytes with urine in both cases. Such information is a quite significance for athletes having short recovery period between competitions and tournaments such as cycling and for those who want to reduce body weight before competition by sweat urine output. So it is of importance to know their need for water, salt and carbohydrates for their specific sport activity [22].

During exercise hydration is very essential because it gives both health and performance benefits. On the other hand, dehydration impairs exercise performance causes danger to health. Blood volume in the body and plasma volume reduces during dehydration and it increases the HR for oxygen and substrates to be transported to exercising muscles. During intense exercise sweat rates increases and athlete’s risk of becoming dehydrated increases if fluid replacement does not lowers the sweat loses during exercise [23].

**FUNCTIONAL FOODS**

Elite class and field athletes use dietary supplements in their exercise, training regimen the supplements generally has, protein, vitamins creatine, minerals, and some of those “ergogenic” complexes. Supplements are now being used globally without the effort of trying to fully understand its use and its potential qualities and without discussion with a skilled sports nutrition trainer. Some of the supplements may prove to be beneficial to athletes in some certain situations, particularly where food ingestion or food selection is constrained. Things like vitamins as well as minerals should only be taken when something can't be dealt with food. Sports drinks, tasty energy bars, and the well-known protein-carbohydrate shakes may provide benefits at a certain event. The well-established participation of creatine, alkalizing agents and caffeine, to boost the high intensity workouts or physical activities, while abundant of the proofs does not relay to precise athletic proceedings. There are expenses that are linked with all of the nutritional supplements, and the hazard of a positive fixing as a result of the present forbidden materials that have not been present on the tag [24].

For growth and development athletes need nutrition. The physical and mental performance of athletes is influenced by nutritional factors and many nutritional substances affect the physiological functions of the body. For athletic performance improvement in nutrition intake is necessary and in various sporting fields nutrition supplements are widely used which...
contain protein, carbohydrates and minerals. To increase production of energy nutritional supplements are very important and metabolic needs of athletes are compensated. Many functional foods are sold on sport market and some of them improve the sport performance [4].

**Protein and amino acids**

In sports, high protein diet consumption is always first preference of athletes as it can help in improving muscle mass but the research theory somehow does not support such supposition up-regulation of protein degradation and amino acid oxidation have been observed with high protein intakes. Lean tissue loss is experienced by the athletes taking high protein diet until new equilibrium is maintained. Although Glutamine, branched chain amino acid, lysine, arginine and ornithine are among those amino acids which are claimed to improve muscle growth. The major source of endogenous acid production is protein and it affects bone mineral density [25].

The most popular dietary supplement among athletes is protein. To increase muscle mass and nitrogen retention protein supplements are recommended to athletes. Chicken, eggs, dairy products and beef contain amino acids. A vegan athlete needs plant based protein sources to meet amino acid requirements. Those who engaged in endurance exercise the role and effect of dietary protein is different and bodybuilders require more protein because of increased workout calories are burned so they need more protein than sedentary individuals. High protein intake can be dangerous for athletes it decreases athletic performance therefore for bodybuilding proper diet plan is required [26].

**Caffeine**

A psychoactive drug which is metabolized by liver is caffeine. Through stomach and small intestine caffeine is absorbed. Many athletes use caffeine before competition to enhance their performance. Many athletes consume caffeine one hour before competition. Initially, the role of caffeine in the world of sports was designated to stimulate fatty acid mobilization which can lead to sparing of glucose and thus maintain energy level during exercise. Recent research indicates that its basic effect is to reduce fatigue or to improve central drive by getting bind with adenosine receptors in brain [27].

The ergogenic outcome of caffeine on strength workout routine is based on many factors; though, there is proof for an influence on both the central nervous system and the contraction due to excitation and skeletal muscle [28].

**Creatine**

By amino acid glycine creatine produces in the body naturally. Meat and fish both are rich source of creatine. The body’s main source of energy ATP (adenosine triphosphate) is regulated by creatine. Power, muscle mass and strength increases by creatine supplementation and it help in athletic activities. Creatine phosphate plays a vital role in very extensive workouts and is really helpful in rapid recoveries during multiple sprints. Although muscle have creatine naturally in them but still fish and meat are also rich source of creatine [29].

Creatine also helps in recovery from exercise and post-injury restoration process is increased by creatine. Creatine is also a neurocognitive enhancer especially in Parkinson’s disease, mitochondrial dysfunction which is caused by Parkinson’s disease is prevented by creatine. In endurance exercise and high-intensity races creatine is used and when time spent in exercise increases effect of creatine decreases. Creatine improves high-intensity performance Creatine storage and production of adenosine triphosphate increases by using supplementation [30].

**Alkalizing Agents**

One of the most light weight substance is considered to be hydrogen and it is widely found in earth. The advantageous properties of the substance hydrogen are considered to be particularly in the diseases that are related to oxidative stress in medical setting. These diseases can be brain stem infarction, neurodegenerative ailments, diabetes mellitus as well as rheumatoid arthritis. Cell signal transduction is in influenced by hydrogen in its molecular form, and hydrogen is responsible to act as an alkalizing agent. Preciously, one of the most beneficial and advanced treatment of exercise induced oxidative stress and injury from sports may be the hydrogen therapy, and this therapy has the potential to upgrade the exercise performance [31].

In the working muscles lactic acid is produced by aerobic exercise metabolism and this lactic acid releases in the blood and disturbs the acid-base balance also it reduces the PH of blood. Many athletes use alkaline water because it has no side effects and it helps in inhibiting the exercise induced metabolic acidosis. According to the research done by Van Montfoort and its colleagues bicarbonates are still considered to outnumber citrate when it comes to positive effect on performance [32].

**CNS-ACTING AGENTS**

There are some drugs that stimulate the central nervous system and they are responsible to lessen exhaustion as well as intensify attentiveness and effectiveness. Mostly they are used in race but they could also be used during workout and training to enhance the strength of exercise period. There are also possible threats linkening to mismanagement in sports. These stimulants which may be ergogenic. Now a days, these stimulants are extensively used by athletes, in which some illegal stimulants like cocaine and amphetamine are commonly used by athletes and are considered to have psychotropic effects [33].

**Glucosamine**

Athletes are more liable to suffer from several different difficulties in immense deterioration on joints. Cartilage and tendons, in joints are present which are buildup of amino acids and protein collagen and proteoglycans. Chondroitinis the chief glucosaminoglycan, it is a chain which is long structured molecule and also consists of large number of molecules. It consists of two main compartments: glucuronic acid as well as galactosamine. It is made up of animal cartilage tissues. Chitin which produces primary component of structure of sea shells, the carbohydrate amino compound is glucosamine is developed from it [5].

For the enhancement of muscle strength protein rich diet is very essential. During severe and high intensity exercise vitamin C, carotenoids, flavonoids are necessary. For muscle growth
and repair essential amino acids, protein hydrolysate is used. Chondroitin sulphate and glucosamine is used for joint health. For fluid and electrolyte balance sport drinks and electrolyte supplements are used. Prevention of a decrease in immuno-
competence is obtained by vitamin C and E [34].

**Physiology of Athlete**

The product of stroke volume and heart rate is cardiac output which rises between 5 to 6 times in extensive exercise. In a young athlete who exercises regularly heart rate is from 40 bpm at rest to 200 bpm. Increase in heart rate is liable for the bulk of cardiac output expansion throughout exercise. Due to exercise and cardiovascular hallmarks of the endurance parasympathetic system and enlargement of cardiac chamber also the ability to produce a large stroke volume and accompanied with sympathetic initiation, is obligatory for this to befall. Heart rate in the athlete may range from 40 bpm at rest to 200 bpm. The daily exercise requires static or isometric exercise. To gain strength and muscle bulk power athletes use activities such as high resistance activities [32].

**PHYSIOLOGY OF TESTOSTERONE**

The scrotum of the male contains testes which produces Te. Te brings about its effects in the body through two main ways. The first way is by activating the androgen receptor and the second one is to converting to estradiol. The primary androgen in males is Te which is a substance that stimulates and maintains male development. Te levels increases during puberty and brings many changes in male such as growth of facial hair, development of male sex hormones. In the 19th century athletes have used many performance enhancing drugs even today the tests are positive of any athletes. Long term consumption of Te supplements reduces fat mass in male and in middle-aged man serum Te levels are lower with visceral obesity. In men there is an inverse relationship between visceral fat mass and Te levels. The physiologic effect of Te has increased size of muscle, decreased fat mass, aerobic endurance and enhances muscular power. These effects help athletes in every performance. The increased dosage has enhanced the effects but the damage to the body due to high dosage or long term dosage is not studied yet [35].

**RESPIRATORY SYSTEM AND SPORTS**

Take part in sports means more cellular respiration which requires more carbon dioxide and more oxygen. In transitional reaction extra carbon dioxide is produced and in Krebs cycle where they occur mostly due to high energy. Lungs play important role in balancing the PH of body and they are part of homeostasis system. The breathing rate decreases and PH of blood is basic. When PH of blood is acidic breathing rate increases and tries to remove carbon dioxide and return to its normal level [36].

Carbon dioxide is produced from cellular respiration when a person exercises and blood PH becomes acidic. Homeostasis system balances the PH when the blood PH becomes acidic. The feedback shutdown the effectors when the blood PH is balanced. This is the process which explains that why our breathing rate increases when we workout. During exercise carbon dioxide is produced and blood PH becomes acidic [37].

**THE IMPORTANCE OF MUSCULAR STRENGTH IN ATHLETIC PERFORMANCE**

Greater muscle strength is associated with improved overall performance of athletes. Many researches support that greater muscle strength can improve the ability to perform sport skills for example sprinting, change of direction task and jumping. Many athletes perform more during sport specific task. Another thing is more muscle strength can permit individual to potentiate before and also decrease the risk of injury [38].

Individual strength features can be monitored by using dynamic, isometric and reactive tests by practitioners. The strength is categorized into strength association, strength insufficiency and strength and strength reserve stages. The phase in which person falls into it influence their exercise emphases and performance level. To support greater muscular strength long term training is executed by sports scientists and practitioners [39].

Muscle tissue consists of proteins (for example myosin and actin) and water, protein content increases by modulating protein metabolism. The aim of resistance exercise is to increase the muscle bulk, and it increases by production and secretion of growth hormone and numerous growth factors. A lack of exercise declines the production and number of mitochondria in skeletal muscle, while exercise stimulates mitochondrial health [5].

**SPORTS ENDOCRINOLOGY**

The athletic endocrinology permeates all sports. The significance of endocrine glands and their hormonal influence in sports is evident to endocrinologist. The key hormone is adrenaline and its action in physical activity is very well-known in untrained public [40].

The exercise is a stressor which interrupts homeostasis and can significantly increase and impacts the actions of hormones. The endocrine reaction to a critical exercise period occurs in the form of stages with the degree of the response being relative to the exercise work volume or intensity. Several physiologic mechanisms are responsible for these responses [41].

The exercise releases certain hormones which causes favorable changes in the body. For example exercise is a stimulant of growth hormone whose action positively effects the composition of body. Due to disruption in secretion of hormone impairment of sport performance can occur and leads to many health problems. The endocrine system permeates all of the sport just as it pervades all medicine and biology. Endogenous hormones play a role in both disease and health [42].

**The importance of digestive enzymes in endurance athletes**

For improving athletic performance digestion and best nutrition is very essential. For performance of endurance athletes digestion and nutrition is extremely important. They experience digestive stress due to long term training, environmental deadlines experience and sprinting. Large extent of calories should ingest by endurance athletes due to heavyweight trainings. High quantity of calories is very important to sustain weight, energy and muscle. The participation of gut, brain
and interaction of other organs like liver, pancreas, kidneys, nervous system and muscles because nutrient absorption is a very multifarious process. Throughout the whole digestive tract for example in the lining of stomach, saliva, intestinal wall and pancreas digestive enzymes are present. From animal sources, plants and microorganisms these digestive enzymes can be found [43].

It is very difficult to digest digestive enzymes in although they are present in raw food but unfortunately cooking and processing can destroy it. Digestive enzymes are too much vital for athletic performance specifically in athletic performance [44].

Since digestive enzymes are helpful in the utilization and absorption of nutrients and their availability is mostly conceded, it is highly required that supplements should be taken. The reason that digestive enzymes help in nutrient absorption is that they are protein in nature and acts as catalyst speed up the chemical reactions that are taking part in the body.

There is also another benefit of digestive enzymes, in endurance sport persons studies advise that athletic enactment, particularly, those who are often familiar with digestive stress throughout exercise and sprinting, can be aided with supplementation of digestive enzyme [45].

Gastrointestinal system of athletes

Physical exercise can be both advantageous and dangerous for the gastrointestinal tract in a relationship between its health and intensity. Mild-to-moderate amount of exercise play a defensive part against colon cancer, cholelithiasis, diverticular disease and constipation on the other hand acute persistent exercise may aggravate heartburn, vomiting, abdominal pain, nausea, diarrhea and gastrointestinal bleeding [46].

Heart rate during exercise

The product of stroke volume and heart rate is cardiac output which rises between 5 to 6 times in extensive exercise. In a young athlete who exercises regularly heart rate is from 40 bpm at rest to 200 bpm. Increase in heart rate is liable for the bulk of cardiac output expansion throughout exercise. Due to exercise and cardiovascular hallmarks of the endurance parasympathetic system and enlargement of cardiac chamber also the ability to produce a large stroke volume and accompanied with sympathetic initiation, is obligatory for this to befall. Heart rate in the athlete may range from 40 bpm at rest to 200 bpm [32].

IMPROVEMENT OF ENDURANCE

Carbohydrates and lipids provide energy to the body. To improve the endurance these two substrates are very essential. Glycogen is gradually depleted during endurance exercise and makes it difficult to continue exercising. Skeletal muscle Stores and the liver prior physical activity, resolution can be improved by increasing the glycogen. For the renewal of muscle glycogen after exercise intake of carbohydrates and protein can be effective, as compared to intake of carbohydrate supplements only. To perform prolonged exercise for instance marathon, intake of carbohydrates earlier or throughout exercise is also an actual mode of refining endurance. In muscles, PH will be reduced because of amplified lactic acid creation, and the consumption of muscle glycogen will raise it leads to damage of muscle shrinkage. Consequently, it is essential to consume starches that will not hinder lipid breakdown. A lack of exercise declines the production and number of mitochondria in skeletal muscle, while exercise stimulates mitochondrial [5].

HYPONATREMIA AND HYPERTERMIA

A race related deaths and life threatening illness is due to hyponatremia among marathon runners. Hyponatremia mostly occurs in nonelite marathon runners and can be severe. The risk factor for hyponatremia is excessive fluid intake and causes serious problems, some other risk factors include; low body mass index, low racing time and lack of marathon experience [2].

In hot atmospheres, the American football uniform influences athletes to exertional heat exhaustion or exercise-induced hyperthermia at the onset for heat stroke [1].

Fatalities in football players are rare but tragic events and it occurs mostly in high school and college football players. The common causes are heat illness, cardiac failure, brain injury and trauma. This condition requires diagnosis, treatment and prevention [47].

HYPOHYDRATION

In temperate conditions there is less demand for skin blood flow and sweating to dissipate heat. In temperate environment the increase in core temperature and reduction in body fluid volume is less during exercise as compared to in hot environment [48].

RESISTANCE EXERCISE

The ingestion of high protein diet before and after exercise is not well known. The increased intake of protein among athletes decreased myostatin and myogenin mRNA expression but did not affect activin receptor Iib, P21, FLRG expression. Protein intake close to resistance exercise may change mRNA expression in a way which is beneficial for muscle hypertrophy [49].

In a study, the writers determined that taking 120 mg/kg body mass of lactate rises HCO₃⁻ levels and thus, helps in the intensifications of workout presentation throughout high-intensity training like cycling to tiredness [50].

So many of the past studies states the fact that greater muscular strength and agility helps in better performance of sports, skills of sports like, running, hopping, skipping, and alteration of course tasks. Stronger athletes are able to give superior performances in their field. The threat to physical injury lessens with greater agility and strength.

REFERENCES


23. 22. 20. 19. 18. 14. 15. 16. 15. 11. 10. 9. 8. 7. 5. 4. 3.

**intakes.**

**energy ratio: implications for recommended protein and amino acid**

**Millward DJ, Jackson AA. Protein/energy ratios of current diets in**

**athletes.**

**Maughan RJ, Depiesse F, Geyer H. The use of dietary supplements by**

**review.**

**loss on changes in heart rate during exercise in the heat: a systematic**

**sport.**

**Rehrer NJ. Fluid and electrolyte balance in ultra-endurance**

**football training and match-play.**

**Shirreffs SM, Sawka MN, Stone M. Water and electrolyte needs for**

**brain.**

**Maughan RJ, Shirreffs SM, Watson P. Exercise, heat, hydration and the**

**attitudes, and behaviors regarding hydration and fluid replacement of**

**Nichols PE, Jonnalagadda SS, Rosenbloom CA, Trinkaus M. Knowledge,**

**2004;**

**Hoffman JR, Falvo MJ. Protein—which is best?. J Sports Sci Med.**

**2001;**

**Lemon PW. Is increased dietary protein necessary or beneficial for**

**individuals with a physically active lifestyle?. Nutr Rev. 1996;**

**54: S169-S175.**

**Suchomel, Timothy, Nimphius, Sophia, Bellon, Christopher, et al. The**

**Importance of Muscular Strength: Training Considerations. Sports**

**Med. 2018: 48.**

**Tarnopolsky MA. Effect of caffeine on the neuromuscular system—**

**potential as an ergogenic aid. Appl Physiol Nutr Metab. 2008;**

**33: 1284-1289.**

**Bird SP. Creatine supplementation and exercise performance: a brief**


**Bemben MG, Lamont HS. Creatine supplementation and exercise**


**Ostojc SM, Stojanovic MD, Callejo-Gonzalez J, Obrenovic MD, Veljovic**

**D, Medjedovic B, et al. Drinks With Alkaline Negative oxidative**

**reduction potential improve exercise performance in physically active**

**men and women: double-blind, randomized, placebo-controlled, cross-over trial of efficacy and safety. Serbian journal of sports**

**sciences. 2011; 5: 83-89.**

**Maron BJ, Pelliccia A. The heart of trained athletes: cardiac remodeling**

**and the risks of sports, including sudden death. Circulation. 2006;**

**114: 1633-1644.**

**Deftos, Zeiger JM. The use and abuse of performance-enhancing**

**hormones and drugs. In S. Advan, (Ed), Sports endocrinology (2nd**

**edition.). AUS: Paul. 2009.**

**Ostojc SM, Arsic M, Prodanovic S, Vukovic J, Zlatanovic M.**

**Glucosamine administration in athletes: effects on recovery of acute**


**Vanny PJ, Moon J. Physiological and Psychological Effects of**

**Testosterone on Sport Performance: A Critical Review of Literature.**

**Sport J. 2015.**

**Malhotra, Shrestha SR. Effects of sports on respiratory system. In P.**

**Komi, (Ed.), Respiratory system and sports (2nd edition.). (111-113).**

**CA: Thomas. 2015.**

**Marina A. The effect of exercise and lung capacity. Effect of Training**

**and Exercise. 2014; 46: 366-369.**

**Nimphus S, Stone S, Suchomel T. The Importance of Muscular Strength**


**Sole C. Analysis of countermovement vertical jump force time curve**

**phase characteristics in athletes. Sports physiology and performance.**

**2015; 56: 76-77.**


**abuse of performance-enhancing hormones and drugs. In (Ed),**


**Hackney AC. Stress and the neuroendocrine system: the role of**

**exercise as a stressor and modifier of stress. Expert Rev Endocrinol**

**Metab. 2006; 1:785-792.**

**Carter R. Exertional heat illness and hyponatremia: an epidemiological**


**Williams M. Dietary supplements and sports performance: amino**


**Lilly KF. Athletes, NSAID, coxibs, and the gastrointestinal tract.**


**Boden BP, Breit I, Beachler JA, Williams A, Mueller FO. Fatalities in**

**high school and college football players. Am J Sports Med. 2013; 41:**

**1108-1116.**


