



Review Article

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Nutritional Requirements and Sensors Used for Monitoring of Sports Activity

Ayush Bidaliya¹, Junaid Aman^{1*}, Rajat Singh¹

¹School of Applied and Life Sciences, Uttarakhand University, Dehradun, 248007, India.

*Corresponding author e-mail address: junaidaman@uttarakhanduniversity.ac.in

ABSTRACT

Nutrition provides energy to athletes and helps in recovery from exercise, stress and injuries. Inadequate nutrition can cause not only poor performance but also effect the growth and development of body. Athletes may require additional vitamins, minerals, and other nutrients for good recovery and performance. Nutritional requirement for every sports person varies, it depends on age, sex weight, height and sports type or training pattern. Usually, protein intake found high in athletes, as compare with fat and carbohydrates. Proper hydration is compulsory for athletes to perform their best in game, high intensity training sessions, environmental factors increase sweating which leads to dehydration, so regular fluid intake and electrolytes are important to prevent dehydration. Here, in this study we discussed the different nutritional requirements including macro and micronutrients which are required for good health and performance of athletes. Furthermore, we also discussed the different sensors used for monitoring of sports activities.

Keywords: Nutrition; Athletes; Health; Sports; Energy

1. INTRODUCTION

Nutrition was generally acknowledged as a strategy to help athletes train and recover faster. Role of nutrition in athlete life is equal as role of exercise. It became obvious that training intensity and duration had a significant impact on athletes' dietary requirements. The impact of dietary factors on athletic performance has been well documented and dietary advice for athletes should seek to ensure the best possible results (Juzwiak, 2016). Sport nutrition, often known as exercise nutrition, is the practise of using nutritional concepts to improve training, recuperation, and performance. Exercise nutrition is a natural name for this topic since it shows the strong connections between exercise physiology and nutrition as academic subjects. However, the field is most frequently referred to as sport nutrition. Sport nutrition as a specialist field emerged relatively late, despite its importance in maintaining high athletic performance. Initially, the focus was mostly on endurance athletes, which coincided with the exercise physiology studies being undertaken. Technology was also developed to assist those scientists in measuring the responses of human tissue to exercise.

Exercise physiologists began to construct exercise physiology laboratories at universities around the world, primarily in the United States, in the 1970s. Distance runners and cyclists were the

most commonly researched athletes because they were at risk of emptying their glycogen stores, and these activities could be easily replicated in the lab using treadmills. In fact, athletes were usually divided into two categories: endurance and strength. Endurance athletes were frequently more concerned with carbohydrate intake, whereas strength athletes were more concerned with protein consumption. Nutritional need also depends on training types, sports type, and physical properties of an athlete. Even though regular exercise has several health benefits, but this is not necessarily the case in high performance sports. Overtraining, stress, body image dissatisfaction, injury risk, and diets that do not match nutritional demands are just few of the issues that athletes face (Mountjoy et al., 2014). Nutrition provides both the fuel for energy and the basis for recovery from exercise stress for athletes. Inadequate nutrition can cause not only poor performance but also growth and development delays as well as maturation delays. Micronutrients also play an indirect role in athletic performance. Athletes may require additional vitamins, minerals, and other nutrients for peak recovery and performance in addition to adequate calorie and macronutrient intake. Exercise with proper nutrition intake, always beneficial for athletic performance.

2. NUTRITIONAL REQUIREMENT FOR ATHLETES

Compared with general public athlete nutritional needs are different. Because of their physical activity they require more

calories macro and micro nutrients to maintain performance and strength. Proper hydration is also important. Proper consumption

of calories protein minerals and carbohydrate a meaningful role play by dietary supplements (Kerksick et al., 2008). During any type of physical activity muscle breakdown which results soreness and fatigue a good nutrients rich diet helps to repair and recovery of muscles.

A good dietary habit and physical activity reduce risk of lifestyle-based diseases and minimize injuries (Bass and Inge, 2006). To develop functioning of body and metabolic adaptation, nutrition and training have strong interaction. Different types of sports like football, cricket, basketball, swimming, weightlifting, bodybuilding, boxing, wrestling, requires a different type of training pattern, so nutritional requirement for these sports is also vary. In any sport all athlete strives to be number one in their game, many of them are unknown of it their performance relies on their diet and nutrition they take. Inadequate diet may lead athlete to illness, nutrient deficiencies, low energy level and fatigue which affect their goals and health. Most of young athletes are not aware about their diet and nutritional requirement. For effective athletic performance good nutrition is essential at all time. Training plays main role to enhance body ability of any athlete but inadequate nutrition reduces the ability to perform maximum potential. Only good training and physical condition is not enough to achieve best results without right food. Energy requirement is always high in athlete compare to a normal person, physical activity burns calories and use as fuel for body. Calorie's intake depends on player weight, height and sports requirement which he/she plays. Carbohydrates are the main source of energy which is consumed by athletes before, after and during game to fulfil energy requirement. Diet along with proper training could be game changer for an athlete. Fluid intake makes body hydrated and improves functioning of body. During game electrolyte mixed solution help to maintain body electrolyte balance and keep body hydrated. Generally, carbohydrate and protein are high in sportsperson diet and fat are usually low, because most of their energy comes from carbohydrates and protein which help to build lean muscle mass. Lean muscle mass is considered good in sports. Micro nutrients such as minerals and vitamin play an important role for enhancement of athlete performance. It helps to proper absorption of macro nutrients in body and also prevents injuries and macro nutrients deficiencies. Purcell et al., (2013) mostly discusses the importance of nutrition for young athletes, the article starts by giving us a basic outlay for energy requirements. The article tells us how to reduce fatigue, injury or risk of disease and improve athletic performance by using right diet and nutrition. The articles tell as how energy requirement changes after puberty for both girl and boy the articles and provide with a comprehensive chart containing the requirements vis a vis Kcal/day for male and female. Then article tells us the about the individual break up of Carbohydrates, Protein and fats and further goes into detailing of micronutrients, fluids and the most importantly meal planning which one of the main aspects of diet plan in diet which ultimately decides the intake for all the nutrition

which one is going to take in his/her diet. Overall article is really useful for young researchers as to get better knowledge of the subject it is also useful for young athletes who are looking to manage their diet plan in a self-making manner. Kanter (2018) discussed that carbohydrate is one of the most important components in our food as it provides us energy the current article is a discussion as to how high-quality carbohydrates effects performance of an Athlete. The article cites several reports and articles to establish the fact for high intensity performance carbohydrate is the king for example "the experts pointed many athletes do not consume enough carbohydrate to adequately restore muscle glycogen stores" which is one of the important factors when we look at performance because it leads to decrease in performance when someone performs exercise of regular basis. Coming to next leg of article in this article compares a slowly absorbed v/s a rapidly absorbed carbohydrate article suggests us the fact athlete who over consume the protein going overboard can cut intake of carbohydrates. At the conclusion of the article, it does not seem to have a very well stand on as to what is important as it clearly mention still research is being carried out to get a better understanding of this subject which leaves a reader to a point of confusion. Phillip et al., (2019) discussed that dietary protein is regarded as key nutrient, as we all know for optimal training adaptation and for body composition. The article circles around the lines of track of dietary protein for training. Track articles starts with basics what track field events are example racing, sprints, hurdling, shot puts etc. Some these consist of high quality weight loss and some requires not so much later article is divided into two segments one describing the weight loss principle the article put it in a very smart way saying weight loss and weight gain are similar as they both require imbalance of diet which very well quite true the articles lays down all the tricks and guides which are needed for one person routine to do the same the second part of article discusses why weight management is important as well all know in field events weights plays a crucial role in my opinion not just field evens but also other events for example boxing or wrestling where weight is very important taking all these accounts into consideration the article discusses the need for dietary protein according to individual sport which one is associate to it which is quite impressive I think article gives us a brief idea as to how and what a new athlete should take into consideration into his plate while looking at his sport at the same time. Khan et al., (2017) focused the perception of athletes about role of diet in recovery, performance and maintenance. "The article relied on the research study which was comprised of players form different sports club. The article is basically a representation of what happened in the study which was conducted by researcher for this purpose, players were randomly selected for the purpose of sample study. The method use was a questionnaire after analyzing the data. The researcher came to the conclusion that appropriate nutrition is the most important factor in athletic performance. Carbohydrates, fats and proteins are more important for every

sport person, also micronutrients vitamins, fluid and minerals, shown to be important to ingest in the study appropriate amount for involvement in sports. The data shows nutrients both macro and micro and water intake in adequate amount is beneficial for

3. DIET FOR ATHLETES

Diet word comes from Greek *diata*, it represents both physical and mental health and a healthy lifestyle (Foxcroft and Louise, 2014). Banting was the first popular diet, named after William Banting. A diet is full with macro and micro nutrients like carbohydrates, proteins, fat, vitamin, minerals and fluid. Diet or dieting is the way to maintain body weight or to treat or curing diseases by eating food in right way. A Diet is use for increase or decrease in weight and maintains weight by adding and cutting of nutrients like carbohydrates fats and protein. Diet is also used for prevention, curing and treatment for diseases like cancer, high blood pressure, diabetes, cholesterol etc. There are different types of diets such as vegetarian diet, vegan diet, and non- vegetarian diet. Also many types of diet are used for a healthy lifestyle and weight management. Gym goers and athletes diet is depends on their sports, training patterns, and goals. Mostly they consume a

participation in any sport. In addition, food consists of sufficient amount of nutrients which helps repair and recovery is provided to athlete before, during and after training or competition must be regulated” according to one’s sports.

high protein, carbohydrates and low fat diet with all vitamins and minerals. Some of their nutrients also come from food supplements. A high protein diet helps to rebuild muscle which is damaged during their training. Also vitamin, minerals and essential amino acids helps to reduce muscle fatigue. Food which helps to improve immune system, improve physical condition, maintain weight and help to prevent or cure of disease is known as diet (Hoch et al., 2006). Diet is the basic need for every person, performing sports in various levels. It is a valuable tool for athletic performance. If body requirements are not meet than poor performance and health risk increases. The different diets such as Mediterranean Diet, Dash Diet, Paleo Diet, Flexitarian Diet, Trifecta, Nordic Diet, Green Chef, Noom, Ketogenic diet, Vegan diet, Dukan diet, Hcg diet, Zone diet, Low fat diet, South beach diets used by athletes.

4. MACRONUTRIENTS REQUIREMENT FOR ATHLETES

4.1 Carbohydrate

Carbohydrate intake depends on individual training types, energy need, bodyweight and performance (Srilakshmi et al., 2017; Gupta et al., 2020). Body use carbohydrates as fuel for functioning of body or performing any type of physical activity. In a physical activity the main role of carbohydrates is to provide energy. If athlete diet does not contain enough carbohydrate, then they feel tired and their performance decreases. Carbohydrates are stored in liver and muscles as glycogen, during physical activity body uses these stores as fuel source for physical activity. If training at high level, then it’s important to fully fuel the body before going to exercise because glycogen stores in body are limited. The amount of carbohydrate depends upon training type, frequency, duration of game and intensity. Generally, 5-10gm/kg body weight of carbohydrates should consume by athlete per day (Kreider et al., 2010). Low GI carbs or known as slow carb should have majority in diet. A low glycaemic index carbohydrate meal is advisable to consume approximately 1-2 hours before exercise (Wilborn et al., 2010). Endurance Sports like marathon, hiking, cross country race, low-glycaemic index carbohydrates are preferable, because low glycaemic index foods releases glucose in blood slowly which gives constant energy during game. Non endurance sports like weight lifting, strength training, requires high glycaemic index foods for a quick energy burst. Insulin response and hyperglycaemia is increases by high glycaemic foods. Complex carbohydrates take longer time to digest compare to simple carbohydrates. Maintaining of body glycogen stores simple carbohydrates are less efficient, while complex carbohydrates are

preferentially metabolized into glycogen. Recovery between training session or game events, the fundamental goal is restoration of liver and muscle glycogen. When athletes do multiple training sessions, glycogen helps to provide energy. Carbohydrate is key fuel for central nervous system and brain. When high intensity exercises are performed it support muscular work due to its utilization is done by two pathways, one is oxidative pathway and another is anaerobic pathway. Oxidative phosphorylation supports when working at the high intensities, carbohydrate also have advantage over fat. Per volume of oxygen, it provide a greater yield of adenosine triphosphate that delivered to mitochondria Athlete who maintain high carbohydrate availability their performance enhanced in high intensity exercises. Recent work identifies regulating muscles adaptation to training, glycogen plays indirect and direct roles as a muscle’s substrate (Phlip et al., 2012). Body breaks down both carbohydrates (simple and complex) into glucose which is absorbed in blood stream. When the intensity of exercise increases muscle glycogen is used, due to this body need more carbohydrate. Low carbohydrate diet decreases athletic performance and muscle potential. Exercise with high intensity requires carbohydrate as primary fuel, higher intake of carbohydrate enable athlete to train more and reduce fatigue. Stored carbohydrate (muscle glycogen and liver glycogen) depletes, when competition and training session are done, which leads muscle fatigue and decrease performance in high intensity exercise. Stores of muscle glycogen take almost 24hours to fully replenish. Carbohydrate recommendation for endurance athlete is

1gm per kg body weight each hour of exercise, exact need is depended upon exercise, sport or activity, weight, glycogen level and fitness level of an athlete. For strength and power performance sport athletes should consume approximately 5 to 6 gm per kg body weight carbohydrate intake, also exact need is depended on individual.

4.2 Protein

Protein is the nutrient which helps to repair muscle tissue which are damaged during training time. For allowing optimal training adaptation the main key nutrient is dietary protein (Tipton, 2008). It can boost glycogen storage, promote muscle growth by repairing and reduce muscle soreness. Protein helps to build muscle but there is a mistaken belief that high protein intake alone increases muscle mass. In high intensity training and endurance training, protein uses increased by body as an energy substrate, also when muscle glycogen levels are low protein contribute to total energy production. The presence of protein in body is, 50% in muscle, 20% in bones and 10% is present in skin, and rest of protein is present in other part of the body. Protein intake with sufficient energy intake can maintain a lean body mass, if the goal is building muscle and train to hypertrophy the higher intake of protein may be beneficial to athlete. Protein recommendation for strength athletes is about 1.2 to 1.7gms per kg of body weight/day and for endurance athletes it is 1.2 to 1.4gm per kg of bodyweight/day, sometimes athlete (like bodybuilder and weightlifter) consume 2gm/kg of body weight. The exact protein need is depended on the sports person goals and training. Protein is necessary for increase in muscles and strength. Muscles adapt training and dietary intake of athlete, to maintain proper muscle mass protein synthesis should be increased regularly. Study shows that training and high protein intake increase in lean muscle mass compare to group which have less protein intake (Burke et al., 2001). Repair and maintenance of muscles high quality dietary proteins are very effective, also milk based protein are effective for muscle growth. High protein sources are pork, egg, beef used to fill protein requirement. When protein requirement is not fulfilled by food sources than dietary supplements are used, dietary supplements like whey protein, soya protein, egg protein, casein protein are used to meet athlete protein need. Protein is made up from amino acids, essential amino acids are important for muscle protein synthesis compare to non-essential amino acids which are not necessary for muscle protein synthesis. Amino acids are coming from food sources and also taken from supplementation, Intake of Bcaa and Eaa increase athletic performance, reduce muscle fatigue and help a fast recovery. Recovery is the most important for any sportperson or athlete, essential amino acids are most important for recovery, intake of essential amino acids results net muscle protein synthesis (Tipton et al., 2001). Energy and carbohydrate intake is most important, to match energy expenditure because of those amino acids are not oxidized and spared for protein synthesis (Rodriguez et al., 2007). Study shown that consumption of protein before exercise and during exercise have less impact on muscle protein synthesis compare to postworkout consumption. Higher consumption of protein is beneficial for resistance training and muscle building.

4.3 Fat

Fats are high in calories and it is essential nutrient for body in small amount, 1gm fat has 9 calories. Because of high calories excess amount of fat consumption leads weight gain, so it is important to control fat intake if goal is maintaining weight. Body stored energy in form of fat, excess amount of stored fat leads to overweight. Mainly fats are Saturated fatty acids and unsaturated fatty acids. Intake of fat type is also important. Mostly foods which are high in fat contain both unsaturated and saturated fat. Fat intake for most of athletes ranges between 20%-30%. Currently dietary standards recommended that monounsaturated fat makes up 10% of total fat intake, saturated makes up 10% of total fat intake and polyunsaturated fat makes up 10% of total fat intake (Rodriguez et al., 2009). Replacement of saturated fat with unsaturated fat in diet helps to reduce blood cholesterol level and lower the risk of stroke and heart related diseases. Fatty acids, linoleic acid and alpha linoleic acids are essential for body, Fat also play role in absorption of vitamins (fat soluble). It is important to include fat in diet but amount should not increase from 20% to 25 percentage of total daily calorie intake. A moderate lifestyle adult, minimum amount of fat intake should be 10% of daily energy need but most of people consuming a lot of fat then necessary (Celejowa, 2008). During aerobic exercise oxidation of fat occurs at high rate, in aerobic exercise body uses fat as energy source. Athletes like weightlifter requires high energy intake, fat is an important fuel source for them. For Athlete dietary recommendation of fat is same or slightly higher than non-athletes, essential fatty acids have greater importance among athletes. Mostly athlete prefer low fat diet to maintain their body composition, athlete should avoid trans- fat and saturated fat because its lead to heart disease. Mono and poly unsaturated fats are good choice because they are burn rapidly for fuel compare to saturated fat and trans-fat. When carbohydrates are reduces from diet fat oxidation occurs but it may impair high intensity activity performance (Stellingwerff et al., 2006).

4.4 Water

Hydration is very important for everyone specially who are physically active, athlete require high amount of fluid rather than normal person, most of water loss due to sweating because exercise increase body temperature so body release sweat to cool down. Sweat loss depends on the environmental condition, duration or type of training and individual characteristics (Burke et al., 2007). High duration workouts and training sessions makes body dehydrate, if body lose fluid higher than 2% of body weight than athletic performance can compromise (Goulet, 2012). Due to dehydration fainting, muscle cramps, vomiting, fatigue and nausea like problems occur. To stay hydrated and avoid hyperthermia, fluid loss during physical activity should be replenished. Water is a solvent it plays an important role in metabolic reaction, water quantity in body is 70%. Fluid need after exercise can be determined as if athlete loses 1kg of weight during training then he/she needs to drink 1250ml of fluid to meet fluid need of body. Athletes can monitor their hydration status by symptoms like colour of urine (dark/light), volume of urine and weight measurement. Juices like sugarcane, fruit juices, coconut water and sports drinks are good choice to maintain fluid and electrolyte balance in body. Sports drinks helps athlete to maintain fluid

balance and electrolytes in body, it contains minerals sodium, potassium, calcium, magnesium which help to maintain fluid balance during sweating. Proper hydration maintains body temperature and blood volume, also help to reduce fatigue during training. Cool water is preferred for athlete rather than normal

room temperature water because it cools body faster and absorb fast. Fluid requirement for athlete is 0.5l water in 1 to 2 hour before event and 0.6l water in 10 to 15 minutes before event, during event it is 150ml to 250ml in every 10 to 15 minutes. Water should consume sip by sip not all in one breath.

5. MICRONUTRIENTS REQUIREMENT FOR ATHLETES

5.1 Vitamins

An important role played by vitamins is energy production, helps immune system, bone health and haemoglobin synthesis. Vitamins are not produced by body so consumption of vitamin are very important from food source or through supplementation. Categorize into fat soluble (A, D, E, and K) and water soluble (B, and C), catabolism of macronutrients for energy production in body requires presence of vitamins. Training and exercise involve many metabolic pathways where micronutrients required, muscle biochemical adaptation may increase due to training and exercise which also increase micronutrients need (Farajian and Kavouras 2004). A high intake of micronutrients requires for repair and building of lean body mass in athlete, due to training and exercise muscle damage and energy requirement increases. Sometime athlete practices extreme weight loss or restrict energy by eliminating food groups which cause nutrient deficiency, to avoid this micronutrients intake is beneficial. Vitamin B - Riboflavin, niacin and thiamine are important for energy production, B₁₂, pyridoxine, riboflavin is lack in some female athletes especially in vegetarian athletes. Main source of vitamin B₁₂ is animal. Because of water solubility they are not stored in body so no toxicity issue by consuming it. Vitamin C- is not produced by human body so it must be consumed by externally food sources. It also serves as antioxidant in body and reduce free radicals. It should not be taken in excess amount because it acts as a pro-oxidant. Vitamin A- known as retinol and produce from beta carotene and carotenoids, it helps to work immune system properly, improve vision and keep skin healthy. Overdose can lead kidney disease and anorexia. Vitamin D- is important to absorption of calcium in body and helps to keep bones healthy. To prevent bone related injury and bone loss calcium supplementation is important for athletes. Deficiency of calcium result osteoporosis and overdose of D vitamin may lead to hypercalcemia and hypercalciuria. Vitamin E- it's an antioxidant and active form is tocopherol, it helps against oxidative damage, support immune function and also prevent

muscle damage. Ergogenic acids – Athletes employ ergogenic acids such as mechanical, dietary, pharmacological, physiological, and psychological techniques to boost their energy, performance, and recuperation. Antioxidants- Helps to decrease oxidative damage, enhancement of performance or muscle recovery is not yet known but they may reduce lipid peroxidation and oxidative stress.

5.2 Minerals

Iron, calcium, zinc, magnesium and potassium, sodium plays an important role in athletic performance. During exercise, training or any sport event loss of some minerals are happened. Sodium level increases in body by sweating so water intake is required to balance sodium concentration, also potassium level goes down during heavy training session. To balance sodium potassium level during game athlete should take electrolyte or sports drinks and food rich in both minerals. Calcium is also an important mineral for athlete it helps to maintain a good bone health and helps to maintenance, repair and growth of bone tissue. Iron need in athlete is especially high because iron carry oxygen through blood and circulates it in body. As it carries oxygen so low level of iron cause decrease in endurance and fatigue, anaemia is also a cause of iron deficiency especially female athletes. Zinc helps to heal injuries and wound also repair and growth of muscle tissue, found in non-vegetarian food sources. Poor zinc levels in body cause decrease muscle strength and endurance in athletes, animal products are good source of zinc. An adult body contain about 20 to 25 gms in body, where 60 to 70 % in bone and muscle contain around 20 to 30 % magnesium. It is commonly found in food source, role of magnesium in body is protein metabolism, cellular metabolism and glycolysis. Magnesium and zinc together effective for recovery, good sleep and protein metabolism. If low magnesium levels in body, then supplementation may be required, food products like legumes, pulses, cereals, plant-based product and animal products are good source of magnesium.

6. SENSORS USED FOR MONITORING OF SPORTS ACTIVITY

6.1 Microcontroller

A microcontroller is essential for wearable technology to function. This is commonly referred to as a mini-computer (chip system). This makes it easier to participate in this Internet of Things programme (IoT). It also minimises the number of

electronic components on a single chip that are charged with performing different duties. It is ideal for wearable technology because of its ease of programming, reprogramming, cost, size, interoperability with various sensors, and capacity to control sophisticated outputs, such as graphical displays. The processor reads the input data and stores the information before making

judgments and writing output data. The oscillator is a temporal clock that keeps all of the needed data in sync. There are three types of storage: random access memory (RAM), which loses data when power is lost, read-only memory (ROM), which does not lose data when power is lost, and flash, which stores data. The ports serve as the last component of a microcontroller. These are the wires that go into and out of the microcontroller. It reads the incoming data (polling) and outputs the data. An analogue to digital converter (ADC) is a device that converts analogue signals into digital values. Distinct types of microcontrollers have different configurations. All of the components are powered by the given voltage, control logic takes precedence over all other components, and pulse sequences are stabilized by a timer.

6.2 Gyroscopes

Gyroscopes are another type of wearable sensor. There are several varieties, including gas bearing, optical, and mechanical. Optical is the one that works differently (non-angular momentum), in which two optic fiber coils are spun in opposite directions, travelling separate distances, and the Signac effect is used to monitor this. Gyroscopes, in essence, measure angular velocity on its disc. Vibration gyroscope sensors measure angular velocities due to the Coriolis force. These are natural forces caused by the Earth's rotation, which act on a vibrating element. A potential difference is created by the motion, which is converted into an electrical signal. This is useful for stats that require angles or precise positioning because it is used to measure orientation and projection. If the sensors must be integrated with equipment, another thing to consider is selecting appropriate electronics and placements for the sensors.

6.3 Heart Rates

Heart rates can be measured using a variety of sensors. The electrode (sensor) and the human skin can be idealized as two components that compose a typical capacitor in one form of capacitive sensing. Photoplethysmography is a phenomenon in which light is used to quantify blood flow and so is linked to heartbeats. The photodiode can measure the light absorption by emitting a continuous green light onto the user's skin. This

7. Conclusion

Nutritional support for athlete allows them a healthy and injury free life, also help to maximize their performance and recovery during training sessions. Nutritional requirement for every sports person varies, it depends on age, sex weight, height and sports type or training pattern. Compare to sedentary person athlete requirement is always higher, an adequate amount of energy should consume by athletes during training session to maintain energy balance and increase their athletic performance. Usually, protein intake found high in athletes, because it is the nutrient which helps in repair, build and growth of muscles. Fat intake in athlete is usually not high it's

information is transformed such that a pulse measurement can be performed. The amount of light absorbed by the diodes increases as more blood flows through the user's body, indicating a higher intensity. There are now methods for determining oxygen levels that use this phenomenon with red light. The "wavelengths" of light determine how "strong the penetration through tissues" can be. Green and red are typically utilized for this purpose.

6.4 Accelerometers

Accelerometers are a prominent wearables sensor. Their sensing skills cover a wide spectrum of accelerations (linear and gravity). Because of its measurement capabilities, monitored data can be programmed for a variety of purposes. When a user runs, for example, top speed and acceleration can be output. Sleep habits, which have been linked to seizures, are also monitored using accelerometers. These two examples demonstrate how an accelerometer-based wearable can produce a wide range of useful data, which is beneficial to industries such as sport and medicine industry.

6.5 Global Positioning System (GPS)

GPS is a most common sensor that can be found in a variety of devices (smart phones). GPS technology has been employed in professional athletics, both in training sessions and during competition. It's essential for navigation because it tells users where they are. Data is transferred to a satellite, which provides the precise location and time. This serves as both a transmitter and a receiver, with the data being sent back into the sensor to provide location information. It's used in wearables to track important statistics like distance, which may be seen in a variety of ways depending on the application. Designers have concerned about the sensors' power consumption. In team sports, GPS is useful because it eliminates concerns with time motion analysis and allows coaches to manage positional team play. This is especially crucial for instructors who have several priorities and may not always be able to provide personalized attention.

always balanced with total energy requirement and athlete need; it ranges between 20%-30% of total energy consumption. Currently dietary standards recommended that mono-unsaturated 10% of total fat intake, saturated 10% of total fat intake and polyunsaturated fat makes up 10% of total fat intake. Micronutrients may not directly enhance performance but they help to decrease free radicals, oxidative damage and improve immune system. Proper hydration is compulsory for athletes to perform their best in game, high intensity training sessions, environmental factors increase sweating which leads to dehydration, so regular fluid intake and electrolytes are important to prevent dehydration. In this study we also

discussed the importance of different types of sensors used for monitoring of sports activity. The sensors are playing important role to measure the heart rate, blood pressure, location and

movement of athletes and in future more portable, cost-effective sensors will be required to access the activities of athletes

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