Chapter II

Review of Literature

The literature pertaining to the present study entitled "**Development and Evaluation of Nutraceutical Energy Rich Nutribar on The Sprint Performance of Women Athletes during Covid- 19 Pandemic**" is presented under the following heads:

2.1. Importance of sports Nutrition for Sprinters

2.2. Physical fitness and sprint performance of Sprinters

2.3. Impact of socio economic status on sports performance

2.4. Nutrient and nutraceuticals potentials of sweet potato, *ulva fasciata* and basil seeds

2.5. Nutritional anthropometry and body composition status of Sprinters

2.6. Importance of nutrition education for Athletes

2.1. **Importance of Sports Nutrition for Sprinters**

Sports Authority of India (SAI) was established in 1982 under the aegis of the Department of Youth Affairs and Sports, Ministry of Human Resources and Development, Government of India. The basic aim of SAl is to provide scientific backup to the national campers and talented children under sports.

An athlete's diet should meet their energy, macronutrient, micronutrient, and water requirements. Exercise may increase or alter the need for some nutrients through increased biochemical and metabolic demands, increased turnover of nutrients, and increased needs for repair and maintenance of lean tissue mass in athletes.

The study and practice of nutrition and diet with regards to improving athletic performance is known as Sports nutrition. Nutrition is an important part of many sports training regimens, being popular in strength sports (such as weightlifting and bodybuilding) and endurance sports (e.g. cycling, running, swimming, rowing). Sports nutrition focuses its studies on the type, as well as the quantity of fluids and food taken by an athlete. In addition, it deals with the consumption of nutrients such as vitamins, minerals, supplements and organic substances that include carbohydrates, proteins and fats. Sprinting is defined as races over short distances, or sprints, which are among the oldest running competitions. Athletes compete in sprinting events to achieve and maintain their fastest potential running pace. The 100, 200 and 400 metres are the three sprinting events now competed at the Olympics and outdoor World Championships.

Athletic performance, recovery from exercise and physical activity are enhanced by optimal nutrition. Arciero *et al.,* (2015) rightly points out that the difference between winning and losing largely depends on the training and nutritional status of the athlete. Thus in order to be successful in athletic performance, proper training and nourishment must be a daily priority

Mattioli (2020) conducted a survey on intake of food during covid 19 lockdown, in total, 258 respondents completed Survey of the total respondents, 58% indicated they lived with family during lockdown. Total food intake was reported to be higher in 36% of respondents. Of the respondents, 72% prepared and 67% purchased their own food. Less than half of respondents consumed high-protein food more than twice daily either during or following lockdown.

As the past 18 months of Covid-19 had been a sobering and awakening to the dangers of an uncontrolled virus, the suffering and loss of life that has occurred throughout the world. Many people found solace and relief through exercise during the pandemic. In addition, the loss of organized sport at all levels made it

very clear that exercise and sport play important roles in the lives of many people (Spriet *et al.,* 2021).

There is great variability in individual needs, especially because of the onset of growth spurt, which is unpredictable. Physical training requires additional calories exceeding those needed for basal energy and growth. Avoiding heat illness and fatigue that accompany dehydration is important. Rowland concluded that given adequate to drink during exercise, volume driven by thirst of athletes who are older than 9yrs but younger than 13 years should be sufficient to prevent significant levels of dehydration (or >1% body weight loss during 2-3 hours of intense exercise. Rehydration requires the presence of dextrose and sodium, therefore sugar free sports drinks have an advantage of being lower in calorie but lose rehydration power (Kay,2014).

Energy needs of athletes depend on the body size, body composition, gender, training regimen and activity pattern. Energy requirements of athletes and sports persons have been estimated employing the classical procedure of direct or indirect calorimetry (Hackman, 1984), the intake of .other nutrients have however been fixed rather arbitrarily at 2-3 times for good performance.

As reviewed by Goran (1994), energy expenditure was found to vary from about 2600 kcal in female swimmers to about 8,500 kcal in male cyclists participating in the Tour de France bicycle racc. However, the nutritional needs of very active athletes can exceed the RDA's considerably. Some competitive sports require adherence to rigid weight standards. Athletes, who participate in competitive sports, must closely monitor their weight and thus their calorie intake. It is important that the daily energy intake is contributed by sufficient amount of carbohydrates, protein and fat for optimum performance. Table: 1 shows **Classification of sports and games according to energy expenditure.**

Table: 1 Classification of sports and games according to energy expenditure

Category	Event
Group I	Power events of Higher weight category (80Kg and above), Weight lifting, Boxing, Wrestling, Judo, Throwing events, Kabbadi
Group II	Endurance events: Marathon, Long distance running, Walking, Road cycling, Rowing middle and long distance swimming
Group III	Team events, Athletics and power events of middle weight category(65Kg), Hockey, Football, Volleyball, Basketball, Tennis, Sprints, Jumpers, Boxing, Wrestling, Weight Lifting, Judo and Swimming
Group IV	Events of light weight category: Gymnastics, Table Tennis, Boxing, Wrestling, Weight Lifting and Judo
Group V	Skills games shooting and Archery

Table: 2 Average body weight and energy expenditure levels assumed and allowances suggested

Category	Body weight (kg)	Energy allowances		Calories ration		
		Kcal/kg/day	Kcal/day	Carbohydrate	Protein	Fat
Group I	85	70	6000	55	15	30
Group II	65	80	5200	60	15	25
Group III	65	70	4500	64	15	21
Group IV	60	60	3600	65	15	20
Group V	60	50	3000	55	15	3150

Source: Nutrition and hydration guidelines by Panandiker *et al.*, (2007)

Carbohydrates yield more energy per unit of oxygen consumed than fats. Because oxygen often is the limiting factor in long duration events, it is beneficial for the athlete to use the energy source requiring the least amount of oxygen per kilocalorie produced. As work intensity increases, carbohydrate utilization increases (Anderson, 2012). Table :2 shows average body weight and energy expenditure levels assumed and allowances suggested

Yeo *et al.,* (2011) suggested restriction of carbohydrate intake long enough to promote fat adaptation and then increasing carbohydrate intake prior to or during a competition in order to restore glycogen levels. Endurance athletes must maintain blood glucose and replenish glycogen stores during and following longer bouts of exercise .

Protein is the most crucial nutrient for general health and athletic performance because of its role in protein synthesis, energy metabolism, body composition, immune support and satisfaction (Arciero *et al.,* 2014). Research supports timed daily protein feedings throughout the day to maximize protein synthesis and thus lean muscle mass accretion (Areta *et al.,*, 2013). Dietary protein containing a full complement of essential amino acids with high leucine content highly stimulates muscle protein synthesis (Moore *et al.,* 2009). In addition there is speculation that a frequent intake of macronutrient protein containing meals favours an anabolic state resulting in an increase in protein synthesis and accretion. This enhances functional capacity of muscles and an increase in lean body mass, leading to improved body weight control and athletic performance (Areta *et al.,* 2013; Moore *et al.,* 2009).

Panandiker *et al.,* (2007) suggested that endurance athletes and body builders should consume 1 to 1.5g protein/ kg body weight to maintain lean body mass. Athletes who follow vegetarian diets have greater protein requirements (1.3 to 1.8g/kg body weight) because of the lower quality of plant derived proteins (Pameela, 2009). While planning diets for Indian athletes protein intake may exceed 2g/ kg body weight .

Fat is an important source of energy used to fuel longer exercise and endurance activities, such as hiking, cycling, and long-distance running. Eating a diet that is too low in dietary fat may decrease athletic performance and cause other health problems, such as deficiencies of certain vitamins which require fat to be absorbed (Health Guides,2013).

Fat intake varies among athletes in different sports. Endurance athletes tend to have lower fat and higher carbohydrate intake than sprinters and short distance runners. Collegiate athletes many of whom are living away from home may consume too much dietary fat because of an over reliance on fast foods. They should focus not only on the total amount of fat in their diet but also on the type of fat consumed.

Adequate body stores of iron are necessary for optimal endurance exercise performance. Severe iron depletion resulting in iron-deficiency anaemia clearly depresses endurance fitness. Competitive athletes therefore have considerable interest in assuring proper iron stores, recognizing that levels of iron in the body can be readily assessed and that a deficiency that would affect negatively on sports performance can be promptly managed (Thomas,2012). Young athletes with iron-deficiency anaemia may experience performance inhibition ranging from decreased work capacity to extreme fatigue, impaired immune function, and impaired cognitive reasoning.

Iron is critical for proper health as well as optimal performance. It is best known for aiding in the formation of compounds essential for transporting and utilizing oxygen, thus it is critical for aerobic activities and endurance training. Iron also plays a role in healthy immune function and brain development as well as energy production through its inclusion in various enzymes (Bean, 2002). Recommended Dietary Allowances for Indian women is 21mg/day (ICMR 2010).

Zinc deficiencies have been shown to be higher in athletes and/or individuals who recreationally train. Zinc deficiencies in athletes have been suggested to contribute to impaired immune function and decreased performance. Athletes have been reported to have lower levels of zinc and magnesium possibly due to increased sweating while training or inadequate intake in their diets. Additionally, zinc and magnesium supplementation has been reported to have positive effects on resistance training athletes. Theoretically, zinc and magnesium supplementation may enhance anabolic hormonal profiles, reduce catabolism, improve immune status, and/or improve adaptations to resistance training (Colin,2004).

Zinc interacts with insulin and increases the affinity of haemoglobin for oxygen.It strengthens the resistance of interoseous ligaments or muscle tendons during dislocation and sprain and prevents tendonitis in athletes (Speich *et al.,* 2001).

Anti-oxidant nutrients are important in helping protect the body's tissues against oxidative stress. Since exercise increases the generation of oxidative species, it sounds logical that athletes who train hard might benefit from anti-oxidant supplementation. However, studies in which athletes have been supplemented with common antioxidants such as Vitamin E and C have not shown advantages to training and performance outcomes. The current advice is to avoid chronic supplementation with high doses of Vitamins C and E, and to increase our intake of the variety of antioxidants and phytochemicals found in foods (Louise *et al.,* 2011).

A diet deficient in micronutrients with antioxidant functions can result in an imbalance in the athlete's redox biology in favor of accumulation of Reactive Oxygen and Nitrogen Species (RONS) and disturb redox signalizing and control. This situation is called oxidative stress, resulting in molecular cell and tissue damage (Peterneli *et al.,* 2011).

Researchers have indicated that the prevalence of nutrition disorders is high among young female athletes engaged in sports that emphasize the importance of leanness and low body weight, such as Olympic gymnastics and distance running. The presence of a low body weight and a very restricted energy intake is the principal risk factor for the development of nutritional disturbances. The athletes and their coaches do not have appropriate knowledge about nutrition, so it is necessary an individualized nutritional orientation to avoid the development of these disturbances (Bonci, 2007).

An increase in protein oxidation during endurance exercise, coupled with nitrogen balance studies, provides the basis for recommending increased protein intakes for recovery from intense endurance training (Burke and Deakin, 2006). Nitrogen balance studies suggest that dietary protein intake necessary to support nitrogen balance in endurance athletes ranges from 1.2 to 1.4 g/kg/d"' (Dunford, 2006).

Energy balance, or the consumption of adequate calories, particularly carbohydrates, to meet those expended needs, is important to protein metabolism so that amino acids are spared for protein synthesis and not oxidized to assist in meeting energy needs (Gaine *et al.,*, 2006 and Rodriguez *et al.,*, 2007). Vallier *et al.,* (2007) points out that dehydration not only reduces athletic performance but also places athletes at risk of health problems and even death. DeOliveira and Burini *et al.,* (2011) emphasises that fluid losses during vigorous activity may account for upto four litres/hour. A body water loss of as little as one percent of body mass impairs exercise capacity by as much as 30 percent. Heat exhaustion can occur at around five percent body mass loss. Circulatory collapse and heat stroke can occur at around ten percent body mass loss (Birch *et al.,* 2007)

Female players drank approximately 6.3±1.09 to 8.7±0.5 glasses of water daily whereas male players drank approximately 9.4±1.6 to 12.7±1.8 glasses of water daily (Mudafale *et al.,* 2007).

There is a large body of evidence showing a relationship between food consumption and athletic performance. A poor diet will almost certainly have a negative effect on the performance of even the most casual athlete. A good diet with adequate calories, vitamins, minerals, and protein will help provide the energy required to finish a race or simply enjoy a recreational sport or activity. The diet recommended for an athlete differs little from the diet suggested for any healthy individual. However, the amount of each food group needed will depend on the type of sport, the amount of training and the time in relation to activity or exercise. Calorie needs vary with the size, age, sex and physical activity performed by the individual and so the number of servings a person requires will vary (Joint Committee of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine, 2009).

2.2. Physical fitness and sprint performance of sprinters

Nutrition plays a very important role in attaining high level of achievements in the field of sports. Nutritional status has a direct bearing on the level of physical

performance. Hence, physical fitness and training are very much dependent on nutritional status of sports personnel. Generally most of athletes have tall, muscular and well balanced physique, which is an indicator of good nutritional status.

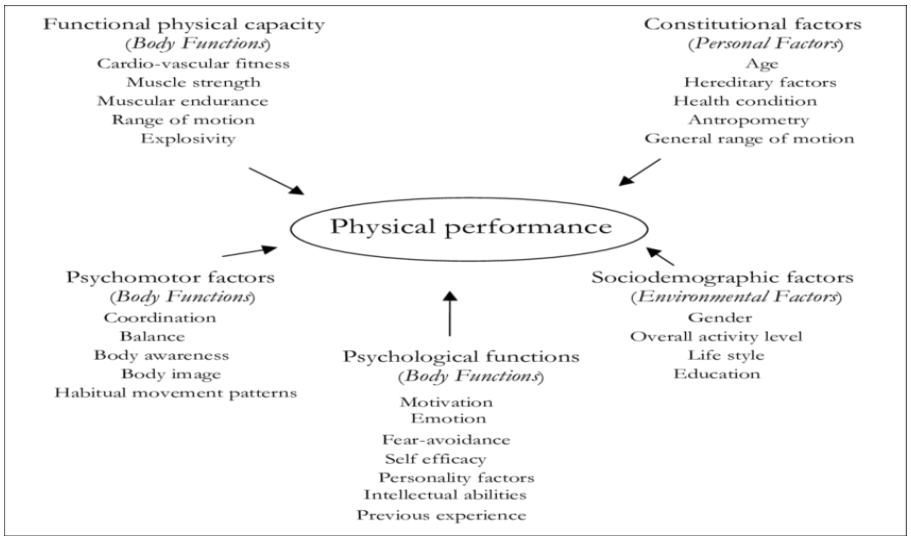
Anthropometry involves the application of physical measurements to appraise human size, shape, proportion, body composition, maturation and gross function. These measurements are useful to reflect both growth and development of children and adolescents and give indication of body composition in adults. They are also useful as an indication of moderate to severe under nutrition or overweight or obesity

A study was conducted on almost 2.5 thousand Italian citizens of weekly physical activity and mental health before and during the pandemic and recorded reductions in energetic expenses in all subjects aged between 21 and 64 years. The drop-in motor activity strongly correlates with a worse general feeling and found out that the use of regular exercises constitutes a significant prophylaxis for maintaining physical and mental health during the social isolation in connection with the outburst of the covid-19 pandemic (Maugeri, 2020).

Miyamoto *et al.,* (2018) reviewed a study on the 24 boys for sprinting performance and kinematics between preadolescent boys who are fore/mid and rear foot strikers and found different sprint performance and kinematics in preadolescent boys. Specifically, sprint speed was higher and 50-m sprint time was shorter in FF and MF strikers than RF strikers.

According to Wolinsky *et al.,*(2000) the overall health benefits attributed to regular physical activity for the elderly athlete include better functional capacity, less physical and musculoskeletal disability, less need of medical care, lower body weight, and better cardiovascular fitness. Regular physical exercise, consisting of a balanced aerobic and resistance-training exercise regimen, can modify many of the aging-related physiological and metabolic changes and improve quality-of-life factors for the adult.

Terms from the ICF Classification (WHO 2001) are added to illustrate the multiplicity covered by the physical performance tests. Impairments are problems with body functions, e.g. muscular endurance, coordination or motivation. Activity limitations are problems such as fear avoidance behavior. Figure 1 represents the factors affecting the physical performance of athletes



Ljungquist (2002).

Figure 1

Factors affecting physical performance.

Hansda & Bandopadhyay (2019) conducted a comparative study on selected physical and psychosocial profile of santal tribal and general boys for 13 to 16 yrs and found significant difference in speed between for 16 yrs. age group. In the age group of 16 years tribal boys were superior to general boys. No significance difference was found in Power and Coordination between tribal boys and general boys for the age group.

Deb & Dhara (22.4020) reviewed that the tribal students had significantly higher cardio-pulmonary fitness and flexibility than the non-tribal students from five hundred sixteen (516) tribal boys and 256 non-tribal Bengali boys in the age group of 8-15 years from seventeen different schools had no significant differences were obtained for hand grip strength, upper body endurance and BMI.

Physical activity interventions were associated with improvements in health indicators. Health benefits included increased physical fitness both cardio respiratory fitness and muscular strength. Hence physical activity is positively related to cardiorespiratory and metabolic health in children and youth (Chanda and Mathur,2015).

Suchomel (2016) examined the influence of muscular strength on various factors associated with athletic performance and the benefits of achieving greater muscular strength. Greater muscular strength is strongly associated with improved force-time characteristics that contribute to an athlete's overall performance.

Much research supports the notion that greater muscular strength can enhance the ability to perform general sport skills. Further research indicates that stronger athletes produce superior performances during sport specific tasks. Greater muscular strength allows an individual to potentiate earlier and to a greater extent, but also decreases the risk of injury.

Relative strength may be classified into strength deficit, strength association, or strength reserve phases. The phase an individual falls into may directly affect their level of performance or training emphasis. Based on the previous literature, it appears that there may be no substitute for greater muscular strength when it comes to improving an individual's performance across a wide range of both general and sport specific skills while simultaneously reducing their risk of injury when performing these skills. Hence, sport scientists and practitioners should implement long-term training strategies to promote the greatest muscular strength within the required context of each sport/event.

Mangine *et al.,* (2014) studied the relationships between 30-m sprint time and performance on a non motorized treadmill (TM) test and a vertical jump test on seventy-eight physically active men and women. Strong relationships were found between 30-m sprint time and peak and mean vertical jump power. Sprinting performance on the TM can significantly predict short-distance sprint time.

Adolescence is the period of psychological and social transition between childhood and adulthood. The World Health Organization (WHO) defines adolescence as the period of life between 10 and 19 years of age. (http://www.sciencedaily.com/articles/a/adolescence.htm). Their nutrient needs vary depending on the type of the sport (endurance, team and weight class sport) and the type and intensity of training and competition (Kay, 2014).

Involvement in sports can begin at or prior to puberty. This is a time of rapid changes in size, shape and body composition for both sexes. The onset of puberty, however, can vary considerably between individuals. The difference in maturation has important implications for sporting ability, as the late maturing boy will not be as strong as early maturing boys, as the spurt in strength will follow the spurt in height (Ackland *et al.,* 1994). In girls, late maturation is an advantage in sports where low body mass and narrow hips assist movement such as in gymnastics, ballet and distance running (Ross *et al.,* 1988). During pubertal growth, the relative gain in adipose tissue drops markedly for both males and females. This is a response to an increase in energy requirements at this time. The absolute amount of adipose tissue may even decline for adolescent males. Following puberty, the increased deposition of fat is much more marked in females than in males. It is important that coaches and young female athletes understand that increased fat deposition may occur with maturation (Marshall, 1978).

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Monitoring height and the peak height velocity (PHV) can provide important information on maturation (Ross and Marfell Jones, 1991). Ideally, height should be measured for every three months, prior to and during adolescence. For girls, the

PHV usually occurs at 12 years of age. Breast budding occurs prior to the PHV and the menarche occurs when the height velocity is falling. Therefore, menarche is an important indicator of when the height velocity is falling in females. In boys, the adolescent growth spurt usually peaks around 14 years, which is two years latter than girls. The peak strength spurt will occur after the spurt in height. This means that males will get stronger after the peak height velocity has occurred.

Redman (2005) reviewed that the reproductive system is tightly coupled with energy balance, and thereby changes in the status of energy balance through changes in physical activity can impact on the reproductive system. At both extremes of the energy spectrum, disorders of chronic energy excess and energy deficiency are characterized by a wide range of reproductive disorders in women and men.

2.3. Impact of socio economic status on sports performance

"An economic and sociological combined total measure of a person's work experience and of an individual's or family's economic and social position in relation to others, based on income, education, and occupation" (Donnelly, 2001). Socio economic status plays an important role to the success of every player's life more than that it pertains to the psychological factors and emotional behavior. Psychological stress over the players affects the playing ability and the performance of the players at low and higher levels. Sports is based on close relationship of physical, psychological and sociological aspects of human development. In the domains of social life, the social structure, traditional and newly emerging values do have social consequences and effect on its members. The impact of widespread social distinction between classes, ethnic groups and sex has been constantly reflecting the changing scope of sport.

According to Kodli, (2016) there was a significant difference between sportsmen from high and low socio-economic status sportsmen in terms of physical fitness components such as speed, endurance, flexibility, agility and strength. The physical fitness of high socio-economic status sportsmen of Bidar Taluka was found

to be better off than that of sportsmen from low socioeconomic status of Bidar Taluka. Moreover, high socio-economic status had a positively effect on physical fitness of sportsmen belonging to Bidar Taluka.

Socio-economic status (SES) is one of the critical factors that influence participation in sports and physical activity. Elmagd *et al.,* 2018 demonstrated the effect of socio-economic status on the sports barrier perception of a cohort of participants and non-sports participants in higher education in UAE. Family income, parents, education level and occupation were found also to affect the perception to sports participation barriers. Low SES was strongly related to the socio cultural barriers against the student participation in sports which need to be considered and awareness about sports importance need to be emphasized in this group of the community. Sports facilities and physical activity programmes in university should take into consideration the SES effect and make sports activities available for all students by providing feasible facilities with minimal costs

Shaw *at al.,(*2021) reported the impact of COVID-19 pandemic on the economic status and its effect on diet training and fitness of Masters level cyclists with 12 males, 20 females completed two incremental exercise tests through online questionnaires during the pandemic to assess sport-specific fitness. The study concluded that the COVID-19 pandemic has undesirable effects on economic status which had adversely affected the nutrient intake of masters cyclists which may have adverse effects on their overall health and fitness in the long term.

Chandrasekaran *et al.,*(2010) conducted a study on the socio economic status and psychological factors that potentiates the playing ability of the low and high performers of state level football players in the age of 20-25 years from Tamilnadu state level men football tournament. It was reported that the socioeconomic-status and psychological factors plays a vital role in football players in their skill development, ensuring the playing ability and enhances the performances to achieve the player's goal.

A study on female American athletes, based on a nationwide sample of 500 families reported 33 percent of black and 18 percent of white girls said their families could not afford to pay for equipment and lessons (Wilson, 2014).

A study conducted by Bhushan in 2016 reviewed about the socio-economic status that exhibit a positive and significant influence on self confidence and achievement of sports women. Also it was reported that there was a significant difference in socio economic status and self-confidence of sports woman. Also a significant difference was observed in the level between socio economic status and achievement motivation of sports women also.

Kavitha and Malipatil in 2016 reviewed that the low SES sportswomen have high achievement motivation than the high SES sportswomen and there is a significant difference in their achievement motivation level.

2.4. Nutrient and nutraceuticals potentials of sweet potato, *ulva fasciata* and basil seeds

The idea of Nutraceuticals went back 3000 years ago when Hippocrates (460-377 B.C) stated “let food be the medicine and medicine be the food” to predict the link between appropriate foods for health and their therapeutic advantages (Bagchi, 2016. Nutraceuticals are natural medically beneficial foods or bioactive phytochemicals that are health-promoting, illness defeating, rehabilitative, functional foods and beverages that contain specific components (vitamins, lipids, proteins, carbohydrates, minerals, etc.) that have healthful profits (Sharma *et al.,* 2016). In 1989, the term "nutraceutical" was coined by combining the words "nutrition/nutrients "a nourishing dietary component and "pharmaceutical" a medicine or a chemical used as a drug and implying use for illness prevention and/or therapy (Pastor *et al.,* 2021).

Functional foods containing various functional components such as vitamins (A, B, C, and D), minerals (selenium, zinc, and iron), and polyphenolic compounds (quercetin, resveratrol, catechins, and anthocyanins) can act as natural therapeutic

agents against SARS-CoV-2 or preventive therapy for COVID-19 patients, in addition to enhancing the body's immunity to fight COVID-19 infection (Hamid *et al.,*2021).

Sweetpotato features among the top seven staples in the world. Sweet potato is a major source of carbohydrate for millions of people, especially in developing countries. Sweet potato (*Ipomoea batatas*L.) is one of the most important root crops globally. It is considered an important, versatile and underutilised food security crop (Motsa *et al*., 2015). Sweet potatoes have been ranked number one in nutrition out of all tuber crops by the Centre for Science in the Public Interest, USA because they are a rich source of dietary fibre, natural sugar, complex carbohydrates, protein, carotenoids, vitamin C, iron and calcium. (Temengen and Retta*.,* 2011).

Kostrakiewicz-Gieralt (2021) reviewed on sweet potato-derived nutritional products for athletes. It was concluded that wide acceptability of sweet potato products due to their beneficial effects on health and performance such as improvement of cardiopulmonary functions, prolongation of physical performance and recovery from fatigue.

Comparative study carried out by Waidyarathna *et al.,* (2021) on analysis of nutrient composition and glycaemic indices of nine sweet potatoes (Ipomoea batatas) varieties and revealed that sweet potatoes are a good source of highly available carbohydrate thus energy with considerable amount of dietary fiber than any other nutrient. Glycemic indices of all studied sweet potatoes were high providing high glycemic loads. Sweet potatoes are suitable for individuals who require high energy food and have the potentials to be included in high energy food products.

Basil (*Ocimum basilicum L.)* is native plant of tropical regions. It belongs to genus Ocimum which comprises between 50 and 150 species of herbs and shrubs (Paton *et al.,* 1999). It is one of endemic plant which is used not only as pharmaceutical plant but also used as culinary herb (Naghibi *et al.,* 2005).

Munir *et al.,(*2017) studied the Nutritional Assessment of Basil Seed and its utilization in Development of value Added Beverage findings revealed that basil seeds are good source of fiber, protein and phenolic compounds micronutrients and have antioxidant potential which is highly beneficial for human health. Swollen basil seeds in beverage also showed good sensory scores in beverage which shows it would be acceptable by consumers.

Bravo *et al.,* (2021) reviewed Basil Seeds as a Novel Food, Source of Nutrients and Functional Ingredients with Beneficial Properties and concluded that Basil seeds are a source of vegetable compounds, including proteins, omega 3 fatty acids, dietary fiber, minerals, flavonoids, and polyphenols, all of which are attractive characteristics for the food industry and consumers looking for foods with healthy properties. In addition, they have remarkable properties that are beneficial in relation to health and disease prevention.

The term algae has been derived from a Latin word algae (means seaweed). The study of algae is called algology or phycology, which consists of two greek words – phycos means seaweed (algae) and logas means discourse. Seaweeds are also called macro algae. This distinguishes them from microalgae which are microscopic in size, often unicellular and are best known by the blue green algae. Naturally growing seaweeds are often referred to as wild seaweed in contrast to seaweed that are cultivated or framed. Macroalgae are sometimes able to withstand inundation in fresh water (eg.fucus) and occasionally may even become adapted to permanently low salinity eg.Ulva (Jobri, 2004)

Chew *et al.,* (2008) evaluated the nutritional value of Ulva lactuca as food for ruminants. Ulva lactcua was characterised as low energy high nitrogen food stuff, but it is considered as a good food for ruminants. It contains all essential minerals. he protein level of Ulva species were in the range of 15 to 20 per cent of dry weight (Arasaki, 1997).

Seaweeds have high fiber content, making up 32 per cent to 50per cent of dry matter. Soluble fibers are generally associated with cholesterol-lowering and hypoglycemic effects. (Buck *et al.,* 2006).

Pattama and Anong (2009) studied the nutritional qualities of two edible green seaweeds, Caulerpa lentillifera and Ulva reticulata, with a view to their utilization in human nutrition. Both seaweeds contained high amounts of minerals and balanced amino acid profiles. Both seaweeds showed their potential of being healthy food for human diet or as source of ingredient with high nutritional values.

2.5. Nutritional anthropometry and body composition status of sprinters

A nutrition assessment is the first step in advising athletes on dietary strategies or supplement use. Nutrition assessment is the "systematic method for obtaining, verifying and interpreting data needed to identify nutrition-related problems, their causes and their significance"(Academy of Nutrition and Dietetics, 2015). A complete assessment should ideally include dietary evaluation, anthropometry and body composition analysis, biochemical testing, nutrition-focused clinical examination, and patient history (Academy of Nutrition and Dietetics, 2015; Driskell & Wolinsky, 2010). In the sport setting, nutrition assessment in relation to dietary supplement use should ensure the athlete (a) is consuming a well-chosen sports nutrition plan that is adequate in energy, macronutrients, and micronutrients; (b) is not at risk for health issues, including interactions with prescription or over-the-counter medications (Deal & Van Reken, 2017)

Body composition measures provide a better evaluation of overall health relative to weight. Health professionals can measure body fatness by a variety of methods. Body composition and body weight is just two of the many factors that affect exercise performance. Body composition can affect strength, agility and appearance. Athletes often seek to improve their power and strength by increasing the muscle mass. Weight gain as muscle requires can be increased by dietary calories, primarily as carbohydrates, combined with strength training (Paul,2010).

Assessment of body composition is an essential measure of health and fitness both for athletes and the general population. The body composition is a factor contributing to sport performance. The body fat varies with age and sex and the desirable body fat of athletes can vary depending on the sport, training level, energy intake. On non-athletes the assessment of body composition is important in order to appreciate the nutritional status and monitoring the treatment. Assessment of body composition is an important component of the ongoing monitoring of athletes interested to improve their performance (Ionescu *et al.,* 2006).

Comparison of height and body weight parameters with 'ideal' or reference standards such as body mass index (BMI: weight (kg) and height (m^2) are used to estimate the body composition. Adolphe Quetelet, the Belgian astronomer and mathematician was one of the first scientists to collect population statistics, which included height and weight. It was Quetelet's observation that the weight of adults of differing height is nearly the square of stature. Ilisloncally, Quetelet's observation on the dimensional relationship between weight and height is the origin of BMI. More recently, epidemiologists have used the BMl in the identification of health risk factors (Van Itallie and Abraham, 1985).Sports include gymnatics, weight category sports, distance running or jumping types of sports where the assessment of body composition and body fat is of primary interest.

Assessment of human body composition can be done at three levels. The first one, dissection is considered to be the most direct measure of assessing body composition. This method is understandably labour intensive, while it also involves ethical issues when working with cadavers. The second level is an indirect method of estimating body composition. The third level is a doubly indirect method of assessing body composition and the most often used approaches include anthropometry and impedance.

Majumdar and Robergs (2011) examined the factors influencing the 100m sprint including starting strategy, stride length, stride frequency, physiological demands, biomechanics, neural influences, muscle composition, anthropometrics,

and track and environmental conditions. The sprint start depends greatly on muscular power. Three considerations of the sprint start are reaction time, movement time and response time. Hence it was concluded that, 100 m sprint world record times have progressed drastically, human physiology and physique combine to be the most influential determinants of improved sprint performance.

Punitha, (2016) reported the nutritional profile of adolescent female athletes through nutritional anthropometric measurements such as body weight, height and body mass index, waist circumference and hip circumference measurements and concluded that the diets consumed consisted of low energy, protein and low carbohydrate intake.

Shaijamol and Subapriya, (2010) assessed the nutritional status of 30 female rural athletes (15-18 years of age) through anthropometry and blood haemoglobin analysis. Majority of the subjects were mild or moderately anaemic and 57% were in different stages of chronic energy deficiency, all of them were in negative energy balance.

Nascimento *et al.,* (2016) studied the effect of a nutritional intervention in athletes's body composition eating behavior and nutritional knowledge where the researcher compared between 21 adults and 21 adolescents and concluded that the results both groups improved their body composition (lean body mass, mid muscle arm circumference), dietary intake and nutrition knowledge.

2.6. Importance of nutrition education for athletes

Basic nutrition education is the first step in helping athletes, coaches and trainers understand the importance of nutrition in athletic performance (Jacobson *et al.,* (2000). Thus there is a need for continuing nutrition education programme for both coaches and sports men and women (Kunkell *et al.,* (2001). Zawila *et al.,*(2003) reported that nutritional knowledge should be a part of the everyday athletic routine. So that, to know what and when to eat and benefit from eating the proper foods.

Nutrition education is a key to influencing the athletic performance. Various studies have done nutrition education on athletes and their findings suggested that nutrition education increases nutrition knowledge. Athletes in general should have special diet depending on training and particular event as well as proper hydration. Education improved body composition (lean body mass, mid muscle arm circumference), dietary intake and nutrition knowledge on adult and adolescent athletes. Nutrition education had an overwhelming effect on KAP (Knowledge Attitude and Practice).

Sherman and Thompson, (2004) reported that lack of nutrition knowledge can lead to improper dietary practices. Female athletes, especially those involved in sports that emphasize body size, are at even greater risk due to weight management issues, inaddition to physical performance. Nutrition education is an important tool that enhances knowledge and improve dietary intake among athletes.

Newbury *et al.,* (2022) reviewed nutritional intakes of 13 highly trained adolescent swimmers before, during, and after a national lockdown in the COVID-19 pandemic. The obtained information was used to provide each swimmer with individual feedback (face-to-face, interventions), whereas group trends were used as topics for classroom-based education sessions (varying topics, 30 min, weekly. The study concluded that to maintain health and performance, the adolescent swimmers would benefit from sport nutrition support and education during times of isolation and restricted training

Hatabu *et al.,* in 2020 evaluated Knowledge Attitude and Practice toward COVID-19 among 362 university students in Japan between May 22 and July 16, 2020, via an online questionnaire, and it further investigated the associated determining Knowledge Attitude and Practice factors. The study revealed that all respondents (100%) possessed knowledge on avoiding enclosed spaces, crowded areas, and close situations. Most respondents showed a moderate or higher frequency of washing their hands or wearing masks. In addition, 68.5% of respondents showed a positive attitude toward early drug administration and helped

university managers, experts, and policymakers control the future spread of COVID-19 and other emerging infections.

Bakhtiar (2021) conducted a cross-sectional study in Bangladesh to determine the nutrition knowledge, attitude and practices of adolescent sports trainee, among adolescent trainee athletes selected conveniently from 11 sports departments of Bangladesh Krira Shikkha Protishtan. The researcher reported that Nutrition knowledge was significantly correlated with attitude and practices. The emphasized was placed on the need for the development and collaboration of sports nutritionists in each sports department to bring positive changes in this area.

Chaudhary and Sukhwal (2016) studied the impact of nutrition education programme on college going girls engaged in sports activity for 50 (female athletes) education carried out with the help of Standard questionnaire and found out that experimental design Nutrition education improved mean awareness score among the athletes.

Sedek *et al.,* (2015), studies the Knowledge, Attitudes and Practices on Hydration and Fluid Replacement among Endurance Sports Athletes in National University of Malaysia (UKM) for 80 athletes. The results of this study identify specific areas of education for athletes with regard to hydration

Nazni (2010) assessed the nutrition knowledge, attitude and practice among the 102 athletes, 32 sportsmen belong to Volleyball discipline, 25 belongs to weightlifter discipline and 45 belong to runners discipline in sports from five different private colleges situated in Salem District, Tamilnadu, India were selected. Among the three disciplines sports persons, the mean nutrient intake of the runners is high compared to volleyball and weight lifters. The study concluded that the sports disciplines strongly affected the nutrition knowledge, attitudes and practices of sportsmen. The overall scores indicate that most sportsmen had good knowledge of nutrition and supplements.