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Food Choices for Athletes with Respect to nutritional status, fitness stability and effectiveness: A review

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Food choices made by athletes impact their nutritional status, their fitness stability and effectiveness of their performance on an event. When contrasted to some of the other influences that influence performance – ability, coaching, encouragement, wound resistance, and many others – nutrition plays a minor role. The recommended energy demands for athletes on the basis of their exercise schedule and training severity are habitually from the scale of 50-80 kcal per kg per day. On the basis of some factors (intensity, time taken, sports and mode of exercise and athletic qualities and skills) daily demands of carbohydrates on basis of tolerance and power for competitive athletes are 6-10 g per kg per day and 3.9- 8.0 g per kg per day individually. Requirement of protein should be 1.2–1.8 g/kg/day derived from whole food sources after exercise. Fluid requirement after exercise: 450–675 mL/0.5 kg and additional sodium consideration to account for loss through sweat. Vitamins and minerals required for better performance of athletes are calcium, iron, zinc, magnesium, the B vitamins, and vitamin D, and some antioxidants which are vitamins C and E, beta-carotene, and selenium.

Keywords: Athletes, Nutrition, Sports, Performance, Vitamins

INTRODUCTION

Performance of athletes is based on a main principal that is nutrition. For better selection of food, suitable and best knowledge in context of food consumption should be given to the athletic community. To reduce the chances of wound and to enhance the execution of sports in addition with development, growth and to improve nutritional status sufficient nutritional consumption is very basic principal (Bass and Inge, 2006).

To aid better health status and to enhance psychological and physiological aspects of performance all the members of athletic community should be motivated to stick to the strategies of sports nutrition (Maughan and Shirreffs, 2011). However minor changes in physiological fitness can have an impact on achievement in the greater world of international athletics. Food choices that an athlete made will also impact nutritional status and their fitness stability as well as the effectiveness of their performance on an event can also be affected. When contrasted to some of the other influences that influence performance – ability, coaching, encouragement, wound resistance, and many others – nutrition plays a minor role. Best selection of food does not reimburse with the ability of an athlete and absence of coaching except it can support athlete with ability and encouraged athlete to put his best in his performance with all the possibility. If bad food selection is made than athletes are not going to give their best as compared to what they are capable of due to lack of nutrition. All the kinds of food products consumed, as well as the quantity and frequency of dietary consumption, can impact

an individual's capacity to maintain continuous rigorous coaching and competition before surrendering to tiredness, wound, or sickness (Maughan et al. 2007). Where caloric expenditure is limited to decrease body weight, choosing nutritionally adequate foods is indeed essential for preventing the spread of nutritional inadequacies, which can affect overall well-being. While athletics benefited via nutritionist's advice on their energy, nutritional, & water requirements, as well as help regarding athletic nutrition approaches, supplementation is often sought (Maughan and Shirreffs, 2011).

To enhance athletic activity and performance there are many approaches that involves an adequate diet with adequate caloric intake to reach recommended vitamins, minerals and energy demands of their practice, coaching and competition and also to reach required body weight or ideal body weight (Maughan and Shirreffs, 2011; Thomas et al. 2016). A variety in diet and stabilize nutrition that is involving excess portion of different nutrients and will also cover the water requirements, some of the nutrients and elevated caloric requirements, this varied and balances nutrition is going to support and enhance gaming practice and coaching (Kreider et al. 2010; Thomas et al. 2016).

The Swiss pyramid model, placing glucose-free drinks just at bottom with candy, salty foods, all sweetened drinks only at highest point, illustrates current guidelines for athletics, including sections of fruits and veggies, whole grain snacks and legume items, protein food items as well as oils and peanuts suggested for eating with different proportions and timing (Burke, 2008).

The National Food and Nutrition Institute in Warsaw released a new variant of Polish Pyramid of Physical Activity and Healthy Nutrition on Jan 2016, highlighting the significance of fluids as well as other sweetened liquids for successful fluids and electrolyte level control, as well as fruits and veggies with less GI and med. GI items that are high in healthy fiber, B complex vitamins, K, Mg and other antioxidants for antioxidant activity and acid-base balance restoration (Potgieter, 2013; Yavari et al. 2015).

In the course of intensive exercise, it is prioritized to provide diet with excess CHO mainly when healing frequency is minimized, and the requirement of calories and CHO's might not be that increased when most of the practice and coaching is based on high tech work other than the intensive exercise. Mainly in hot temperature at the time of escalate exercise load and intensive exercise there should be sufficient water intake to maintain fluid and electrolyte balance and to fulfil their needs by the body. As if there is not a condition of hypertension or high blood pressure, then salt consumption should not be limited if some athletics have excess salt loss during their vigorous exercise. At precise times, well-prepared energy drinks, high caloric bars, other food replacements all seem to have a place. These issues are discussed in more detail somewhere else in this review (Maughan et al. 2007).

Female athletics consumption of food doesn't really correspond to sports nutrition guidelines regarding caloric and carbs for greater sports (40–70 kcal per day and 6–10 g per kg per day respectively) (Kerksick et al. 2018; Jenner et al. 2019). Decreased performance of female athletes and decreased physical effects are linked with insufficient dietary consumption which involves decreased bones strength and imbalance of hormones (Escalante, 2016).

Selection of different food items is affected by many elements, such as change in age, biological factors, decreased appetite/starvation processes and many flavoring and textures likings; how they encounter specific food items, that can lead to liking and dislikes of certain food items and their related products, social physical and individualized factors are also considered that are if the food is available or not and whether it is in reach or not and their religion is also important is selection of food product. These are the strong elements that correlate with each other to decide the choices and selection of food (CDN, 2008).

In some ways athletes are unusual that they are frequently disclosed to a number and variety of food conditions that are probably to affect the standard of diet and following to food choices. Dining rooms that represent buffet style settings grant many choices for the athlete that may lead to problem to decide what to eat and what to leave. Dietary intake, poor food selection as well as excess and poor consumption is result of the large number of options available because they are overwhelming (Burkhart and Pelly, 2016). In making food choices these are accepted factors such as acoustic appeal and peer influence plays an important role (Symmank et al. 2017; Nestle et al. 1998).

Most athletes feel that maybe a regular diet would not provide them with enough nutrients to achieve peak success, so they turn to nutritional supplements to help them boost their health or obtain a competitive advantage. Certain types of supplements such as botanicals, sports

supplements and spices have been affected by excessive utilization of nutritional supplements (Dickinson et al. 2015). Nutritional supplements are not a strategy used to reimburse the insufficient dietary intake and bad food choices but can only be used as a temporary strategy change in dietary behavior is not feasible.

Recommended energy demand for athletes:

The recommended energy demands for athletes on the basis of their exercise schedule and training severity are habitually from the scale of 50-80 kcal per kg per day (Kreider et al. 2010). There are number of factors on which overall energy demand depends on are exercise, weight, age and sex. The maintenance of energy is the basic step of each and every type of nutritional course. Mass of muscles can be lost unintentionally energy is not available in recommended and adequate amounts. Body mass and exercise load should be used to set daily carbohydrate consumption goals. On the basis of some factors (intensity, time taken, sports and mode of exercise and athletic qualities and skills) daily demands of carbohydrates on basis of tolerance and power for competitive athletes are 6-10 g per kg per day and 3.9- 8.0 g per kg per day individually (Rodriguez et al. 2009; Genton et al. 2010). And now it is previously reported in moderation of good quality protein in the scale of the adequate range given as (0.3 g/kg) in all the day after training or endurance sports (Kenney et al. 2015).

Athletes know the method and strategy of their field in a long-term coordinated process known as sports training. Physical health, as well as somatic qualities and personality, and awareness of their training, are all established. The energy demands of athletes in training vary considerably, and are largely determined by mass off body and the amount of practice. It is beneficial in sports to maintain a normal body mass and more importantly, a low body fat content by maintaining a pattern of controlled eating for long durations. For strength power of athlete's nutrition practice play a very important role.

Carbohydrate intake:

Carbohydrate is an important for the proper functioning of brain and a flexible stratum for muscular work, as it can support exercise at a variety of intensities because it is used by both anaerobic and oxidative pathways. Because oxygen is frequently a reducing factor in long term duration and highly intensity work, athletes should use the energy source that requires the least amount of oxygen per calorie produced (Clifford and Maloney, 2015). Athletes have to consume 5 to 10 grams of carbs per day, which depends on the force, duration and frequency of their workout (Kreider et al. 2010).

Complex carbs with a low to moderate glycemic index can account for the majority of nutritional carbohydrates (named "slow carbs"). Whole grains, fruits, sauces, legumes, and other foods are good sources. 1–2 hours before training, consume high carbs with low glycolic index in dinner (Abir Al Mahmud et al. 2019). If there is a great demand of energy for the proper activity or exercise, then the body depends on starch as a fuel. In proportion to the amount that can be used during workouts, the body's starch reserves are limited. During the hard exercise the oxidation rate of carbohydrates is 3 to 4 grams per minute (Maughan, 2009).

Exogenous Carbs availability while workout (about 78 to 90 g/h) (Jeukendrup et al. 2011) (Zügel, 2017) increases efficiency by conserving hepatic glycogen and preventing hypoglycemia, and also maintaining an increased Carbohydrate oxidation rate, which allows for a larger activity level (Cermak et al. 2013). As a result, in order to produce a good level of performance throughout activities that depend mostly on anaerobic glycolysis (resistance or endurance activities), it is recommended to begin training with complete glycogen reserves and to provide CHO throughout the endeavor (Mata et al. 2019).

The restoration of muscle and liver glycogen is a fundamental aim of recovery between training sessions or competitive events, particularly when the athlete performs several workouts in short periods of time. When the total carbohydrate intake falls below critical level which is required for synthesis of glycogen, strategies like eating pattern, timings, quality and type of carbohydrates intake may help athletes to perform well. Following high-intensity physical activity, the body's energy and nutrient stores must be replenished. The post-workout diet should include carbohydrate to replenish energy lost during exercise, as well as protein to aid in energy recovery and muscle tissue repair and growth. Sweat-lost fluids and electrolytes (potassium and sodium) should be replaced (Khan et al. 2017). Athletes tend to eat a liquid nutrition source that contains two carbohydrates: 1 protein ratio that can help you recover faster, digests easily, and is generally well tolerated (Berardi and Andrews, 2017).

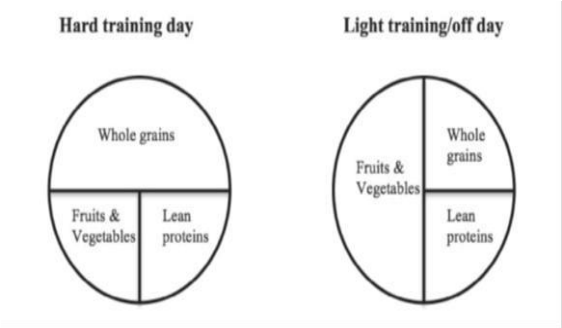

Figure 1: Performance Plates, developed by Sports, Cardiovascular, and Wellness Nutrition and Collegiate and Professional Sports Dietitians Association sports dietitians, were used to teach student-athletes how to eat a balanced diet (Ellis, et al. 2018).

Carbohydrate-rich foods that are easily digestible will help you stay energized for the duration of your workout. A complete meal cannot be eaten during a sporting event. Moreover, in addition to adequate intake of fluid from energy drinks and water, the small, high carbohydrate snack should be eaten. In most cases, the athlete would not want to eat more than three hundred calories in these circumstances. The main goal is to keep the athlete hydrated and not hungry while still leaving the digestive tract empty when competition starts (Khan et al. 2017). Per hour of exercise, energy drink containing thirty-gram carbohydrate and fifteen-gram protein (in five hundred milliliter water) (Berardi and Andrews, 2017).

Protein intake:

On the basis of kind of exercise and timing of exercise athletic protein requirements should be increased due to intensive exercise. The performance of athletes and nutritional guidelines recently suggested the protein requirements ranges from 1.2 to 2.0 g per kg per day (Gigou et al. 2010). Many exercise therapies are covered by such guidelines, which provide for versatile modifications with periodize skill and practice (Rosenbloom, 2012). The whole protein shown to have every amino acid which is required by human body and they involved animal based sources such as fish, chicken, meat and milk products. In sufficient protein products are normally known as plant proteins which always have deficiency one or two of crucial amino acids that are required by the body.

The Institute of Medicine (IOM) states that Recommended dietary allowance for protein for men and women aged 19 years of age seems to be 0.8 g protein per kg per day, that also corresponds to 56 to 72 g per day for male and 40 to 56 g per day for female to sustain nitrogen balance utilizing ‘athletic' benchmark body mass of 70 to 90 kilogram for male and 50 to 70 kilogram for females. Although there is no specified bearable upper limit for protein intake (except for not exceed from 35 percent of power harvested from protein as explained in detail in the AMDR) and any independent amino acid, if somehow the consumption of particular independent amino acids will indeed exceed that generally present inside the meal from food products, warning has been recommended (Institute of Medicine 2005) (Phillips, 2012).

Fat intake:

An important element of nutritionally adequate diet is fats which are responsible for several functions in our body such as provision of energy, responsible for immersion of fat soluble vitamins and also provide important components for cell membrane. As for continuous intensive exercise revival of fats are considered as fuel for energy for athletes in the latest studies. Insufficient carbs limitation with adaptive period could be too responsible for the failure of performance advantages observed in research examining "Excess-fat" diets. The impacts of elevated fats diets on performances are still being studied (Abir Al Mahmud et al. 2019).

Athletes' fats consumption requirements seem to be equal to, if not slightly higher than, non-athletes' fats consumption requirements. Sufficient fats consumption enhances the production of muscular enzymes which is helpful is metabolizing fatty acids at the time of exercise. 15% of caloric consumption should be taken from fats sources. Fats that seem to be healthy fats are unsaturated fatty acids. These fatty acids are driven from plant-based sources such as nuts, seeds, olive oil and sunflower oils etc. Fats that seem to be unhealthy fats are known as saturated fats. These fats are derived from animal sources such as red meat and excess fat dairy products. These fatty acids are responsible for increasing the threat of chronic diseases. The least recommended quantity of fat for an adult who is living an average and simple lifestyle to meet his daily caloric requirements is 10% (Zabrocki and Kaczyński, 2012). Sportsmen, for instance, were shown to eat too much fat. As per Borchers et al. 21% of the Division 1 college athletes (mean age, 20

years) were overweight (25 percent body fat) that had insulin sensitivity, whereas 9% seemed to have metabolic diseases. (All overweight). So for these sportsmen weight loss is recommended to stay away from different chronic illnesses. Fish oil supplements are indeed widely known; cold pressed, unprocessed oils are preferred (Zabrocki and Kaczyński, 2012).

Total caloric intake ranges of fat intake (20%-30%) are also linked with the dietary patterns that can further linked to the nutritional objectives. According to the nutritional recommendations 10% of fat consumption should be taken through the monounsaturated fatty acid food sources and other 10% of fat requirement should be fulfilled through the polyunsaturated sources and less than 10% of fat requirements of athletes can be consumed through saturated fatty acid sources (Rodriguez, et al. 2009; Genton, et al. 2010).

Athletes have used enhancing the amount of dietary fats as a nutritional approach. The reasoning for this strategy is depending largely upon increasing endogenous muscular triglyceride reserves, that should increase long-term workout performance and conserving glycogen, according to the idea (Genton et al. 2010). Lowering nutritional CHO consumption to a point that leads in ketosis state (flowing ketones concentrations greater than 0.5 mmol/L) with raising fat consumption for many weeks is the most effective way to speed up the body's capacity to metabolize fat (Volek et al. 2015).

However, because fat overloading or elevated fat meals have been shown to be unsuccessful in certain research, a meal that includes 20 to 30percent of overall daily calories from fat is suggested to guarantee adequate fat consumption (Kerksick et al. 2013).

Athletes who limit their food or energy intake in order to lose body weight or body mass, particularly fat. May get advantage from artificial minerals and vitamins supplements. Before using such products safely, productively, and compliance with applicable anti-doping codes and legal requirements should be observed carefully. Too much caffeine causes a lot of health issues for athletes such as sleeping disorders, headache, bleeding and gastrointestinal irritation etc. So the intake of caffeine should be avoided. Caffeine's diuretic effect is frequently emphasized, especially in situations where dehydration is a main issue (Baghurst, 2019).

Recommended fluid intake for athletes:

It's not really unusual for people to inadvertently dehydrate while workout, meaning they take less liquids than they require. Increased water consumption can often be harmful, in extreme situations of water intoxication leading to hyponatremia (McDermott et al. 2017).

Considering a mixture of evaluations to track daily fluctuations in fluid intake in athletic circumstances is a helpful approach for monitoring daily fluctuations in fluid intake status. Measuring regular variations in body weight, as well as urinary color & thirst feeling, offers sufficient sensitivity for most sporting circumstances (Cheuvront et al. 2016).

Table 1: Supplemental Nutrition Recommendations for Athletes (Smith et al. 2015).

NUTRIENT	RECOMMENDATION
Protein	1.2–1.8 g/kg/day derived from whole food sources After exercise: 20 g of high quality protein shortly after exercise
Carbohydrates	During exercise: 30–60 g/hr for exercise lasting more than 1 hour After exercise: 1.0–1.5 g/kg of body mass within 30 minutes of exercise cessation
Fluid	Before exercise: 5–7 mL/kg 4 hr prior to exercise During exercise: assess sweat rate and develop hydration plan to maintain body mass during exercise After exercise: 450–675 mL/0.5 kg and additional sodium consideration to account for loss through sweat
Micronutrients	During exercise: sodium to offset losses associated with sweat being lost in sweat

Dehydration, caused by sweat losses or insufficient fluid intake, is well known to poor performance during long exercise; thus, inadequate fluid intake during and before exercise cause critical health issues. Taking a fluid while exercising has the goal of addressing sweat losses and assisting thermoregulation. All athletes in competition should make it a priority to keep their body water content close to EU hydration. All micronutrients should be consumed in amounts that are recommended according to their RDA for athletes. The maximum amount of athletes gets adequate vitamins from their recommended diet so they don't need artificial vitamins. But, some teenage and mature athletes have B6, B12, folate, and E intakes that are below the RDA.

Dehydration can be resulted if protein intakes become excessive and athletes become needy for energetic fuels sources. For the excretion of excess nitrogenous compounds through urine when excess protein meal is consumed body's water demand begin to increase. Through this metabolism rate will also increase and utilization of oxygen will also be elevated (Du, 2013).

To normalize the hydration status with thermos regulation to enhance performance of athlete's fluid intake and balance is very important before and while exercise. Perspiration is the main factor to correlate with hydration demands that is varying from person to person (0.5-2.0 L per hour) (Sawka et al. 2007). Electrolytes loss and excessive dehydration may result if work out begin long lasting and fluid intake is not adequate. Dehydration is the loss of fluids from body, and water deficiencies of more than 2% of weight may impair sports performance as well as brain ability (Goulet, 2012). If intensive exercise and performance begins in a pre-hydrated condition of the body, then it might be very harmful (Thomas et al. 2016; Goulet et al. 2010). Prior to 4 hours of beginning of an event an athlete must consume 5-7 ml/ kg body weight to prevent the chances of dehydration during any event (Clifford and Maloney, 2015).

Kerksick et al. found in his research that athletes must consume chilly waters or electrolyte beverages to keep up with perspiration losses (Kerksick et al. 2018). Increased temperature of the body can interfere with intensive and powerful work out which can be reduced or decreased by the consumption of chilled water and cold energy beverages. With each pound losses in body a sportsman must drink 16-24 ounces of water (Elias, 2017). Perspiration levels could be measured by regularly monitoring pre- and post-work-out weight change, enabling for even more effective hydrolysis throughout sports events.

Recommended vitamins and minerals intake for athletes:

The use of various minerals and vitamins can increase as an athlete's level of activity rises. This requirement however, simply meets by consuming a good diet that includes a variation of meals. Sportspersons who limit their intake of energy regularly, utilize extreme methods of weight-loss, omit extra food types from diets, or eat nutritionally diet may be deficient in micronutrients and benefit from supplementation. Deficiency of iron may affect musculature and ability of work whether or not anemia is present. D vitamin primarily effects on health of bone, so it has a direct skeletal influence According to increasing proof, many athletes, especially the few who train inside, dress shielding tools when outside, or stay around different temperatures, are vitamin D deficient or inadequate (Willis et al. 2012).

Prevalence studies have found several proof of a connection among circulation of level of vitamin D, health and physical activity, but strong evidence on whether or not regular supplements of vitamin D is important for sportsperson is lacking (Thomas et al. 2016).

Calcium is crucial for bone tissue development, maintenance, and repair, as well as muscle spasm regulation, functions of nerves and usual blood-clotting. Low energy availability, as well as menstrual dysfunction in female athletes, increase risk of less bone mineral density and fractures, with reduced nutritional calcium intake adding to the risk (Nickols-Richardson et al. 2006). Potassium levels will drop during exercise, but the losses aren't as severe. During preparation and after the tournament, potassium is obtained by consuming foods that are rich in potassium such as potatoes, oranges and bananas. Iron transports oxygen to all of the body's cells through blood. This mineral is particularly important for endurance athletes. Iron-rich foods like lentils, red meat, fortified cereals and dark leafy greens may prevent deficiency of iron and supplement of iron can also recommend.

Table 2: Type of supplements and their uses according to various studies

Study	Type And Classification Of Supplement	Reasons For Supplement Use
Petroczi et al. 2008	• Vitamins/minerals • Sports products • Ergogenic supplements • Herbs	• Maintain strength • Avoid sickness • Increase endurance • Ability to train longer • Increase recovery
Braun et al. 2009	• Vitamins • Minerals • Carbohydrate • Protein/amino acid • Fatty acid • Ergogenic aids • Plant extracts	• Maintain health • Immune function • Prevent deficiencies • Recovery/regeneration • Improving performance
Kim and Pham, 2011	• Vitamins • Minerals • Protein • Creatine • Enzymes • Metabolites • Oriental supplements/medicine	• Improve recovery • Muscle performance • Maintain health
Lun et al. 2012	• Sport products • Multivitamins/minerals • Meal replacements • Vitamins • Minerals • Herbs • Fatty acids	• Health related • Energy • Recovery • Strength • Immune function

In sports, the use of dietary supplements is common. A dietary supplement is introduced to one's diet to make up for nutritional deficiencies. It must be used in conjunction with the good diet. Drinks for gaming, gels, electrolytes multivitamins, bar, mineral, supplement, nitrates and creatinine caffeine are among medications available.

A high carbohydrate, adequate protein, moderate fat, moderate fiber pre-event or training diet is recommended. To build and maintain energy stores, eat bigger meal three to four hours before exercise, while the small snack 30 to 60 minutes before exercise can provide the last minute energy boost. According to the Hargreaves et al., consuming a high-carbohydrate diet 3-7 days before the competition may be more beneficial, and should include:

Carbohydrates make up 70-80% of the diet; Protein makes up 10%; Fats make up 10-20% (Hargreaves, 1999).

Eight-ounce sweet potato, two cups vegetables and four-ounce lean meat with dressing of olive oil are excellent examples of a bigger pre-workout meal; if this is ever so much, a couple of string cheese, a fruit piece, and half cup mixed nuts can also work (Berardi and Andrews, 2017).

CONCLUSION

The food should be able to provide all the essential nutrients and a sense of fulfillment because without a healthy lifestyle and healthy eating patterns an athlete can't step on the ground to perform its sport.

A nutritionally perfect diet refers to adequate quantity of kilocalories that is settled according to the weight and activity factor requirement, carbohydrates that is required 6-10 g per kg per day and 3.9- 8.0 g per kg per day individually and proteins that is 1.2–1.8 g/kg/day, in order to make sure that the principal amount is provided by the food.

Fluid requirement after exercise: 450–675 mL/0.5 kg.

Athletes should get their vitamins (B complex, vitamin D, C, E, beta-carotene) and minerals (calcium, iron, zinc, magnesium and selenium) from food for better performance.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

HN, NS, MH, FA, MJ, RW and AZ came by the idea athlete's nutritional food choices. TN and SA supervised and guided the process of collecting data. All authors made valuable contribution in process of manuscript writing.

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