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Review Article

NUTRITION FOR OPTIMAL SPORTS PERFORMANCE – A REVIEW

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ABSTRACT

Nutrition affects a sports person in many ways. At the basic level, it plays an important role in achieving and maintaining health. Optimal nutrition can reduce fatigue, allowing a sportsman to train and compete longer or recover faster between training sessions (Ruud.1996).

INTRODUCTION

Nutrition affects a sports person in many ways. At the basic level, it plays an important role in achieving and maintaining health. Optimal nutrition can reduce fatigue, allowing a sportsman to train and compete longer or recover faster between training sessions (Ruud.1996). Nutrition is an important component of any physical fitness program. The main dietary goal of active individuals is to obtain adequate nutrition to optimize their health and fitness or sports performance. Indeed, nutrition affects almost every process in the body involved in energy production and recovery from exercise (Jacqueline. 2000).

Sports nutrition is a discipline which applies principles derived not only from nutritional but also biochemical and physiological scientific knowledge for the purpose of promoting optimal performance while remaining healthy. Sports nutrition does not restrict itself exclusively to sports, but also applies its principles to exercise in general. Sports nutrition is clear that times have changed and almost everyday today is concerned about health, fitness and longevity. The goal of sports nutrition is not only to enhance performance of sports person but also to widen its scope for non-sports person by providing good health and physical fitness for all individuals. (William. 1999)

Therefore to understand and apply the principles of sport nutrition, some basic understanding of nutrition is necessary. This includes the knowledge of biochemical and physiological processes that occur in different cells and tissues as well as how these processes are integrated throughout the body (jeukendrup. 2004). All of the factors connecting muscle, ventilation/ respiration and circulation are important in determining the success of a particular individual in competing in a particular sport. Additional factors involve coordination (skilled movement), body size and motivation. However, energy is needed for the performance of short-term explosive events, long-term endurance events and the many sport activities that involve the development of varying amounts of power during the course of a consist. Therefore, proper nutrition must be considerd to be a key element to success in a wide variety of competitive sports. The moment a competitive event begins, the athlete should be at appropriate body mass, sufficiently hydrated, possess proper amounts of vitamins and minerals, and be nourished with sufficient carbohydrate that an appropriate balance of carbohydrate and fat metabolism will provide the energy for the ensuing muscular activity (Maugham. 2000).

Physical fitness

Physical fitness is a general term used to describe an individual whether he/she is capable to carry out a variety of physical tasks without feeling fatigued.
According to W.H.O.(1994) "Fitness is ability to perform muscular work satisfactory ".**According to Rusby** (2001) physical fitness is " The ability to meet physical demands placed upon us, either generally in the terms of everyday life or the specific demands of a sports or physical activity".

Nutritional requirement for sports person

All sports person require a balance diet with a proper intake of energy, protein, fat and carbohydrate. The major goal of diet is

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to ensure sufficient calories consumed to eater the demands of the body throughout the day (resting energy expenditure, daily activity and training experience). Therefore a diet full of nutrients are essential for sports person.

Energy

Energy requirement among sports person depend on the volume or total amount of their performance and the specific energy costs of their physical activity. During exercise, the energy demands of muscle contraction will fluctuate enormously. For muscle contraction to occur, chemical energy stored in the form of adenosine triphosphate (ATP) must be converted into mechanical energy needed by the muscles. However, the muscle store of ATP is relatively small and therefore for activity to continue beyond a few seconds ATP must be resynthesized from phosphocreatine, carbohydrate and fat (Maugham. 2000). A more complex situation involving a gathering of proposed risk factor is the **"energy drain"** syndrome. This syndrome specially effects the female who consumes few calories to support the full range of body functions. Involved in optimal health and performance low energy availability can be induced by the reduction in calories and can result in ill health. Immediate consequences of low energy availability include decreased muscles glycogen stores, fatigue, dehydration, loss of concentration and motivation, depression, electrolyte imbalances, mood swings, poor sleep, increased risk of infection and illness supper workouts and performances. Therefore eating foods from five food group are essential (yeager. 1993).

Types of activity	Total energy requirement (kcal/d)
Boxer, weight lifters, judo, power lifting and kabaddi	6000
Long distance running, walking, cycling, and swimming	5200
Football , hockey, volleyball, and basketball	4500
Gymnastics, table-tennis, and yatching	3600
Shooting, archery and horse riding	3000

(Source williams. A., 1991)

Protein

Protein required for optimal function of the body. Protein helps to repair and rebuild muscle after exercise and can also be used during exercise. As an energy sources for when carbohydrate by enhancing the energy utilization or stimulating increases in fat free mass in activity individuals (Lemon. 2000).Sports person engage in activity are required for higher level of protein intake than 0.8 g/kg body weight per day, regardless of the mode of exercise (endurance, resistance, etc) or training (recreational, moderately or well-trained) (Khoury, E., *et.al*., 1999).Common sources of protein:- milk, whey, casein, egg and soy based powder. Different protein sources and purification methods may be affects the bioavailability of amino acid. A protein provided an adequate circulating pool of amino acid before exercise and after exercise is readily taken up by skeletal muscles to obtain nitrogen balance and muscles protein kinetics. Purpose of growth and development of the body organs and tissues (Tipton, K.D. *et. al*., 2004).

Protein intake is a part or the nutrient requirement for the regular sports person and is an important component of activity performance, because it is also aid in performance and recovery. Protein intake for well-trained sports person should occur before during and after physical activity as it is advantageous in gaining muscles mass and strength (Rodriguez, *et . al* ., 2009).Very few sports person are at risk of protein deficiency if their intake is sufficient to maintain body weight and sound nutrition practices are followed (Wolfe. 2004). (Protein is necessary to build muscles power which act as fuel for energy (Burke. 2004).

Protein intake equal to 15-20% of total calorie will meet the protein requirements of most sports person ICMR 1985 recommends 12-14% of total energy requirement and upper limit could be placed at 2 g/kg body weight. Protein intake above 2.0 g/kg body weight do not improve strenght gains compaired to intakes, of 1.4-1.8 g/kg body weight. consuming more protein that 2.0 g/kg body weight result in increased protein oxidation, urea formation, diuresis and can increase risk for dehydration.

Fat

Fat provides the main fuel sources for long duration, low to moderate intensity exercises such as marathous. Even during high intensity exercise, where carbohydrate is the main fuel sources, fat is needed to help access the stored carbohydrate (glycogen). Adequate intake of fat is necessary for numerous metabolic activities also that promote optimal health. Fat intake for a sport person should range between 20-35% of total daily calories. Current dietary guidelines recommend that 10% of fat intake should come from monounsaturated sources, 10% from polyunsaturated sources, and no more than 10% from saturated fat (Rodriguez . *et. al*., 2009).

Carbohydrate

Carbohydrates is a primary fuel for high intensity exercise. The body ability to store carbohydrate, primarily in the form of glycogen in the muscles and liver is limited and insufficient. The sports nutrition can maintain their glycogen stores by consuming approximately 65-70% of total daily energy from carbohydrate (Burke. *et. al*., 2004).Carbohydrates include both complex and simple sugars. Carbohydrates maintain blood sugar levels to fuel exercise. They also replenish glycogen which is the storage form of carbohydrates within muscles. The recommended daily carbohydrate intake for athletes ranges from 6-10 g/kg body weight (Rodriguez. *et. al*., 2009).The type of carbohydrates consumed also affect the fuel stores and the overall nutritional status. Simple sugars occur naturally in fruits, vegetables, honey, milk and other foods, as well as, in a refined state, such as table sugar or sucrose. Complex carbohydrates are a complex chain-like structure of many simple sugar like starches and dietary fibre as found in cereals, grains, fruits, vegetables and foods such as noodless, potatoes etc. Complex carbohydrates should consist a chunk of total carbohydrate consumed. A variety of fruits, vegetables and grain should be consumed. Whole grain breads and cereals. Peas, fruits and vegetables are generally low in fat, contain no cholesterol and are rich in fiber, which facilitates proper bowel functions and can reduce symptoms of chronic constipation. In addition to this, these are generally good sources of vitamins and minerals, simple sugars in moderation can be taken to add to energy levels needed for large fuel sources.

Micronutrients requirement

Minerals represent a class of inorganic substances found naturally in a variety of foods. They are also essential for a wide variety of metabolic and physiologic processes in the human body. They are important for sports person as they are involved in muscle contraction, normal hearth rhythm, nerve impulse conduction, oxygen transport, oxidative phosphorylation, enzyme activation, immune functions, antioxidant activity, bone health, and acid base balance of the blood (Speich. 2001).

Calcium

About 99 percent of the calcium in the body is stored in the skeletal system, while the remaining one percent is present in other cells, such as muscle cells. Although in muscle cell calcium is involved in a variety of physiologic processes associated with energy metabolism and muscle contraction. calcium supplementation is not considered to possess ergogenic potential because, if necessary, the muscle cells may draw on the vast reserves stored in the bone tissue (Speich, 2001).Calcium intakes ranging from 800-1200 mg/d. calcium main role in the prevention of stress factures both of the elderly and elite female sports person (Nielsen.P *et al*.1998). Decrease bone density in sports person of failure to optimize peak bone mass may be a risk factor for the development of stress fractures during their sports person career, and more importantly, the earlier onset, or increased risk of osteoporosis in later life. Therefore calcium must be supplied from the diet and sources of calcium milk and milk products, garlic, brockeli and green leafy vegatables (Turner.2001).

Iron

Iron is one of the most critical minerals with implications for sportsperformance. Iron is a component of hemoglobin, myoglobin, cytochromes, andvarious enzymes in the muscle cells, all of which are involved in the transport and metabolism of oxygen for aerobic energy production during endurance exercise. The benefits of iron supplementation may depend on the iron status of the athlete (Dressendorfer.2002). The iron intake is 15-18 mg/d. and 10-15% iron to a absorbed your body**.** The iron range of normal heamoglobin levels is reasonably wide, it is possible that an sport person may show a level that is within references standard, but is below the level that is usual for them and is required for their optimal activity performance. Good iron rich sources included in a diet such as :- green leafy vegetables, amla, meat, til and beetroot (Deakin. 2000)

Fluids

Activity performance is optimal when sports person maintain fluid balance during activity and activity performance is impaired by dehydration. Optimal hydration can be achieved by drinking 150-350ml of fluid every 15-20 minutes during activity (Maughan. *et. al*., 2006). It is generally recommended that individuals consume about 400-600 milliliters of water or water based fluid approximately 2 hours prior to about of activity . This will allow for rehydration, if important and excretion of residual water. Sports person who sweat more can experiment with higher levels. Regular water intake becomes more difficult with the duration of the effort both in training and competition (Sawka. *et. al*., 1990).

Hydration is an important consideration for optimal activity performance. Because dehydration increases the risk of potentially life-threatening heat injury such as heat stroke, sport person should struggle for heaviness before, during, and after activity. Dehydration (loss of >2% body weight) can compromise aerobic activity performance, particularly in hot weather, and may impair mental/cognitive performance.

Importance of pregame and post game nutrition

Most of the sports person are continously looking for ways to improve his or her performance encouraging their body to perform at maximum potential. In order to keep their body healthy and keep themselves in optimal shape for sports, they have to hit two important points with their diet: high energy and healthy nutrients with right attention paid on these points the desired results can be achieved.

Pre game meal

The main objective of pre game meal is that firstly it keeps sportsperson active before and during the game and secondly helps in maintaining optimal levels of energy (blood glucose level) for exercising muscles during competition. Therefore ideal pre game meal should comprises of complex carbohydrate, moderate protein and low fat (Davis. E. M., 2015) At least 4 h before exercise, individuals should drink approximately 5-7 $mL \cdot kg^{-1}$ body weight (~2-3 $mL \cdot lb^{-1}$) of water or a sports drink. This would allow enough time to optimize hydration status and for excretion of any excess fluid as urine (Sawka. *et. al*., 2007).

During activity

Athletes dissipate heat produced during physical activity by radiation, conduction, convection, and vaporization of water. In hot, dry environments, evaporation accounts for more than 80% of metabolic heat loss (Sawka, *et. al*., 2007).Therefore during exercise also one should remain hydrated, provide immediate fuel to boost performance and preserve muscle to improve recovery (Pierre, B. S., 2013). During sports activity time person feel too tired, than carbohydrate can provided immediate fuel source and energy is important for gaining a freshness and protein is also important muscles build up and stored energy (Sawka, *et . al* ., 2007).Carbohydrate should be taken- 60-70grams/hours and protein should be given 15 grams/hours. But try to avoid eating fatty diet during exercise as it is more difficult to digest (Pierre. B. S., 2013)

After activity

After activity carbohydrate is important nutrients for giving a energy and fell fresh ness. Protein is also important for build up muscles. One should consume enough fluids after exercise to balance fluid losses, they complete their exercise session dehydrated to some extent. Given adequate time, intake of beverages will restore hydration status by replacing fluids and electrolytes lost during exercise.

Consuming protein along with a sources of carbohydrate after exercise provides amino acids neceessary for muscle repair.Eating after peak performance is also very important. It helps in repleneshing the muscles immediately after exercise

allowing the muscles cells to take up more glucose therefore maximizing muscle glycogen synthesis. Muscles are most receptive to recovery the first 30 minutes after competition.

Rapid and complete recovery from excessive dehydration can be accomplished by drinking at least 16-24 oz (450-675 mL) of fluid for every pound (0.5 kg) of body weight lost during exercise. Consuming rehydration beverages and salty foods at meals/snacks will help replace fluid and electrolyte losses

Role of ergogenic aid

The two key factors important of sports success are genetic endowment and state of training. At certain levels of competition, the contestants generally have similar genetic sports abilities and have been exposed to similar training methods, and thus they are fairly evenly matched. Given the emphasis placed on wining, many sports training for competition are always searching for the ultimate method or ingredient to provide that extra winning edge. Indeed one report suggests that two of the key factors leading to be ytter sports records in recent years are improved diet and ergogenic aids.

Ergogenic word is derived from the Greek words *ergo* (meaning) work and gen (meaning) production of, and is usually defined as to increases potential for work output. In sports different ergogenic aids have been used for their theoretical ability to improve sport performance by enhancing physical power, mental strength, or mechanical edge.

Classification of ergogenic aids

Mechanical Aids

Mechanical or Biochemical aids are designed to increase energy efficiency. Light weight racing shoes may be used by a sports in place of heavier ones so that less energy is needed to move the legs and the economy of activity performance increases.

Psychological Aids

Psychological aids are designed to enhance psycological processes during sports performance, increasing mental strength. Hypnosis, through posthypotic suggestion, may help remove psychological barriers it may limit physiological performance capacity.

Physiological Aids

Physiological aids are designed to development natural physiological processes to increase physical power. Blood doping, or the infusion of blood into an sports, may increase oxygen transport capacity and thus increase aerobic endurance.

Pharmacological Aids

Pharmacological aids are drugs designed influence physiological or psychological processes to increase physical power or mental strength. Anabolic steroids , drugs that mimic the action of the female harmone, testosterone, may increase muscle size and strength.

Nutritional Aids

Nutritional aids are nutrients designed to influence physiological or psychological processes to increase physical power or mental strength. Protein supplements is used increase muscles mass because protein is the major dietary constituent of muscles.

Why are nutritional ergogenic so popular

The most used ergogenic aids are those that are classified as nutritional. Because it may believe that certain food possess magical qualities, it is no wonder that a wide array of nutrients or special food preparations have been used.

There are a number of theoretical nutritional ergogenics aids in each of the six major classification of nutrients, and sports have been know to take supplements of almost every nutrients in attempts to improve performance.

- Special carbohydrates compounds have been developed to facilitate absorption, storage and utilization of carbohydrate during exercise.
- Special fatty acids have been used in attempts to provide an alternative fuel to carbohydrates.
- Special amino acids derived from protein have been developed and advertised to be more potent than anabolic steroids in stimulating muscles growth and strength development.
- Special vitamins mixtures and even "nonvitamin vitamins," such as vitamin B15, have been asscribed ergogenic qualities ranging from increases in strength to improved vision for sport.
- Special minerals supplements, such as chromium, vanadium and boron, have been advertised to be anabolic in nature.
- Special water have been developed specifically for sports.

(Source:-Williams.H., 1999)

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