PEDAGOGICS PSYCHOLOGY
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NUTRIONAL NEEDS OF ATHLETES

Shruti Pandey, Vasudeva Singh
Central Food Technological Research Institute

Annotation. Aim – is to provide a comprehensive information regarding the nutritional needs of athletes, followed by female athletes who have a higher necessity for Iron. Sports and nutrition are directly related to each other. Taking into consideration the fact that sports person need more energy to carry out their sporting activity effectively, it becomes of prime importance to take care for sports performance. Athletes must supposedly eat the perfect ratio of Protein, carbohydrate and fat at each meal and snack to control the hormonal systems and thus reach their maximum performance and ideal weight .The carbohydrate/protein/fat ratio of the 40-30-30 diet allegedly maintains the proper balance between the hormones insulin and glucagon. The present review focuses on the intake for a wholesome nutrient and well balanced diet for better performance among male as well as female athletes.
Keywords: sports performance, endurance sports, Glycemic index, female athletes, hemodilution.

Introduction

Training to improve performance in sports is undoubtedly necessary, however over the years, it has been realized that nutrition is also critically important. Success in sports depends on three factors genetic endowments, the state of training and nutrition. Genetic constitution cannot be changed, specialized exercise training is the major means to improve athletic performance and proper nutrition is of paramount importance. As per the conference held by Sports Authority of India in 2005, Sports nutrition assumed critical importance, because long before deficiency symptoms start appearing, physical performance of the athlete declines. The level which permits the athlete to achieve the maximum possible physical performance should be the minimum level aimed in the sports nutrition.(Nutrition and Hydration Guidelines for excellence in Sports Performance, 2005).Requirement may vary from 12.5-25 Mega Joule (MJ) the higher values associated with high intensity endurance sports such as cross country running or skiing and marathon running. An optimal diet is one which consists of the supply of required nutrients is adequate amount to cover energy expenditure, tissue maintenance, repair and growth. The nutritional needs differ from individual to individual, and are based on age, sex, body size and composition, occupation, physiological condition etc. Nutritional requirements of athletes should take care into consideration the specific energy requirements of particular sports and phase of training and by the athlete's dietary preferences. There is no particular diet for optimal sports performance. However, there is a need for sound nutritional guidelines in planning and evaluating food intake of an athlete. Athlete's nutritional status can be assessed by the ABCDE method that is generally being used for population studies. Here 'A' implies for Anthropometrics which includes measurements such as weight, height and other physical parameters of athlete. Biochemical analysis includes recognizing signs and symptoms of deficiencies or excesses in the individual's body. Diet history is a method of assessment that indicates what a person has been eating over a period of time. Economic status is an additional factor that should also be taken into consideration when assessing one's nutritional intake. There are about 45 nutrients viz Glucose, essential fatty acids and amino acids, 13 Vitamins, 21 minerals and water which are obtained from a diet or supplemented in a diet.

Buskirk (1982) opined that the total caloric need is influenced by the body weight, the frequency of repetition of the event, category of sport taken and the length of practice during training. Training itself increases the daily caloric need by 5-40% depending on the nature of the exercise and the length of practice. Women athletes require 10% fewer calories to cover the energy need for each type of sport or during training. As per the guidelines for Nutrition and Hydration for excellence in sports and Nutrition (2005), athletes especially females and participants in endurance and aesthetic sports are chronically energy deficient. This energy deficiency impairs performance growth and health. Reproductive disorders in female athletes are caused by the low energy availability perhaps specifically by low carbohydrate availability and lot by the stress of exercise. Focus should be given on wholesome unrefined complex carbohydrates in the menu planning for athletes as they are rich in fiber, vitamins, minerals, phytochemicals, have essential fatty acid, antioxidants and promote satiety. These disorders can be prevented by dietary supplementation in compensation for exercise energy expenditure.

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Results.

Carbohydrate

They are the preferred source of energy for all body functions and muscular exertions and are necessary to assist other foods in digestion, assimilation, and elimination. It is generally recommended that at least 55% of total calories should be from carbohydrate for an average person (FAO/WHO/UNU, 1985, Technical Series No 724).Athletes need total carbohydrate to be closer to the WHO recommendation in order to properly store enough fuel for their events, especially for endurance competition. A minimal daily amount of carbohydrates recommended for an athlete is 300 grams if the total intake is 2000 K.cal

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Muscle cells utilize the energy provided by fats, carbohydrates and protein. In sports activities, however, protein as a source of energy is not desirable. Certain sports activities need additional amount of glycogen storage to be spared during the events. In such situations appropriate carbohydrate loading techniques may be adopted if the carbohydrate stores are below normal. However, recent studies have shown that as long as the intake of carbohydrates is meeting the recommended levels, carbohydrate loading is not desirable since it will limit intake of other essential nutrients which are required for optimal performance. The first source of glucose for the exercising muscle is its own glucose store. When this is depleted glycogenolysis and then gluconeogenesis maintain the glucose supply. During endurance exercise that exceeds 90 mins, such as marathon running, muscle glycogen stores become progressively lower. When they drop to critically low levels high intensity exercise cannot be maintained. In practical terms the athlete is exhausted and must either stop exercising or drastically reduce the pace. It is recommended that athletes in heavy training should consume a carbohydrate intake of 6-10 g/kg of body weight daily to prevent daily carbohydrate and glycogen depletion. The amount required depends on the athlete's total daily expenditure, type of sport, gender and environmental conditions. Hargreaves (1991) both recommend that carbohydrate with a moderate to high glycemic index be consumed after exercise. Research has demonstrated that a diet based on high Glycemic index carbohydrate foods promoted greater glycogen storage in the first 24 hours of recovery after strenuous exercise than an equal amount of carbohydrate eaten in the form of low GI index foods. Numerous studies have concluded that increased carbohydrate intake can improve capacity. Nilsson (1973) was of the opinion that, high carbohydrate diets optimize muscle and liver glycogen stores. Recent studies have also suggested that benefit of carbohydrate consumption is not limited to maintenance of glycogen stores, but also related to maintenance of Krebs cycle intermediates Spencer & Yan (1991) and preservation of the bio energetic state of exercising muscle Larson & Hesslink (1994). Sports nutrition guidelines recommend that 60-65% of total energy should come from CHO. It may be more appropriate; however, to base recommendations on body weight which is independent of energy intake Coyle (1992).Furthermore the low GI meal was found to maintain both glucose and free fatty acids at higher concentrations during the later stages of exercise. Staleness is a physiologic state caused by gradual depletion of the glycogen reserves in the body by strenuous endurance workouts even though the person may be consuming a typical carbohydrate intake. An athlete can optimize his/her glycogen reserves by gradually decreasing the intensity of exercise workouts several days prior to competition, while maintain a high complex carbohydrate intake. In glycogen loading the athlete trains at a high aerobic intensity and about one week before the event gradually reduces or tapers the duration of exercise on successive days. Carbohydrate represents 50-55% of calories during the first 3 days and then is increased to 70-75% of calories for the last 3 days before the competition. The pre event meal should be largely digested and absorbed before the event so as to minimize gastric upset and energy being expended to digest and absorb the food during the event.

According to Thomas & Brotherhood (1994) low GI meal eaten before an event prolongs endurance during strenuous exercise. The bio chemical findings suggest that the mechanism is associated with the ability to produce relatively low concentration of plasma glucose, insulin and lactate compared with the high GI meals in the period immediately after ingestion. Furthermore the low GI meals were found to maintain both glucose and free fatty acids at higher concentration during the later stages of exercise.

Protein – The Recommended Daily Allowance (RDA) for protein for most people is 0.8 grams per kilogram of body weight for endurance athletes and body builders. Power and endurance athletes appear to need protein 1.2-1.5 g/ Kg body weight. Endurance athletes may need additional protein for repair of damaged muscle fibers. The International center for sports Nutrition endorses the range of 1.0-1.5g/Kg body weight/day. Endurance athletes require a little more protein than power athletes as they retain some of this protein in their muscles. Some evidence exists that creatinine formed from glycine plus Arginine and Methionine may be beneficial. It is one of the most important nutrients in the maintenance of good health and vitality. It is of vital importance in the growth and development of all body tissues. The active body's use of proteins as a fuel to meet 2-5% of energy needs during rest and low/moderate exercise, while, it provides 10-15% of energy needs during endurance exercise. A carbohydrate rich diet spares protein from being used as fuel. Athletes do not generally need extra protein unless they are trying to gain muscle mass or they engage in endurance sports.

Fat –Moderate consumption of fat and a balance between saturated and unsaturated fats are desirable. For a balanced diet, the total dietary fat has to be reduced to less than 30 per cent of total calories whereas saturated fats intake has to reduce by 10 per cent of total calories.

Micronutrients-Apart from macro nutrients like carbohydrates, proteins and fats, the body requires micronutrients, minerals and vitamins in small quantities for its proper functioning. Micronutrients are required in micro quantities and include vitamins and minerals. These are required for growth and repair of body tissues, metabolic reactions and immune functions.

Vitamin E- It is needed for normal muscle function. Exercise is known to alter skeletal muscle blood flow. Exercise influences oxidation metabolism and Vitamin E may lower the oxidative stress associated with exercise.

Iron-Surveys of athletic group have shown that both males and females, particularly those involved in intense endurance sports, have hemoglobin concentration in the low and mid range of the population norms. This is referred to as sports anemia. In most athletes the lower hemoglobin is caused by a training which induces increase in plasma volume that dilutes the Red Blood Cell. The increase in blood plasma is a beneficial adaptation to aerobic exercise and should be called dilutional pseudo anemia. Some athletes however develop true anemia which is a deficiency in the total amount of circulating Hemoglobin or RBC. The extent of iron deficiency in athletes appears to be higher than in the

general population, without question elite runners have lower plasma ferritin levels than the general population. This difference may be attributed to hemodilution. Transfer of absorbed iron into larger muscles and RBC or altered iron metabolism comprehensive examination in male endurance athletes have concluded that psuedoanemia or Iron deficiency existed when all markers of iron status were considered.

Dietary fiber-Dietary fiber, or sometimes **roughage** or **ruffage** is the indigestible portion of plant foods having two main components:

- Insoluble fiber that is metabolically inert, absorbing water as it moves through the digestive system, easing defecation.
- Soluble fiber absorbs water to become a gelatinous, viscous substance and is fermented by bacteria in the digestive tract. Insoluble fiber has bulking action and is not fermented Anderson & Baird (2009). The recommendation for a healthy amount of dietary fiber varies between 25 and 48 grams a day for diets ranging from 3000-7000 k.cal per day. In some cultures and in ancient diets 60-100 grams of fiber was consumed. Some examples of fibers naturally found in foods are hemicelluloses, pectin, and gums. The foods with the highest amounts of fiber are beans, legumes and peas. In addition to the weight control benefit and reduced blood cholesterol and colon disease, fiber also benefits health by promoting softer larger stool and regularity, by slowing glucose absorption and reducing hemorrhoids and diverticulitis.

Water

- Water is required for a variety of reasons; It transports nutrients and gases to cells, wastes from cells, as also other substances
- It combines with viscous molecules to form lubricating fluids for joints, for smooth movement of food through digestive tract etc.
- It helps maintain body temperature
- It maintains cellular shape, is an integral part of cell membrane, cushions organs and helps maintain body structures.

Pre event Rehydration

Athletes should consume 1.5 to 3 L of fluid above their normal intake the day before the event.

Athletes should consume 0.5 L of water 1-2 hours prior to the event and 0.6 L of water or other fluids 10-15 minutes before event.

Empty their bladder 15 minutes prior to the event is a must.

Athletes should drink cool water during the event as it is absorbed faster and cools the body better than water at room temperature.

During – event Hydration

Athletes should drink 150 ml to 250 ml every 10-15 minutes to maintain fluid balance.

Athletes should sip the water, and not gulp it down.

Performance Enhancing Substances

The following broad categories of performance enhancing substances and methods were banned by the International Olympic Committee (IOC) in 2005 .These categories are

1 Stimulant
2 Narcotic Analgesics
3 Androgenic anabolic steroids
4 β- Blockers
5 β-2agonists
6 Alcohols
7 Diuretics and other estrogenic activity
8 Peptide hormones and analogues
9 Substances that alter the integrity of urine samples.
10 Enhancers of oxygen transport
11 Chemical & physical manipulations
12 Agents with other anti- estrogenic activity
13 Gene doping
14 Cannabinoids
15 Glucocorticosteroids

Sports Supplement

Sports supplement including vitamin and mineral supplements should be taken only in case of their deficiency and only after consulting a Doctor and of prescribed potencies to avoid any adverse effect on health. Some athletes take excessive amounts of supplements under the mistaken belief that it will improve performance. Following points need to be noted;

- While calcium is good for woman's health too much of anything can cause problems. The body has a natural mechanism for protecting against calcium overdose, but it can be over-ridden if more than 4 grams of calcium are consumed per day. The two most serious effects of calcium overdose are renal damage and the deposit of calcium in other parts of the body besides bone.

- While it is important to meet the body's requirements for vitamins and minerals, it is sometimes dangerous to exceed these needs. Taking extra vitamins and minerals or any other nutrient will not make an athlete bigger, stronger or faster.
- The majority of supplements have not been researched thoroughly, especially on teenage athletes. In addition long term studies on safety are not extensively available. Stimulating herbs such as guarana and yohimbine can cause anxiety and dizziness. One such dangerous example is ephedra, which can have adverse effects such as nervousness, irregular heartbeat, and can be deadly in some cases.
- Creatine supplements may negatively affect kidney function and promote dehydration.
- Amino acid and protein supplements, while not dangerous, are an unnecessary expense when diet alone can meet protein needs. Hard training and proper nutrition, and food should be the first priority in an athlete's nutrition program.

Elimination of free radicals

Increased physical activity may necessitate higher input of vitamins particularly vitamins C, B_2, A and E. But this increased input would come from diet if energy expenditure is met from energy input. For most athletes there is, therefore no need for vitamin supplements. However in respect of athletes who have to restrict body weight and therefore no need for vitamin supplements. However in respect of Athletes who have to restrict body weight and therefore their diet there is likely to be inadequacy of micronutrients and supplementation will become necessary.

Losses of minerals can occur from strenuous exercises. Losses of iron and magnesium are likely from sweat particularly in hot conditions. If dietary intake fails to compensate for these losses athletic performance will be adversely affected. Hence iron, zinc and magnesium supplements may be necessary. But these should not exceed 1-2 times the RDA. Excessive intake of minerals can be toxic. Female athletes who are trained in hot conditions are likely to lose iron and calcium. They will require calcium supplements to maintain healthy bones.

Nutrition for Female Athletes-

The Ideal diet is based on the woman's weight and consists of percentages of various food types proportional to that weight. In general, for female athletes, the recommended allowances for macro nutrients are similar to those recommended for male counterparts. Care should be taken in the case of micronutrients especially iron and calcium, because of additional physiological demands of female athletes. In addition to iron and calcium the meals should be rich in B-12, Folate and zinc. Diets should include 30 mg of iron, 800-1200 mg of calcium and 1.3 mg of B-12 a day. Calcium needs can be met by 3 to 4 servings of low fat milk, yogurt or other calcium rich foods. Calcium absorption requires adequate amount of protein, lactose, vitamin D and acidic foods.

Weight training is important to the female athlete. Women need to balance upper and lower body weight to achieve overall body strength. Weight lifting programs that are done 2 or 3 times a week increase bone density, decrease fat and improve muscle definition.

Conclusion.

Training is an important part of sports performance but diet also plays a major role. While the calorie requirements varied with the sports categories it is now found that in the same category of sports energy expenditure at different stages of training varied a good deal. These variations have to be reflected in energy intake to prevent undesired weight gain. Hydration is as critical as nutrition performance will be seriously affected if fluid balance is disturbed.

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Information about the authors:

Shruti Pandey: shruti@cftri.org; Central Food Technological Research Institute; ysore, Karnataka, 570020, India

Vasudeva Singh: shruti@cftri.org; Central Food Technological Research Institute; Mysore, Karnataka, 570020, India

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