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NUTRITIONAL SUPPLEMENTS AND SPORTS PERFORMANCE: INTRODUCTION AND VITAMINS

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Abstract- An increasing number of athletes are adopting vegetarian diets for ecological, economic, religious, health and ethical reasons. Vegetarian diets (except possibly fruitarian and strict macrobiotic diets) can easily meet the nutritional requirements of all types of athletes provided they contain a variety of plant-foods. Vegetarian athletes, like most athletes, may benefit from education on food choices that benefit athletic performance and promote overall health. Sports success is dependent primarily on genetic endowment in athletes with morphologic, psychological, physiologic and metabolic traits specific to performance characteristics vital to their sport. Such genetically-endowed athletes must also receive optimal training to increase physical power, enhance mental strength, and provide a mechanical advantage. However, athletes often attempt to go beyond training and use substances and techniques, often referred to as ergogenics, in attempts to gain a competitive advantage.

Keywords- Sport nutrition; Nutritional supplements; vitamins; sports performance

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Introduction

Nutritional supplements are used by athletes worldwide. In the United States, the Nutritional Supplement Health and Education Act has distinct Nutritional supplements as something added to the diet, mainly (1) vitamins, (2) minerals, (3) amino acids, (4) herbs or botanicals, and (5) metabolites/constituents/extracts, or mixture of any of these ingredients. In count to genuine food products beset to athletes and physically-active persons, several organisations have marketed Nutritional supplements to athletes, often with the argue that sports show may be improved. This is the first in a sequence of six articles to argue the major course of Nutritional supplements listed above. The key focus will be on usefulness of such Nutritional supplements to improve exercise or sport performance, with brief treatment of protection, validity, and ethicality.

Vitamins

Ergogenic Theory

Vitamins function in the human body as metabolic regulators, influencing a number of physiological processes significant to exercise or sport performance. For example, many of the B-complex vitamins are involved in processing carbohydrate and fats for energy production, an significant thought during exercise of varying strength. Several B vitamins are also necessary to help form hemoglobin in red blood cells, a major determinant of oxygen release to the muscles during aerobic endurance exercise. Moreover, vitamins C and E function as antioxidants, significant for preventing oxidative injure to cellular and subcellular arrangement and function during exercise training, theoretically optimizing grounding for contest. Complete details of vitamin functions and needs are offered in several recent treatises from the National Academy of Science.

Vitamin deficiencies can surely injure exercise performance. A daily intake of fewer than one-third of the RDA for several of the B vitamins (B_1, B_2 and B_6) and vitamin C, even when other vitamins are supplemented in the diet, may lead to a important decrease in VO_2max and the anaerobic threshold in less than four weeks. However, mainly studies report that athletes who devour high-calorie diets that contain the RDA of all nutrients have few vitamin or mineral deficiencies. Nevertheless, recent survey data indicate that vitamins are the most commonly used Nutritional supplements among various athletic groups. Can vitamin supplementation above that provided by an adequate, healthy, balanced diet enhance sport or exercise performance.

Vitamin Supplements

Efficacy

Studies have been conducted to assess the ergogenic possible of almost every individual vitamin, as well as clusters of vitamins and connected substances, including the B-complex vitamins, multivitamin/mineral compounds, and antioxidants.

B Vitamins and Choline

As many of the B vitamins are concerned in the metabolism of car-

bohydrate, fat and protein, their ergogenic possible has been studied individually and in mixture. In general, although a paucity of the B vitamins may injure both aerobic and anaerobic exercise performance, supplementation has not been shown to enhance performance in well-nourished individuals. Niacin supplementation may manipulate fat metabolism, blocking the release of free fatty acids (FFA) from adipose tissue and growing reliance on carbohydrate consumption, possibly primary to untimely reduction of muscle glycogen. Some examine has indicated that glut niacin supplementation may essentially impair aerobic patience presentation. Vitamins B_1, B_6 and B_{12} are believed to influence the configuration of serotonin, an important neurotransmitter concerned in leisure. Some research with large doses (60-200 times the RDA) of these vitamins has shown increases in fine motor control and feat in pistol shooting. Others have recommended that the helpful effect was connected to the role of these vitamins in promoting the growth of neurotransmitters that persuade relaxation. Additional research is merited to assess these effects on performance in accuracy sports dependent on fine motor control. However, it should be noted that such doses could surpass the Tolerable Upper Intake Level (UL) for vitamin B_6.

Choline, an amine, is found naturally in a variety of foods and its RDA is grouped with the B vitamins. Choline is concerned in the creation of acetylcholine, a neurotransmitter whose decrease in the nervous system may be theorized to be a contributing factor to the growth of weariness. Because plasma choline levels have been reported to be considerably compact following marathon running, choline supplementation has been theorized to prevent fatigue. Research has shown that choline supplementation will raise blood choline levels at rest and during long-standing exercise, and some initial field and laboratory research has optional increased plasma choline levels are associated with a appreciably decreased time to run 20 miles. However, other well-controlled laboratory research has exposed that choline supplementation, although growing plasma choline levels, exerted no effect on either brief, high-intensity anaerobic cycling tests or more drawn out aerobic exercise tasks. For example, choline supplementation, even though rising plasma free choline in marathon runners, had no effect on predicted or actual marathon time.

Multivitamin/Minerals

The overall review of the literature supports the viewpoint that multivitamin/mineral supplements are needless for athletes or other physically active individuals who are on a well-balanced diet with sufficient calories. For example, some studies have provided multivitamin/mineral supplements over drawn out periods and reported no important effects on both laboratory and sport-specific tests of physical performance. In one of the most complete studies, Telford and others evaluated the effect of long term (7-8 months) vitamin/mineral supplementation (100 to 5,000 times the RDA) on exercise recital of nationally ranked athletes in tuition at the Australian Institute of Sport. The athletes were experienced on a variety of sport-specific tasks as well as common tests of power, anaerobic power, and aerobic patience. They reported no momentous effect of the supplementation protocol on any gauge of physical performance when compared to athletes whose vitamin and mineral RDA were met by normal Nutritional intake.

Antioxidants

Antioxidant vitamins embrace vitamins C, E and beta-carotene, while coenzyme Q_{10} (CoQ_{10}) is a lipid with vitamin characteristics. Antioxidant vitamins have been studied individually and collectively for their latent to improve exercise performance or to avoid exercise -induced muscle tissue injure.

Antioxidants and Exercise Performance

Vitamin C supplementation has been shown to advance physical performance in vitamin C-deficient subjects, but some major reviews support the general conclusion that vitamin C supplementation does not enhance physical performance in well-nourished individuals.

Vitamin E has been shown to improve oxygen utilization during exercise at altitude, but does not appear to be an capable ergogenic under sea level conditions. A contemporary review indicated that although vitamin E supplementation may enhance tissue or serum vitamin E concentration, most proof suggests there is no discernable effect on training, performance, or rate of post-exercise recovery in either leisure or elite athletes. CoQ_{10}, also known as ubiquinone, is an antioxidant and may get better oxygen uptake in the mitochondria of the heart, and has been used therapeutically for the cure of cardiovascular disease. Theoretically, enhanced oxygen usage in the heart and skeletal muscles could get better aerobic endurance performance. Only limited data are offered, but these studies have shown that CoQ_{10} supplementation to strong young or older subjects did not manipulate lipid peroxidation, heart rate, maximal oxygen uptake, anaerobic threshold, or cycling fortitude act. One study reported that CoQ_{10} supplementation was linked with muscle tissue injure and essentially impaired cycling recital compared to the placebo cure. Overall, a recent review resulted that there is partial indication that Nutritional supplementation with antioxidants improves human act.

Antioxidants and Muscle Tissue Injure

Sen indicates that tiring exercise may spawn reactive oxygen species (ROS) to a level to overwhelm tissue antioxidant defense systems. The effect is oxidative stress, and one possible result is oxidative injure to muscle tissues. Preventing muscle tissue injure during exercise training may help optimize the training effect and ultimate competitive sports recital. Many studies have evaluated the possible of antioxidant vitamin supplementation to stop exercise-induced muscle tissue injure, and several widespread reviews have evaluated the available literature. However, the viewpoints of the reviewers vary somewhat.

Several reviewers bring to a close that antioxidant vitamin supplementation does not emerge to prevent exercise-induced muscle tissue injure. Goldfarb [9] concluded that research findings, mostly conducted with vitamin C, vitamin E, and beta carotene, have indicated that clear proof for their prophylactic effect on various types of muscle injure following exercise is lacking. Other studies have indicated that although animal studies have shown some capable effects of antioxidant supplementation to lessen exercise-induced oxidative stress injure, studies with humans are less convincing.

Nutritional supplementation with antioxidant vitamins has positive effects on lipid peroxidation and exercise-induced muscle injure and recommend vitamin supplementation to individuals performing regular heavy exercise. Evans noted that quite a few antioxidants, including vitamin C and especially vitamin E, have been shown to reduce the exercise-induced increase in the rate of lipid peroxidation, which could help prevent muscle tissue injure. Other researchers are persuaded that vitamin E contributes to preventing exercise-

induced lipid peroxidation and possible muscle tissue injure, and advise that athletes supplement with 100-200 milligrams of vitamin E daily to help prevent exercise-induced oxidative injure. Ji indicates that the slight balance between pro-oxidants and antioxidants suggests that supplementation of antioxidants may be pleasing for physically lively individuals under convinced physiological conditions by providing a larger protective margin. In particular, Ji remarks that the aging process lessens the exercise training-induced development in natural antioxidant enzymes and suggests exercise training in older athletes might be assisted with antioxidant supplementation in attempts to optimize antioxidant defense.

Sacheck and Blumberg conclude that utilize of Nutritional antioxidants like vitamin E to reduce exercise-induced muscle injury have met with mixed success, which seems to be the prevailing viewpoint. All reviewers point towards more research is needed to concentrate on this issue and to provide guidelines for implication to athletes.

Vitamin Supplements: Safety, Legality and Ethicality

Vitamin supplementation, particularly when restricted to 100 percent of the RDA for each vitamin, is normally regarded as secure. However, surfeit amounts of several vitamins may add to serious health problems and passable upper limits (UL) have been recognized for many vitamins. For example, extreme amounts of vitamin A consumed by women who are pregnant may cause birth defects. Extreme amounts of niacin may chip in to liver injure.

The employ of pure vitamin supplements by athletes is legal and ethical. However, some vitamin sports supplements marketed by dishonest entrepreneurs may contain barred substances. At the present time the Nutritional supplement production is weakly regulated, and some measures for athletes may be tainted with banned substances, such as ephedrine. Athletes who devour vitamin supplements should purchase them only from trustworthy organisation, such as those whose products that bear the USP (United States Pharmacopeia) official recognition on the label.

Vitamin Supplements and Sport\Exercise Performance

Summary

In general, health professionals indicate that vitamin supplements are not necessary for the individual on a well-balanced diet, but they may be recommended for certain individuals, such as the elderly, vegans, and women of childbearing age. Moreover, some health professionals note that mainly people do not devour an finest quantity of vitamins by diet alone and specify that it appears *cautious* for all adults to take vitamin supplements. In such cases, there is no need to take more than 100-150 percent of the RDA.

Obtaining sufficient vitamins, counting use of supplements, may also be cautious behavior for some athletes. Melinda Manore eminent that athletes involved in serious training may require more of quite a lot of vitamins, such as thiamin, riboflavin and B_6 because they are drawn in energy production, but the amount essential is only about twice the RDA and that may be easily obtained during improved food intake connected with heavy training. However, in a recent scientific roundtable exchange, several sport nutrition experts indicated that some athletes may be at risk for a vitamin deficiency, such as those in weight-control sports and those who for one reason or another do not eat a well-balanced diet. Others note that the careful use of antioxidant supplementation can give insurance against a suboptimal diet and/or the eminent demands of powerful physical activity, and thus may be optional to limit the effects of oxidative pressure in individuals performing regular, heavy exercise.

Nutrition Before, During and After Exercise

Pre-Event Meal

Nutritional intake in the food ahead of a competition or exercise session should raise fuel stores, provide sufficient hydration and thwart both hunger and gastrointestinal suffering. Studies have revealed that use of between 1 and 5 g of CHO/kg BW one to four hours before patience exercise has the budding to improve endurance recital by as much as 14% (20) and is also thought to benefit high-intensity performance. Vegetarian athletes should be optimistic to consume familiar, well tolerated, high-CHO meals that are low in sodium, simple sugars and fiber. Studies looking at CHO supplementation during the 30-60 min prior to exercise, however, have indicated that CHO may need to be avoided during this period. To keep away from the option of bounce back hypoglycemia and less performance seen in some athletes. Grippingly, recent studies have suggested that use of CHO (1 g/kg) with a low glycemic index (lentils vs. glucose or potatoes)1 hour before exercise may extend survival during tiring exercise by maintaining higher blood glucose concentrations towards the end of exercise, and may also confer an benefit by given that a slow-release source of glucose without an supplementary insulin surge. On the other hand, ingestion of a liquid CHO supplement right away before exercise (5 min) is suitable and has been found to pick up performance during stamina and resistance exercise.

Specific pre-event food choices, however, may need to be individualized. Athletes responsive to gastroesophageal reflux should keep away from caffeine, chocolate, sulfur-containing vegetables and concentrated sources of fat. Those experiencing frequent nausea, cramps and vomiting should pay attention to meal timing and not eat within 3 or 4 hours before exercise. Those experiencing diarrhea often benefit from a low residue diet 24-36 hours before a major event. Also, liquid meals are more simply digested and may be supportive for avoiding the pre-game nausea occasionally related with solid foods. Guidelines for fluid consumption take in consuming at least 2 cups fluid about 2 hours before exercise, followed by another 2 cups approximately 15-20 min before endurance exercise.

Supplementation During Exercise

Carbohydrate intake at levels between 45 and 75 g/h have been shown to benefit drawn out, moderate intensity exercise (2 h) and variable strength exercise of shorter duration most probably by maintaining blood glucose levels as endogenous glycogen stores become low. Ingestion of fluid substitute beverages easily provide CHO requirements while at the same time meeting fluid needs. For instance, consumption of 4-8 oz of 7% CHO drink (level of most commercial beverages) every 15 minutes, would supply 34-50 g CHO/h. Even more CHO can be provided when fluid is ingested in accordance with ACSM recommendations.While commercial sports drinks work well, vegetarian athletes may prefer diluted fruit juice (4 oz juice in 4 oz water = 6% solution) or low sodium vegetable juices such as carrot juice (7% solution). Solid CHO supplements are found to work equally as well providing they are ingested with water. Foods that are well absorbed and easily-carried include bananas, grapes, orange section, baked potatoes, bagels and sport bars.

Post-Exercise Nutrition

Glycogen and fluid substitute are the instant concern after long-lasting or tiring exercise. This is mainly significant during grave training. To facilitate rapid muscle glycogen synthesis, research has found that athletes should consume CHO straight away after and at frequent intervals following exercise. According to Sherman, the rate of CHO expenditure should be just about 1.5 g CHO/kg BW at 2 hour intervals for up to 4 hours. Hence, an 80 kg runner should consume about 120 g at 0, 2 and 4 hours post-exercise. Other glycogen replenishing regimens have also been optional (6, 19) Two recent studies have optional that intake of foods with a high glycemic index and protein (~1 g protein:3 g CHO) may raise the rate of muscle glycogen storage after exercise by inspiring greater insulin secretion. In the latter study, however, it is difficult to tell whether superior insulin emission resulted from improved protein or augmented energy intake. Current recommendations for post-exercise fluid requirements are to consume at least a pint of fluid for every pound of body weight deficit. Consuming water with the upturn meal should be enough providing the meal contains sufficient sodium and potassium. However, if food is not available or attractive, ingested fluid should contain sodium chloride and other electrolytes. When sodium is provided in fluids or foods, the osmotic drive to drink is maintained and urine production is decreased.

Of Special Concern For the Female Athlete

The prevalence of amenorrhea among exercising women is reported to be between 3.4 and 66% with upper occurrence in runners as different to cyclists and swimmers. The cause of this derived hypothalamic amenorrhea is unfamiliar, but may be related to training level, nutritional status, body composition changes, stress, and hormone changes with exercise. While some studies have noted higher occurrence of secondary amenorrhea among "vegetarians", other have not come to the same conclusions. By definition, however, "vegetarians" in these studies consumed low-meat and not necessarily vegetarian diets. In nonathletic females, Goldin, et al found lower circulating estrogen levels in vegetarians compared to non-vegetarians which were linked with elevated fiber and lower fat intakes, higher fecal outputs and 2-3 times more estrogens in feces. This may suggest that nutrient composition of some vegetarian diets may be predisposing to amenorrhea. In athletes, several studies have usually found lower intakes of energy, protein, fat, and zinc, and higher intakes of fiber and vitamin A in amenorrheic compared to eumenorrheic athletes.

Given the high occurrence of amenorrhea among athletic women, nutritionists have to take a menstrual cycle history as division of screening procedure and if suitable refer the athlete for medical assessment and action. Nutritional assessment and education of vegetarian athletes needs to centre on adequacy of energy, protein, fat, zinc and fiber intakes. If suitable, eumenorrheic athletes can add to energy intake and reduce fiber by consuming 1/3 to 1/2 of their cereal/grain servings from refined quite than whole grain sources and by replacing some high fiber fruit/vegetable servings with fruit/vegetable juices.

Conclusion

Nutritionists can play an necessary role optimizing the health and athletic performance of vegetarian athletes of all ages and abilities. Sports nutritionists who work with vegetarian athletes and their coaches and trainers, however, need to be sensitive to and knowledgeable about vegetarian issues. In this place, the role of the nutritionist is to effort with the sportsperson to certify sufficient nutritional eminence given his/her vegetarian beliefs, income and lifestyle. While athletes should be confident to eat a wide diversity of plant foods, this does not mean persuasive the vegetarian athlete that they need poultry, fish or dairy products in the diet.

Conflicts of Interest: None declared.

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