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Assessing Vegetarian Athletes' Needs

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There's little doubt that food and nutrition can positively or negatively affect physical performance or that vegetarian diets offer extensive health benefits,[1,2] but there's limited research on the segment of the population for which these two areas overlap: vegetarian athletes.[3,4]

One reason for the limited data on vegetarian athletes' needs may be attributed to the fact that this group represents only a small subset of the population, though exact numbers are uncertain. If the prevalence of vegetarians among athletes mirrored the prevalence of vegetarians in the general population, 3% likely would be vegetarian, defined as those who avoid meat, poultry, and seafood, and 1% would be vegan, defined as those who avoid all animal foods. If the definition is expanded to those who avoid only meat, the estimate would be closer to 8%.[5]

Some direct surveys of athletes show a prevalence of vegetarians close to these estimates, ranging from 2% to 5%.[6,7] Other research suggests that adopting a plant-based diet is more common, noting that 30% to 50% of endurance athletes, especially women, report following a semivegetarian diet with low meat intake.[8]

Though the interest has been present since the early Olympic games,[9] today's athletes still are looking for dietary strategies or supplements that will give them a competitive edge.[6] It's understood that mineral status as well as fluid and calorie intake can impact performance,[1,3] but conclusions about an overall dietary pattern have yet to be made.

Performance and Health

Records from the mid to late 1800s describe vegetarian athletes striving to prove themselves against omnivorous competitors.[10] At that time, there was a commonly held belief that consuming meat was crucial for athletic performance.[9] But over time, meatless diets increasingly have been considered a feasible option for athletes.[1,3,4] Based on research conducted thus far, it appears that these eating patterns sustain training and performance as well as omnivorous diets do as long as an athlete's calorie and protein needs are met.[1]

One study, from 1986, found no significant differences between vegetarians and nonvegetarians in measured parameters such as aerobic and anaerobic capacity, pulmonary function, hand grip, or back strength.[11] More recently, two studies compared a diet containing meat with a lacto-ovo-vegetarian diet (which includes dairy and eggs) in men completing a strength-training program. One study concluded that meat allowed for larger gains in muscle mass,[12] while the other found both groups had equivalent improvements in muscle strength

and size.[13] To fully understand the effects of a vegetarian diet on performance, more research in this area is needed.[2]

Outside of the performance arena, vegetarian and nonvegetarian exercisers enjoy several health benefits, including lower blood pressure and decreased rates of type 2 diabetes and some cancers. These lifestyle choices also appear to positively impact heart disease and body weight.[2,14]

When taken together, a diet for an athlete and a diet for a vegetarian have some interesting commonalities. While both groups have different nutrients of concern that have been identified, there are a handful that overlap, such as vitamin D, iron, and calcium.[1]

Nutrition Assessment

Dietitians play an important role in helping athletes meet recommended nutrient intakes and ensuring nutritional adequacy while honoring individual dietary practices, including following a primarily or exclusively plant-based diet. The first step to working with such clients is performing a thorough nutrition assessment in order to provide an appropriate individualized nutrition intervention that maximizes an athlete's health and performance.

Types of Vegetarians

An assessment begins by determining what type of vegetarian diet a client follows, and some detailed questions may be necessary to accomplish this, including what particular food groups are included and avoided. The generally accepted definition of a vegetarian is someone who avoids animal tissue proteins such as fish, poultry, and meat,[2,3,5] but there are several common subcategories offering further distinctions, including semivegetarian, pescatarian, flexitarian, lacto-ovo-vegetarian, lacto-vegetarian, ovo-vegetarian, and vegan. While these labels can be interpreted differently among individuals, lacto-ovo-vegetarians generally include dairy and eggs in their diets but no meat, while pescatarians choose fish as their only flesh protein. Flexitarians choose primarily plant-based foods, including meat only occasionally. Lacto-vegetarians include dairy as their only animal-derived food, while ovo-vegetarians include only eggs.[2-4,15,16]

Just as some people eating an omnivorous diet can make considerably different dietary choices from other omnivores, many vegetarians don't fit neatly into one category but instead fall somewhere along a continuum.[2,16,17]

Types of Athletes

Considering the type of athlete also is an important part of the nutrition assessment, as an athlete's priorities for endurance, speed, and strength can differ based on factors such as sport of choice and level of involvement. Nutritionally, for example, a vegetarian diet raises specific concerns about iron for female endurance athletes, and muscle creatine levels for those athletes lifting weights or sprinting.[1,3]

Anthropometrics

Body fat and BMI, including the requisite height and weight information, are valuable pieces of data to obtain during an assessment and likely will be of equal interest to athletes. Body fat can affect strength, agility, and appearance, while weight can influence speed, power, and endurance.[1] Vegetarians often have lower levels of body fat than do omnivores,[10] and while

less body fat can appeal to athletes, minimum healthy limits have been set at 5% for men and 12% for women.[1]

Research consistently shows that vegetarians have lower BMIs than do nonvegetarians, possibly because of their greater intake of high-fiber, low-calorie foods such as vegetables and fruits.[2] Results of the Adventist Health Study-2 showed that nonvegetarians had an adjusted mean BMI of 28.6, while vegetarians had an adjusted mean BMI of 24 despite similar calorie intakes. BMI values were progressively lower for semivegetarians, pescatarians, and lacto-ovo-vegetarians as the degree of animal food avoidance increased.[16]

Athletes often engage in weight reduction efforts to improve performance or appearance or simply to "make weight" before an event.[18] It's essential for RDs to address this topic during an assessment while keeping in mind three key considerations. First, if a vegetarian athlete is losing a significant amount of weight or cites weight loss as the motivation for a vegetarian diet, the possibility of an eating disorder should be explored.[3,19] Second, any recent weight changes should be noted, as this will help establish energy needs.[20] Third, weight-loss efforts should be timed during the off season of the athlete's particular sport when possible.[1]

Lab Tests

While a variety of lab tests may be ordered as part of a standard nutrition assessment, such as vitamin and mineral levels, iron is the chief concern for dietitians working with vegetarian athletes. Monitoring iron status generally is recommended for athletes because of the many factors than can affect it and the important role it plays in athletic performance.[1] Tests commonly used for this purpose include total iron binding capacity, transferrin saturation, hemoglobin concentration, and others.[21]

Iron-deficiency anemia isn't only the most prevalent nutrient deficiency worldwide but also one of the most common among athletes, especially women. In fact, the IOM identifies vegetarians and athletes as populations in need of special considerations with regard to iron.[21]

Supplements

Supplement consumption will affect each athlete's overall nutrient intake and appears to vary by sex as well as the type of sport performed and the level of competition. For example, elite athletes and weightlifters are more likely than other athletes to use dietary supplements.[22]

In one study, among a group of college athletes, 41% took nutritional supplements, which was within the range cited by other studies assessing supplement use among athletes (23% to 94%). The most popular supplements were calcium, protein bars, and multivitamin/minerals.[6] Among nonathletes, vegans report the lowest rate of supplement use compared with other groups.[16]

Though it's been suggested that athletes may have higher micronutrient needs,[7] the position of the American College of Sports Medicine (ACSM) and the Academy of Nutrition and Dietetics (the Academy) is that vitamin and mineral supplements are unnecessary if an athlete meets energy needs and chooses a variety of foods. However, certain individuals may benefit from a specific supplement depending on their particular diet, if they have a documented deficiency, or in accordance with general supplement recommendations, such as folic acid for women of

childbearing age.[1] The Academy also states that for some vegetarians, supplements or fortified foods can help boost intakes of important nutrients.[2]

The use of ergogenic aids is a separate matter that requires caution, since only a limited number provide any athletic advantage and many need more study. Recommended strategies for evaluating these aids' safety and effectiveness include a review of evidence quality, claim validity, and any possible health or legal concerns.[1]

Three widely used ergogenic aids among athletes are protein powders, amino acid supplements, and creatine,[1] though their usefulness is questionable. Supplemental protein is unnecessary if an athlete's vegetarian diet provides enough calories and variety.[2] Protein supplements offer no guarantees of improved performance and aren't more beneficial than whole foods.[1,23] Also, well-controlled studies of individual amino acids show no anabolic benefit.[9]

Creatine is thought to play a role in repetitive high-intensity exercise by affecting energy utilization. Creatine supplementation helps maintain adequate adenosine triphosphate (ATP) levels, which are required for repeated skeletal muscle contractions. Creatine has been studied specifically in those eating meatless diets, since plant foods provide virtually no creatine.[24]

Muscle concentrations of creatine are lower in vegetarians, which could potentially hamper supramaximal (exceeding maximal aerobic capacity) exercise performance.[2,3] Research suggests that those who initially have low intramuscular levels of creatine seem to benefit the most from supplementation,[25] so creatine supplements may benefit some vegetarian athletes with low dietary intake and those participating in short-term, high-intensity exercise and resistance training.[2]

Fluid Intake

A 2% to 3% decrease in body mass caused by water loss may negatively affect athletic performance, and dehydration can be life threatening if not treated. Therefore, it's crucial to assess all athletes' fluid consumption habits, with specific questions about the timing and amount.[1]

Nutrition Diagnosis

As the next step in the nutrition counseling process, it makes sense to identify any significant medical history, especially those diagnoses that nutrition can impact. However, although injuries may be common in this population, athletes likely are fairly healthy, so the list of their current medical complaints may be limited.[14] Regardless, RDs should pay special attention to nutrition-related concerns, especially iron-deficiency anemia and the female athlete triad.

Iron-Deficiency Anemia

Reduced capacity for physical work and impaired cognitive function are the symptoms of iron-deficiency anemia that especially are important to athletes.[21] The condition also can directly affect endurance.[3] Though low iron stores are common among females, the prevalence of true deficiency is comparable in both athletes and nonathletes.[1]

There are several potential causes of iron-deficiency anemia: low iron intake or poor bioavailability (due to inhibitors such as phytates); increased needs during a period of rapid

growth or during high-altitude training; increased iron loss in sweat, feces, urine, or menstrual blood; or increased iron loss from hemolysis, injury, or gastrointestinal bleeding.[1,3] Iron-deficiency anemia diagnoses aren't common for vegetarians, but their iron stores often are lower than those of nonvegetarians.[2,3]

Female Athlete Triad

The three components of the female athlete triad, amenorrhea, osteoporosis, and eating disorders, have been examined in athletes in general and in vegetarians in particular. Though it depends on the field of athletics, if low body weight or body fat is valued, the risk of developing the female athlete triad may be increased.[3,26]

The prevalence of amenorrhea varies but has been estimated to occur in more than 60% of long-distance runners and dancers.[26] The research examining whether vegetarian athletes experience amenorrhea more often than their nonvegetarian counterparts is inconsistent.[2]

For lean female athletes, intensive training sessions can affect hormone levels, potentially leading to reduced bone mineral density.[9] Osteoporosis can be caused by loss of bone mineral density in adulthood but also by failing to build up adequate bone mineral density early in life. Involvement in some type of weight-bearing exercise actually serves to improve bone mineral density in athletes.[26]

Diet influences bone health as well. There doesn't appear to be significant differences in bone mineral density when comparing omnivores with lacto-ovo-vegetarians, though initial research suggests that the same can't be said for vegans.[2] A lower calcium intake, possibly due to avoiding dairy products, may be responsible for vegans' higher rate of fracture, but likely there are other influences as well. Lacto-ovo-vegetarians have a higher ratio of dietary calcium to protein compared with vegans, which may predict bone health more effectively than just calcium intake.[2]

When assessing athletes, several red flags may indicate a possible risk of disordered eating, such as starting sport-specific training and dieting at an early age or exhibiting a sudden increase in training frequency and duration.[26] Research is mixed concerning whether vegetarians are at higher risk of eating disorders.

While rare, there are situations where someone with disordered eating chooses to be a vegetarian, possibly as a socially acceptable way to restrict eating or lose weight.[3,15] While people may cite vegetarianism as the reason for not eating certain foods or not eating at certain events to avoid arousing suspicion, it may be masking more serious eating issues, such as anorexia.[19] However, this correlation doesn't directly identify a vegetarian diet as a cause of an eating disorder. In fact, a majority of women noted that their vegetarian diets started after their first eating disorder symptoms arose, suggesting that this type of dietary pattern may conveniently allow for continued reliance on eating disordered behaviors in public vs causing them in the first place.[19]

Nutrition Intervention

Once RDs have completed an athlete's nutritional assessment and addressed any possible health concerns, they then can move forward with nutritional intervention in the following areas:

Energy

If RDs first determine an athlete's energy needs, they then can address dietary macronutrient composition. Calorie needs for an individual athlete will depend on the type, duration, frequency, and intensity of the exercise along with sex, age, body size, and body composition.[1] For example, a summary of 16 studies showed elite female athletes had an overall calorie range of 1,381 to 4,149, with gymnasts consuming lower amounts of calories and triathletes consuming higher amounts.[7]

Athletes don't want to lose lean tissue to meet calorie needs. Most work long and hard to gain strength and endurance, which low energy intake can compromise.[1] Additionally, micronutrient intake likely will suffer, especially with a diet of fewer than 1,500 kcals.[1,7] Not surprisingly, sufficient energy intake also is considered key for an adequate vegetarian diet.[2]

There are several ways to determine athletes' energy needs, including using the Dietary Guidelines estimated calorie needs for active individuals or calculating estimated energy requirements using formulas from the Dietary Reference Intakes (DRIs).[1] Ideally, helping clients consume appropriate amounts of energy will allow them to achieve or maintain their desired healthy weight. Once an energy intake value has been established, dietitians can address needs for protein and carbohydrate followed by fat.[20,22]

It's been suggested that the acceptable macronutrient distribution ranges for all athletes, vegetarian or not, are 45% to 65% of calories from carbohydrate, 20% to 35% from fat, and 10% to 35% from protein.[27] However, specific variations that contain more carbohydrate for endurance athletes and more protein for strength athletes have been proposed.[28]

Because athletes often eat more calories than do nonathletes, even those with a low percentage of their calories coming from protein are consuming sufficient amounts of protein. This means vegetarian diets with only 11% protein and vegan diets with 13% can meet protein targets for athletes.[3,4] In practice, some sports nutritionists use g/kg of body weight guidelines rather than percentages to estimate macronutrient needs.

Protein

According to the Institute of Medicine (IOM), by consuming a variety of foods, vegetarians can obtain enough dietary protein, and as long as they choose complementary proteins, their recommended intake is no different than that of omnivores. Similarly, the IOM noted that protein intake above the Recommended Dietary Allowance (RDA) isn't necessary for endurance or resistance activity, essentially indicating that there's no need to recommend higher protein intakes for either vegetarians or athletes.[29]

However, there are differing opinions on this topic. It has been argued that the RDA of 0.8 g/kg is the minimum to prevent deficiency, and nitrogen balance studies have identified needs above this for most types of athletes.[4,28] The joint ACSM and Academy position recommends consuming 1.2 to 1.7 g/kg of protein for strength athletes and 1.2 to 1.4 g/kg for endurance athletes.[1] Regardless of the current status of the science, reports show bodybuilders and strength and power athletes typically eat 2 to 3 g/kg.[28]

Similarly, there are researchers and professional groups that recommend protein targets for vegetarians slightly above the RDA.[2,20,30] Because of concerns about the protein digestibility of

some plant foods, vegetarians choosing mostly or exclusively nonanimal proteins should add 12 g/day of protein or aim for 1 g/kg.[30] This would typically apply to vegans who get their protein exclusively from nuts, seeds, legumes, grains, and vegetables as opposed to lacto-ovo-vegetarians who get some from dairy and eggs.

Determining protein needs for vegetarian athletes requires consideration of requirements for both athletes and vegetarians. Generally, vegetarian athletes consume enough protein, even though it's less than the amount consumed by nonvegetarians. As long as variety and adequate calories are priorities, the protein quality of vegetarian diets is acceptable, and paying close attention to protein combining at each meal isn't required.[1,2] This suggests that both plant and animal foods can provide athletes with the protein they need for training and performance.[3] However, because of the digestibility issues, vegetarian athletes should aim for 1.3 to 1.8 g/kg of protein, which is 10% higher overall.[1]

Notably, there's no Tolerable Upper Intake Level for total protein or any amino acid.[29] As is often the case, moderation is important, as protein intakes both too high and too low seem to compromise bone health.[2] However, when healthy and active people consume protein in the range of 1.4 to 2 g/kg/day in an overall healthy diet, the kidneys and bones aren't negatively affected.[31]

Carbohydrate

An emphasis on dietary protein may be one reason some athletes don't meet carbohydrate targets.[9] It can be argued that both protein and carbohydrate goals are equally important since carbohydrate needs must be met to spare protein. This frees amino acids for protein synthesis instead of being oxidized to meet calorie needs.[1]

The 45% to 65% Acceptable Macronutrient Distribution Range for carbohydrate is a good place to start, with some researchers recommending the upper end of the range.[20,22,27] Steps can be taken to create a more specific target amount based on the athlete's sex, type of exercise, and level of activity.

It's important to note that gram estimations derived from these percentages may prove too low if overall energy intake is low,[1] so using grams of carbohydrate per kilogram of body weight can create a more personalized recommendation. Women and less active athletes can use 6 to 7 g/kg, while men and more active women should aim for 8 to 10 g/kg.[32]

When intensively training, athletes may need 500 to 600 g/day of carbohydrate to successfully restore glycogen,[22] but female heptathletes with less focus on endurance average 339 g, with a range of 202 to 624 g/day.[7] Even lifting weights uses muscle glycogen, so carbohydrate is important for resistance exercise as well.[28]

Daily choices should focus on carbohydrate-rich food groups to meet the athletes' increased calorie needs,[1] which also can be accomplished by choosing more plant foods and fewer animal foods.[10] Fortunately, most vegetarian diets naturally offer a higher percentage of calories from carbohydrate, which may provide endurance benefits.[3,16]

Fat

Determining optimal fat intake also is important for vegetarian athletes, with special attention given to essential fatty acids. When setting goals for athletes, the Acceptable Macronutrient

Distribution Range is the suggested target. Less than 20% of calories from fat isn't recommended, and more than 70% doesn't appear to offer any performance gains.[1] A survey of different types of athletes found an average fat intake of 36%, ranging from 20% to more than 50%.[10] Mean intakes for nonathletes ranged from 28.2% in vegans to 33.8% in nonvegetarians.[16]

Overall fat intake recommendations for vegetarian athletes don't require much modification unless their slight increase in protein needs leave fewer calories available for fat. It's also possible that higher fat levels may benefit female vegetarian athletes.[2]

With regard to the composition of these fat calories, the recommendation for vegetarian athletes is first to focus on monounsaturated and omega-3 fats then polyunsaturated followed by saturated and trans fats.[32] Generally, vegetarian diets are lower in saturated fat, with the intakes lowest among vegans.[2,16]

Diets that are very low in fat or based only on plant sources of protein may pose a risk of essential fatty acid deficiency.[1] Additionally, for those who follow diets excluding eggs or fish, intake of the omega-3 fats DHA and EPA can be minimal, and the conversion of the plant-based alpha-linoleic acid (ALA) to EPA generally is low. This means some vegetarians may need more than the DRI of ALA, which can be found in soy, canola oil, flaxseed, walnuts, and microalgae.[2]

Vitamins

Healthy bones and muscles and a well-functioning immune system are priorities for athletes, so in addition to macronutrient intake, micronutrients deserve attention.[1] It's unclear whether athletes need more vitamins than the general population, but some evidence suggests that vitamins and minerals are lost through sweat and urine as a result of exercise.[7] However, currently, an athlete's goal for all the micronutrients is at least the RDA.[1] (Visit our website for a summary/practice sheet of vitamin and mineral recommendations.)

A detailed diet history can give clues to the athlete's vitamin status. Specifically, female athletes' diets often are low in folate, riboflavin, and vitamins B6 and B_{12}.[1] Because of the limited nature of the vegan diet, dietitians may need to more closely assess the vitamin intake of vegan athletes. Vegans need to take a B_{12} supplement or consume B_{12}-fortified foods.[2] Therefore, vegan athletes should be encouraged to identify a regular source of this vitamin.[3,4,32]

Some vegetarians have lower vitamin D intakes than do nonvegetarians, and low serum vitamin D levels and low bone mass have been reported for some vegans who don't have a reliable source of the vitamin. Supplements are recommended for anyone for whom sunlight exposure and fortified foods don't meet needs, such as athletes who predominantly train indoors.[1,2]

The antioxidant vitamins C, E, and beta-carotene also may be of particular interest to vegetarian athletes. They aren't proven to offer a performance advantage, although it's hypothesized they could mediate exercise-induced oxidative stress when consistently provided in the diet by food (instead of supplements).[1,3,4,22] Vegetarians consume more antioxidant

vitamins, with vegans having the highest intakes, and this is reflected in higher serum values compared with omnivores.[3,16]

Minerals

Like vitamins, there are several minerals to focus on when working with vegetarian athletes, especially considering how the phytate in plant foods can negatively affect iron and zinc absorption.[8,21,33] In addition, some vegetarians have lower calcium intakes, particularly vegans.[2,16] These same key minerals also can be low in an athlete's diet, especially women.[1]

Both vegetarians and athletes have been identified as having higher-than-average iron needs.[1,21] For vegetarians, plant foods, dairy, and eggs provide the less bioavailable nonheme iron rather than the highly bioavailable heme iron found in meat. Because of this difference, the target for iron is 1.8 times higher for vegetarians than for nonvegetarians.[21] Specifically, female vegetarian athletes should consider including generous amounts of iron in their diets for the most benefit.[2]

Similarly, people who participate in routine, intense physical activity are estimated to have iron needs that are 30% to 70% higher than those who don't, especially women.[21] To account for this, it may be necessary to further increase iron goals for certain vegetarian athletes.[20]

Athletes appear to be at risk of zinc deficiency, especially women.[1] And although there's significant individual variation, some vegetarians meet recommendations and others fall short.[2] Depending on an individual's food choices and considering the effects of phytate, there's general agreement that vegetarians' goal for zinc intake should be higher than the RDA.4,20,33 The IOM notes that vegetarians, especially vegans, may need as much as 50% to 100% more zinc than nonvegetarians.[33]

Calcium also has significance for vegetarians and athletes. While it appears that lacto-ovo-vegetarians and nonvegetarians have comparable calcium intakes, vegans often fall short of recommendations, so fortified foods and supplements may be sensible choices for them.[2,34] The Academy's recommendations urge female vegetarian athletes to strive for liberal amounts of calcium in their diets.[2]

If both calcium and vitamin D intakes are low, bone health is at risk, which is especially concerning for athletes because of the risk of stress fracture.[1,26] Despite being nutrients of concern, a recent study showed vegans in the general population had intakes of vitamins B_{12} and D, calcium, iron, and zinc that met recommendations.[16]

When assessing an athlete's overall micronutrient status, it's best to confirm that his or her intake of a particular nutrient from diet, supplements, and fortified foods doesn't exceed upper intake levels. In addition, dietitians should ensure the ingredients and substances used in processing any recommended supplements are vegetarian or vegan.[35]

Timing of Foods and Fluids

Once the overall nutrition strategy is established, further detail can be added to best meet an athlete's needs regarding meal spacing. Some specific guidelines have been suggested for meals and snacks before, during, and after exercise to optimize performance, and these apply to all athletes.[1]

Preexercise nourishment should provide enough fluid for hydration. Generally, this can be achieved with 5 to 7 mL/kg body weight four hours before exercise. Often, a liquid meal can be beneficial for some athletes, especially if it eases digestion or minimizes gastrointestinal distress. Familiar foods that are low in fat and fiber, high in carbohydrate, and moderate in protein are best,[1] such as a smoothie with orange juice, a banana, low-fat yogurt, and a small amount of flaxseeds.[35]

During exercise, the main goal is to replace lost carbohydrate and fluid, which will vary among individual athletes. A guideline for carbohydrate is 30 to 60 g/hour given in small doses of approximately 10 to 20 g each.[1] Vegetarian-friendly foods with at least 30 g of carbohydrate per serving include dried fruit, bagels, and some sports bars.[35]

Postexercise meals should replace losses and aid recovery by meeting needs for carbohydrate, fluid, electrolytes, and energy,[1] with consideration given to protein synthesis as well.[22] To address glycogen depletion, consuming 1 to 1.5 g/kg of carbohydrate during the first 30 minutes after exercise is recommended, repeating every two hours for four to six hours as needed.[1] Results are mixed on whether adding protein to this postexercise meal or snack would further enhance glycogen storage,[9] but it can be helpful for building and repairing muscle.[1,23,28]

A protein goal in the recovery period would be 20 to 25 g.[28] Sweat rates vary widely depending on environmental conditions and the individual athlete, so weighing before and after exercise can help individualize fluid needs. In general, replacing 16 to 24 oz of fluid for every pound lost during exercise is adequate, and electrolytes can be replaced with usual food and beverages.[1]

Individualization

Many people describe themselves as vegetarians, but there's significant variation within this group.[3] For example, just because two clients are vegan doesn't mean they're eating the same vegan diet. While keeping in mind the distinctive needs of vegetarian athletes as a group, the most significant task for dietitians is employing an individualized approach with each client.[1,2,20,22]

For instance, both age and sex can dramatically affect nutrient needs and probable shortfalls.[1,3,20,21,36] Athletes also have unique characteristics that will shape the nutrition intervention, including their chosen sport, training and competition schedules, and travel requirements as well as their own dietary style, including vegetarian.[2,7,17,18,22,37] Additionally, athletes likely will have constraints regarding time, money, and varying degrees of cooking ability.[37]

It's possible that adherence to dietary regimens would improve for some athletes if they felt someone understood their particular stressors and demands. A knowledgeable RD who can help navigate the unique performance and nutrition challenges faced by athletes with compassionate support and problem solving could improve a client's stress level. The result may be better compliance with the dietary guidance being offered.[18]

Nutrition Monitoring and Evaluation

Following the nutrition intervention, RDs must monitor and evaluate clients' treatment plans. Tracking body weight can determine whether energy needs have been estimated correctly,

and lab tests would indicate any change in iron status.[3,20,21] A review of food records can provide information on nutrient intake.[20] During this time, the athletes should report to the RD about energy level, menstruation, injuries, and overall performance.[1]

The following are some general nutrition management goals for RDs when monitoring vegetarian athletes. There may be additional considerations depending on the individual client.[1,2,4,6,10,20,22,26,28,32,38,39]

• nutritional adequacy and correction of nutrient deficiencies, including energy, protein, carbohydrate, and fat (especially omega-3 fat), vitamins, and minerals (especially B_{12}, D, calcium, zinc, and iron);

• balance and variety of daily food choices;

• achievement and maintenance of desired BMI and body fat using health-promoting strategies;

• maximal immune function and minimal illnesses;

• optimal healing of wounds and injuries;

• safe and effective use of supplements and ergogenic aids;

• identification of clinical indicators of the female athlete triad: prevention and treatment of amenorrhea, maximal bone mineral density, and referral as needed to a mental health practitioner for eating disorders; and

• enhancement of athletic training and performance, including adequate energy supply for muscles and tissues, maximal stored glycogen to prevent fatigue or exhaustion, maximal glycogen synthesis and protein synthesis during the recovery period, maintenance of blood glucose concentration during exercise, adequate hydration, and optimal timing and composition of foods and fluids.

Nutrition assessment and intervention make sense for vegetarian athletes,[1] especially considering that education ultimately can impact health and performance. Tailoring a meal plan to meet a vegetarian athlete's specific nutrition needs can enhance training and recovery while ensuring a health-promoting diet. An RD familiar with sports nutrition* can encourage a client to set realistic weight goals, optimize fluid intake, and make safe supplement choices.[1] This individualized education can help achieve the ultimate goal: Athletes tend to make better food choices when they're equipped with more nutrition knowledge.[39]

**There are two useful resources for nutrition professionals interested in learning more about this topic. The Academy publishes a Sports Nutrition Care Manual that includes detailed guidelines for working with vegetarian athletes. And, the Commission on Dietetic Registration offers a Board Certification as a Specialist in Sports Dietetics (CSSD).*

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Click here for Practice Sheet: Vitamin and Mineral Summary for Vegetarian Athletes.

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Examination

1. Because of concerns about reduced bioavailability, increased needs, and increased losses, the status of which mineral should be monitored in vegetarian athletes, especially women?
A. Beta-carotene
B. Calcium
C. Iron
D. Potassium

2. Lily is an aspiring Olympic gymnast who began training in grade school. To prepare for an upcoming national competition, she recently increased the number of hours she spends in the gym each week. She's finding it hard to make time for multiple meals and snacks, so sometimes she skips them. Her body weight and body fat have dropped somewhat, which she's happy about, and she mentioned that she hasn't menstruated for a couple of months. Further investigation is needed to rule out which of the following?
A. Dehydration
B. Female athlete triad
C. Vitamin B_{12} deficiency
D. Zinc deficiency

3. Greta is a soccer player and recently has become a vegan. She's heard from friends that there are certain nutrients she needs to pay attention to on her new diet. Which of the following micronutrients (vitamins) should you recommend that she get from fortified foods or supplements?
A. B_{12}
B. C
C. E
D. K

4. As part of Dave's diet history, he describes a typical breakfast as being spinach and Parmesan quiche, fresh fruit, and whole wheat toast with butter. Which type of vegetarian diet is he most likely following?
A. Vegan
B. Lacto-vegetarian
C. Ovo-vegetarian
D. Lacto-ovo-vegetarian

5. What factor must be considered when determining the correct amount of fluid to replace after exercise?
A. Exercise intensity
B. Exercise duration
C. Temperature and humidity
D. Change in weight during event

6. Andrew is playing college basketball and concerned about fatigue on the court. He wants to be sure his diet is meeting his carbohydrate needs. What guideline could you use to estimate his total daily carbohydrate requirement?
A. 2 to 4 g/kg of body weight
B. 4 to 6 g/kg of body weight
C. 6 to 8 g/kg of body weight
D. 8 to 10 g/kg of body weight

7. Meredith, a vegetarian, has been the star of the ice hockey team for four years. She's on the ice several days each week for practice and games, and the rest of her time outside of school is spent in the gym or running laps around the indoor track. Based on this information, you should assess her need for a supplement of which micronutrient?
A. Calcium
B. Vitamin C
C. Vitamin D
D. Vitamin E

8. Kyle and Robin are married and compete together on a coed rowing team. Robin is a pescatarian, and Kyle is a vegan. Which nutrients are Robin likely getting enough of that Kyle may be lacking?
A. Antioxidant vitamins
B. Essential fatty acids
C. High–glycemic-index carbohydrates
D. Complex carbohydrates

9. In addition to containing adequate fluid, what's the optimal composition of a preexercise meal or snack?
A. Low fat, low fiber, high carbohydrate, moderate protein
B. Low fat, low fiber, low carbohydrate, low protein
C. Moderate fat, high fiber, high carbohydrate, high protein
D. Low fat, high fiber, high carbohydrate, high protein

10. Doug is a vegetarian training for his first marathon. He knows protein is important, but isn't sure how much he really needs. What target would you recommend to him for his daily protein intake?
A. 0.8 g/kg
B. 1.3 to 1.5 g/kg
C. 1.8 to 2.0 g/kg
D. 2.0 to 3.0 g/kg