



## Special Concerns for Vegetarian Athletes

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What is your main motivation for restricting intake of animal foods? Is it for ethical or religious reasons? Are you concerned about your health? Are you looking to boost performance? While vegetarian diets have a multitude of benefits, many athletes within the endurance sports arena are simply using plant-based diets as means to control food intake and consequent weight. Unfortunately, severe food restriction will create a major barrier to peak performance and optimal health. Find out why.

The prevalence of vegetarian lifestyles has increased, with some 12.4 million Americans practicing some form of vegetarianism as means to decrease risk for chronic disease and improve overall health.<sup>1</sup> Recently, it was concluded that by replacing high-fat meats with plant foods, one's risk for heart disease may decrease by as much as 25%.<sup>2</sup> There are also an increasing number of athletes engaging in vegetarian eating patterns as means to boost performance. Almost a century ago, Professor Irving Fisher of Yale discovered that plant-eating athletes had twice the stamina and strength of their meat-eating counterparts. While some engage in vegetarian lifestyles for health and performance reasons, there is increasing concern that many endurance athletes may be using vegetarianism as means to restrict their food intake, one warning sign of disordered eating. Severe food restriction and a lack of knowledge about proper vegetarian nutrition can lead to nutritional deficiencies and a consequent decline in athletic performance and overall health. This article examines the risks of an un-balanced vegetarian diet and gives hints on how to correct the imbalance, ultimately helping to boost health and endurance performance.

### Risks of an Un-Balanced Vegetarian Diet

Eating a well-balanced diet containing adequate amounts of calories, protein, vitamins, and minerals is critical for optimal health and peak performance. Several athletes are challenged to obtain these key nutrients due to incorporation of a vegetarian lifestyle, which restricts the intake of animal foods. While most athletes do not eliminate all meat from their diet, increasing numbers are eliminating red meat, thereby adapting a semi-vegetarian lifestyle. Others, however, restrict their intake of animal foods further by eliminating all meat products, including poultry and fish (lacto-ovo-vegetarian), eliminating just meat and dairy (ovo-vegetarian) or eliminating just meat and eggs (lacto-vegetarian). The most extreme vegetarian is the vegan, who eliminates all animal products, including meat, dairy, and eggs. Athletes who merely restrict intake of animal foods as means to control weight or those who simply lack the knowledge are at high risk for unfavorable changes in metabolic

efficiency, altered hormonal status, diminished bone health, and nutritional deficiencies, all of which can severely inhibit peak performance.

**Risk #1: Unfavorable Changes in Metabolic Efficiency**

Endurance athletes expend extraordinary amounts of energy during training and competition. In fact, it has been estimated that endurance athletes require anywhere from 16-30 calories per pound of body weight to meet the high demands of endurance training. Energy needs in vegetarian athletes may be even higher, as resting energy expenditure has been shown to be ~11% higher in vegetarians compared to non-vegetarians.<sup>3</sup> Because vegetarians eat lots of high-fiber low-fat foods (whole grains, fruit, vegetables), it is not uncommon to discover inadequate energy intakes in vegetarian endurance athletes, especially those expending greater than 1,000 calories per day.<sup>4</sup> When energy expenditure exceeds intake by over 1,000 calories, there is significant catabolism of lean body mass, leading to a drop in metabolic efficiency as well as endurance performance.<sup>5</sup> For those vegetarian athletes who have trouble keeping weight on, it is recommended to eat 6 or more medium-sized meals/snacks containing such energy dense plant foods as nuts, avocado, dried fruit, and dairy products. Table 1 exemplifies a sample 3,000 calorie meal plan that includes 6 meals spaced throughout the day.

**Table 1. Sample 3,000 Calorie Vegetarian Meal Plan**

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<b>Breakfast</b>	<ul style="list-style-type: none"><li>• 1 cup raisin bran</li><li>• 1 cup nonfat milk</li><li>• 2 slices multi-grain toast</li><li>• 2 tsp soy margarine</li><li>• 8 ounces orange juice</li></ul>
<b>Snack</b>	<ul style="list-style-type: none"><li>• Banana</li> <li>• 2 small oatmeal cookies</li></ul>
<b>Lunch</b>	<ul style="list-style-type: none"><li>• Whole wheat pita stuffed with shredded spinach, sliced tomato, 2 ounces feta cheese, 2 tsp olive oil</li><li>• 1 large apple</li></ul>
<b>Snack</b>	<ul style="list-style-type: none"><li>• Whole grain bagel</li><li>• 1 T peanut butter</li><li>• 1 T all-fruit jelly</li></ul>
<b>Dinner</b>	<ul style="list-style-type: none"><li>• 3 ounces pasta with lentil spaghetti sauce (1-1/2 cups cooked lentils, ½ onion, 1-1/2 canned tomatoes, 1 T olive oil) and 1 Tbsp parmesan cheese</li><li>• 2 small slices Italian bread dipped in 1 T olive oil and 1 T parmesan cheese</li><li>• 1 cup steamed broccoli</li></ul>
<b>Snack</b>	<ul style="list-style-type: none"><li>• 1 cup low-fat yogurt</li></ul>

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## **Risk #2: Nutritional Deficiencies**

### **Protein**

Protein is perhaps the most recognized nutrient of concern in vegetarians due to the incomplete nature and reduced digestibility of most plant sources of protein. With the exception of soybeans, milk, and egg whites, other vegetarian based foods lack all the essential amino acids necessary for maximal tissue growth and repair. Most vegetarian based foods need to be combined to attain all the essential amino acids; for example, tortillas and beans, rice and lentils, peanuts and wheat bread. Endurance athletes require 0.55 to 0.75 grams of protein per pound of body weight, which is approximately 150%-200% the US RDA for protein intake. Additional amounts of protein are needed to replace the loss of amino acids during exercise and to help repair exercise-induced muscle damage that occurs during weight-bearing activity such as running. The World Health Organization suggests that vegetarian endurance athletes consume 110% of their calculated protein requirement because of the reduced protein digestibility of plant foods, which is attributable to the high fiber content of the diet.<sup>6</sup> Vegetarian diets providing adequate energy and a variety of protein-containing plant foods (see table 2) will supply all the essential amino acids needed for efficient protein metabolism, thereby enhancing recovery from exercise and helping to prevent muscular injury.

### **Calcium**

Calcium becomes an especially vulnerable nutrient for vegetarians who do not consume dairy products. A chronic low calcium intake, especially when combined with an inadequate energy intake, is associated with decreased bone mineral density, leading to elevated risk for bone fracture.<sup>7</sup> Furthermore, a calcium deficiency may lead to severe cramping during endurance exercise as calcium plays a critical role in normal muscle function. Recommended intake of calcium ranges from 1,000 mg to 1,500 mg depending on the individual. Good non-dairy sources of calcium include calcium-fortified foods, calcium-processed tofu (4 ounces = 145 mg), almonds (1 ounce = 332 mg), legumes (1 cup = 90 mg), and collard greens (1/2 cup = 179 mg). Refer to table 2 for calcium content in other vegetarian food sources.

### **Vitamin B12**

Vitamin B12, which is present naturally in only animal products, is essential for maintaining healthy red blood cells and nerve fibers. Vegetarians who restrict energy intake may be at elevated risk for a deficiency, leading to premature fatigue during exercise and potential nerve damage. Fortunately, the US RDA (2.4 mcg) for Vitamin B12 is very small and quite easy to attain in such fortified plant sources as soy milk, soy burgers, nutritional yeast, and certain breakfast cereals (such as Total or Product 19).

### **Iron**

Iron, a trace mineral, is a major component of the body's red blood cells or hemoglobin, whose role is to carry oxygen to various body tissues, including muscle, for use during aerobic activity. A blood deficiency in iron may lead to premature fatigue during exercise due to lack of oxygen transport to working muscles. While iron is found extensively in several plant foods, the absorption is reduced by 20% as compared to the iron found in animal products.<sup>8</sup> Therefore, the risk for iron deficiency is increased in vegetarian athletes even if total iron intake meets the US RDA of 10-15 mg. Check out

table 2 for vegetarian sources of iron. For added absorption of vegetarian iron sources, consume with foods rich in vitamin C (such as orange juice).

### **Zinc**

Along with iron, a zinc deficiency tops the list of the most common dietary deficiencies among vegetarian athletes, perhaps due to urinary and sweat losses during heavy training and/or the fact that plant sources of zinc (such as legumes, whole grains, wheat germ, fortified cereals, nuts, tofu, and miso) are not absorbed as efficiently as animal sources of zinc.<sup>8,9</sup> A study of female distance runners discovered that 50% fell below the recommended daily intake for zinc (12 mg/day), which may lead to an altered zinc status.<sup>10</sup> An altered zinc status will compromise immune function as well as basal metabolic rate and thyroid hormone levels, which can have a major impact on endurance performance and health.<sup>11</sup> Fortunately, a recent study from the US Department of Agriculture found that zinc status can be maintained within normal limits with a vegetarian (lacto-ovo) diet that includes such zinc-rich foods as beans, milk, yogurt, tofu, and peanut butter.<sup>12</sup> Refer to table 2 for zinc content in various vegetarian food sources.

### **Risk #3: Altered Hormonal Status**

There has been some concern that vegetarian athletes are at increased risk for altered hormonal status, especially with the sex hormones estrogen and testosterone.<sup>13</sup> In a study of 8 male endurance athletes, engagement in a lacto-ovo-vegetarian diet over a period of 6-weeks caused a slight decrease in total testosterone levels.<sup>14</sup> Similarly, female vegetarian athletes have reported lower circulating estrogen levels as compared to their meat-eating counterparts.<sup>15</sup> However, it is unclear whether hormonal function diminishes as a result of the food composition in a vegetarian diet or simply a reduction of total energy intake.

Some studies have found that plant-based diets, with their high fiber content, report greater loss of sex hormones in feces as compared to non-vegetarian diets.<sup>14,16</sup> Vegetarians also tend to have lower intakes of protein<sup>17</sup>, fat<sup>13</sup>, and zinc<sup>18</sup> as compared to omnivores. More recent research suggests that the cessation of hormonal function is merely an energy conserving adaptation to an energy-deficit profile, which can be caused by reduced energy intake or by an extremely high energy expenditure from chronic intense exercise, or by a combination of the two.<sup>19,20,21</sup> Regardless of the cause, altered hormonal status can lead to serious health and fitness implications. Symptoms of altered hormonal status include fatigue, weight loss, frequent infections, decreased physical performance, diminished bone health, and increased injury. In order to maintain normal hormonal status, vegetarians should follow a well-balanced diet that meets individual energy needs.

### **Risk #4: Diminished Bone Health**

Although the prevalence of osteoporosis, a.k.a. “brittle bones”, has not established among the athletic population, scientists believe that vegetarian endurance athletes may be at elevated risk due to energy imbalances, low calcium intake, and hormonal aberrations. In fact, over a period of just one year, an athlete with restrictive eating patterns (often the case with vegetarians) may develop osteopenia, increasing the risk for stress fractures 8-fold.<sup>22,23</sup> Generally consistent with a low energy intake is low dietary calcium intake, especially in athletes who do not consume dairy. Dietary restriction of calcium over a mere 9-week period of time has been shown to elevate the rate of bone turnover and consequent loss of bone mass, also leading to increased risk for stress fractures.<sup>24</sup> Related to energy imbalances are hormonal imbalances, which tend to double the risk for stress fractures in athletes.<sup>7,25</sup> In order to prevent loss of bone mass and consequent stress fracture,

vegetarian endurance athletes are encouraged to consume a energy-sufficient diet that includes a variety of calcium-rich foods.

### **Reaping the Benefits of a Vegetarian Diet**

As the popularity of plant-based diets increase within the athletic arena, the risk for poorly planned diets and consequent nutritional deficiencies also increases. A negative energy imbalance not only compromises metabolic efficiency, but also seems to negatively affect hormonal status, bone health, and nutritional intake of protein, calcium, vitamin B-12, iron, and zinc. Sub sufficient intakes of these nutrients will have a profound negative effect on health and endurance performance. However, an athlete can reap many benefits, both performance-based and health-based, from a balanced vegetarian diet. The following tips will help guide your way towards a healthy vegetarian lifestyle:

- Achieve energy balance by consuming enough calories to meet training demands. The average endurance athlete requires anywhere from 16-30 calories per pound of body weight to meet the high demands of endurance training; vegetarian endurance athletes may need about 10% more. To meet the high demands of endurance training, vegetarian athletes are recommended to eat 6 or more medium-sized meals/snacks containing such energy dense plant foods as nuts, avocado, dried fruit, and dairy products.
- Keep in touch with your hormones. Despite popular belief, absence of hormones does not mean that training is going well. Listen to your body. If you are feeling tired, training is not going well, and illness becomes a commonality, your hormones may be out of whack. Try reducing your training load and/or adding more energy-dense foods to your daily meal plan to see if normal hormone function returns.
- Include a variety of protein-containing plant foods throughout the day. The average endurance athlete requires about 0.55 to 0.75 grams of daily protein per pound of body weight to allow for efficient tissue growth and repair. Note that vegetarian endurance athletes may need 110% this amount due to the reduced digestibility of plant foods.
- Don't skimp on bone-building nutrients. Vegetarians should include 3-4 servings of dairy (i.e., 1-cup low-fat milk or yogurt) to fulfill daily calcium needs. Vegans should include such calcium fortified products as soy milk and soy yogurts in their daily diets.
- Pump up the iron. Recommended daily allowances of iron can be fulfilled on one day by consuming ½ cup firm tofu and ½ cup lentils. Plant sources of iron are absorbed better when taken with vitamin C.
- B-12 Shots. While additional amounts of B-12 will not enhance oxygenation of blood, B-12 is essential for maximal energy and normal nervous system function. Good vegetarian sources include fortified soymilks, meat analogs, and breakfast cereals.
- Zinc up. Help keep the bugs away: Consume a well-balanced vegetarian diet that includes lentils, beans, whole grains, nuts, and soy.

### **Table 2. Nutrient Content of Selected Vegetarian Protein Foods**

Food	Kcal	Pro (gm)	Fat (gm)	Cal. (mg)	Iron (mg)	Zinc (mg)
<b>Legumes:</b>						
Black Beans, 1 cup	227	15	1	46	3.6	1.9
Chickpeas, 1 cup	270	14.5	4	80	4.7	2.5
Kidney beans, 1 cup	225	15	1	50	5.2	1.9
Lentils, 1 cup	230	18	1	38	6.6	2.5
Pinto beans, 1 cup	234	14	1	90	4.5	1.9
Tempeh, 1 cup	165	16	6	85	1.9	1.5
Tofu, firm, 1 cup	183	20	11	258	13	1
Tofu, soft, 1 cup	94	10	6	130	6	2
<b>Vegetarian Patties:</b>						
Advantage/10 Southwestern	140	8	1	40	4.2	-
Amy's Organic Vegetables, Texas	130	12	2.5	40	1.8	-
Boca Burger, Vegan Original	84	12	0	50	1.4	-
Gardenburger, Original	130	8	3	80	-	-
Gardenburger, Classic Greek	120	6	3	80	1.1	-
Gardenburger, Hamburger Style	110	16	2.5	100	1.8	-
Gardenburger, Vegan	140	11	0	20	0.7	-
Lightlife, BBQ Grilles	120	10	3.5	20	1.8	-
Lightlife, Tamari Grilles	120	11	5	40	1.8	-
Morningstar Grillers	140	14	6	40	1.4	-
Morningstar Garden Veggie Patty	100	10	2.5	40	0.7	-
Veggie Patch Chick'n Veggie Cutlets	130	10	4	40	1.0	-
Yves Veggie Chick'n Burger	120	17	3	80	2.0	-
<b>Protein Crumbles:</b>						
Lightlife Smart Ground Original, 1/3 cup	70	12	0	60	0.8	-
Marjon Tofu Crumbles, 2.5 oz.	55	6	3	60	1.6	-
Morningstar Protein Granules, 3 T	70	10	1	40	1.8	4.5
Morningstar Crumbles, 2/3 cup	90	10	3	1.5	-	-
Veggie Patch Veggittinos Meatballs, 5	130	14	3.5	60	1.5	-
Yves Veggie Ground Round, 1/3 cup	60	10	0	40	1.5	2.4
<b>Meatless Slices:</b>						
Lightlife, Turkey Style, 3 slices	40	9	0	20	2.7	-
Lightlife, Country Ham Style, 3 slices	50	10	0	0	5.4	-
Veggie Slices, 1 slice	40	4	2	150	0.6	-
Yves, Canadian Veggie Bacon, 3 slices	80	17	0.5	20	2.5	3.0
Yves, Veggie Bologna, 4 slices	70	15	0	20	2.0	2.4
Yves, Pizza Pepperoni, 16 slices	70	14	0	40	2.0	2.4
Yves, Veggie Turkey, 4 slices	85	18	0	40	2.0	2.4
Yves, Veggie Salami, 4 slices	90	17	0	40	2.5	2.4

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**Vegetarian Dogs:**

Morningstar Veggie Dogs	80	11	0.5	0	2.7	-
Yves Tofu Wieners	45	9	0.5	20	1.1	-

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