Nutritional Concerns of Female Athletes: A Case Study

Nancy Clark
SportsMedicine Brookline

Some of the nutritional concerns of female athletes are highlighted in this case study of a 20-year-old woman who wants to lose 16% of her body weight to qualify for the position of coxswain on a national crew team. These concerns include adequacy of vitamin, mineral, protein, and carbohydrate intake as well as amenorrhea and pathogenic eating behaviors.

Athletes, both males and females alike, can enhance their health and performance with the benefits of good nutrition. Since most male athletes eat more than 2,000 calories a day, they can more easily nourish their bodies with the nutrients contained within those foods than can the smaller, more weight-conscious female athletes who usually require fewer calories and hence consume fewer nutrients. This places female athletes at a potentially higher risk of nutritional deficiencies.

The job of a registered dietitian/sports nutritionist is to help all athletes avoid nutritional deficiencies, nourish their bodies optimally, and attain their desired weight. On occasion, some athletes may have to severely restrict their nutrient intake in order to compete in their sport.

The following is a case study of a young woman who, as coxswain, wanted to lose 16% of her body weight to qualify for a position on the national crew team. The case highlights some of the concerns that arise when a female athlete chooses to restrict her nutrient intake. In her words,

I want to try out for coxswain on the national crew team. That means I have to weigh 99 pounds. I’m 5’6” and currently weigh about 118. How can I lose that much weight without losing my health?

Objective Description

Amy (not her real name), a 20-year-old junior in college, currently is coxswain for the women’s crew team at her college. She has three main nutrition concerns: (a) She wants to lose enough weight by July (9 months away) so that she can qualify for the national crew team. (b) She wants to maintain her health. (c) She prefers to eat a vegetarian diet.

Nancy Clark is with SportsMedicine Brookline, 830 Boylston Street, Brookline, MA 02167.
Amy has always been thin, as are the other members of her family, and maintaining a low weight has never been a problem for her. At 5'6" (169 cm) and 118 pounds (53 kg), she has about 16% body fat (as measured with skinfold calipers) and a body mass index (BMI) of 18.6. She currently lifts weights three times a week and either works out on the Erg (rowing machine) or runs for about 20–30 minutes three times a week.

Amy is concerned about her current intake of protein and calcium. She chooses a vegetarian diet and has not eaten red meat, fish, or chicken for the past 6 months. Occasionally she may have some chopped egg on salads, but her primary protein sources are sporadic servings of tofu, beans, lentils (about four meals a week), and dairy products (about one serving a day). She strives to eat low-fat foods and generally restricts her intake of sweets. She has already started to restrict her calorie intake and has lost 3 pounds over the past month.

Her typical daily intake consists of the following:

- **8 a.m.** Bagel (large plain) and coffee with one teaspoon sugar
- **Noon:** Spaghetti with tomato sauce and parmesan cheese; or a salad from a salad bar that offers tofu and chopped egg; or lentil soup and an apple
- **4–6 p.m.** Crew practice/exercise
- **7 p.m.** Pizza; or stir-fried vegetables and rice; or oatmeal (cooked in milk) and a banana
- **10 p.m.** Popcorn (if anything)

**Assessment**

Amy currently eats an estimated 1,500–1,700 calories a day (70–80% CHO, 10–15% protein, 10–20% fat). A computerized dietary analysis suggests that she consumes, at most, about 60 grams of protein, of which only 12 grams are high quality protein from milk or cheese. This comes to a little more than 1 gram of protein per kilogram of body weight. Her intake of several nutrients is undesirably low: 50% of the RDA for vitamin C, 60% for B6, 11% for folic acid, 30% for B12, 50% for calcium, 70% for iron (none of which is heme-iron with a high bioavailability), and 45% for zinc.

**Plan**

Amy’s demanding weight goals—which are also representative of the goals of many wrestlers, oarsmen, and other weight-classed athletes who have to meet specific weight requirements in order to qualify for their sport—raise ethical concerns: Should a nutrition professional help an athlete to endanger his or her health through a drastic weight reduction program?

In Amy’s case I recognized that she was determined to lose this weight regardless of whether I supported her efforts. After evaluating the situation, I decided to work with her to help reduce her risk of diminishing her health while optimizing her nutritional status, and supporting her efforts to succeed with this
difficult challenge. Amy acknowledged my professional/ethical concerns and was grateful for my help. She had feared that I would dismiss her.

Since Amy had 6 months (24 weeks) to lose 19 pounds, she had no need to subject herself to a drastic crash diet. Rather, I recommended that she continue eating about 1,500-1,700 calories a day, an amount that would promote this slow and steady weight loss of about 1/2 to 3/4 pounds per week, without leaving her ravenously hungry. As Amy became thinner and her body adapted to the lower intake, I told her to expect to have to eat fewer calories (8). Through monthly nutrition appointments, I would be able to help her make appropriate adjustments as needed.

We discussed the metabolic adaptations that would probably occur as Amy approached 11–13% fat, the level at which she may have depleted her storage fat and be left with the essential sex-specific fat. She could expect to eat fewer calories, feel cold most the time, obsess about food, sleep poorly, have difficulty concentrating, and stop menstruating (13).

Amy’s target weight would require her to lose about 10–12 pounds of muscle mass. At her current weight of 118 pounds (16% body fat), she had approximately 99 pounds of lean body mass and 19 pounds of fat; at 99 pounds (approximately 11% fat), she would have an estimated 88 pounds of lean body mass and a minimal amount of fat—about 11 pounds. Her BMI would drop from 18.6 to 15.8, similar to the BMI of an anorexic woman.

Since Amy was destined to lose muscle weight in order to get to her desired body weight, we discussed the best exercise program for her, deciding that she should discontinue her weight-lifting program (since that promotes muscular growth). This is contrary to most reducing programs in which weight lifting is encouraged in order to protect lean body mass.

Amy agreed to do light aerobic workouts 3–5 times a week to maintain her fitness and health as well as contribute toward weight loss. Her lifestyle as a college student required that she be moderately active throughout the day. For example, she walked about 1–1.5 hours just to get from her apartment to classes and the boathouse.

I advised Amy that cessation of menses would be a likely by-product of this extreme weight reduction plan. This amenorrhea would not be due solely to the fact that she would be dropping to a very low percentage of body fat; the long-held belief that women who drop below a threshold level of body fat are more prone to amenorrhea (12) has now been disputed. Several studies have found no differences in percent body fat between normally menstruating and amenorrheic athletes (10, 16, 17, 19). My concern was, rather, that the effort needed to reduce her weight to the low level would require a very restrictive caloric intake. Studies suggest that a long-term energy deficit is likely to be related to the loss of menses (17, 21).

Since Amy could potentially be amenorrheic for more than 6 months and consequently could lose a significant amount of bone mass, I said that I would refer her to a gynecologist familiar with the concerns of female athletes if she did stop menstruating. I did not want Amy to place herself at risk of getting a stress fracture secondary to the amenorrhea (2) or to endanger her future bone health. Although amenorrheic women who resume normal menses do regain
some bone stock, there appears to be some irreversible loss (9, 10). This places them at risk of developing complications from osteoporosis in later life.

I recommended that Amy eat a higher protein diet (1.5 grams protein/kg), on the basis that amenorrheic athletes commonly have a low protein intake (17). Since anecdotal evidence suggests that very lean body-builders (who eat a high protein diet) rarely have disrupted menstrual cycles, perhaps adequate protein would prolong her ability to menstruate normally.

Discussion

Athletes such as Amy raise concerns about the importance of nutrition for female athletes. What happens when a healthy young woman wants to restrict her diet in order to attain an abnormally low weight? The following discussion presents a brief overview of some key nutritional concerns of female athletes, using Amy’s case as a springboard for discussion.

Concern 1: Vitamin Adequacy

By consuming from 1,200 to 1,500 calories of a variety of wholesome foods from diverse food groups, a healthy person can get adequate vitamins to support good health. Athletic women who may have a slightly increased need for some vitamins, such as riboflavin, a B-vitamin involved in converting food into energy (3), generally consume more calories, hence more nutrients. This is not the case for dieting athletes.

For Amy, I recommended that she focus her meals upon nutrient-dense foods, that is, foods that would offer her a significant amount of vitamins for the least amount of calories. Some food choices include the following:

- Low calorie vegetables such as broccoli, spinach, green peppers, and tomatoes (vitamins A and C);
- Fruits such as cantaloupe, oranges (and other citrus fruits), kiwi, and bananas (vitamins A and C);
- Low-fat dairy products such as low-fat yogurt and milk (riboflavin, vitamin D).

In addition to eating these nutrient-dense foods, I also recommended a simple multivitamin supplement that provided 100% of the RDA. I felt that this would provide Amy with the added health insurance she might need in light of her extreme weight reducing plans.

Concern 2: Mineral Adequacy

Calcium, iron, and zinc are three minerals of specific concern to female athletes: Calcium is important to promote peak bone mass and retard the development of osteoporosis. A low peak skeletal mass in early adulthood could predispose women to earlier or more severe osteoporosis in later life (18). Iron is important for reducing the risk of becoming anemic (an occurrence among an estimated 20% of menstruating women in North America) (11). Anemia consequently contributes toward reduced work capacity. Iron is also important for optimal immune
function and thereby aids in maintaining good health. Zinc is involved with the immune response, healing, as well as with most metabolic reactions within the body. Women who are iron deficient may also be zinc deficient, since the two minerals are found in many of the same foods.

Since Amy’s current diet was deficient in all three minerals, I taught her how to boost her mineral intake, specifically by including low-fat, calcium-rich dairy foods at least three times a day and selecting iron- and zinc-rich vegetarian foods (spinach, beans, legumes; enriched grains; cooking in cast-iron skillets).

Although I was respectful of her vegetarian concerns, I invited Amy to consider the option of occasionally eating iron- and zinc-rich red meats during this short time in her athletic career. Since the minerals in animal proteins are (a) absorbed much better than those in plant foods and (b) are more densely concentrated in lean meats than in vegetable sources, perhaps the health benefits of two to four small servings per week of lean meats (e.g., extra lean hamburger in spaghetti sauce, turkey-lentil soup, stir-fried lean beef with broccoli) may be a more important health insurance at this time of her life than her long-term desire to eat a vegetarian diet.

Concern 3: Protein Adequacy

Female athletes commonly focus upon carbohydrate-rich foods in order to optimally fuel their muscles with glycogen. They may sometimes neglect their protein needs. Such was the case with Amy, who referred to herself as a vegetarian but tended more toward being simply a non-meat eater. To consume an optimal vegetarian diet, Amy would have had to eat, every day, beans, lentils, tofu, and other protein rich vegetarian foods that would contribute toward an adequate protein intake. She only sporadically included protein-rich vegetarian foods into her meals and was currently consuming a marginal (but perhaps not optimal) protein intake—if one takes into account the low biological value of the plant protein in her diet and her higher needs secondary to weight reduction (5).

Since protein needs are higher during a weight reduction program (5), and since lack of protein may contribute to amenorrhea (14, 17), we agreed that Amy should target for a generous protein intake of about 1.5 gram/kg. This came to about 80 grams of protein per day (~19–22% of calories from a 1,500–1,700 calorie diet). To consume this amount of protein, Amy would need to eat the following every day (Table 1):

**Concern 4: Carbohydrate Adequacy**

Consuming adequate carbohydrates during weight reduction is important for athletes who are simultaneously trying to maintain a rigorous training schedule. Approximately 8–10 grams of CHO per kilogram of body weight are recommended for optimal glycogen replacement (7). This comes to approximately
Table 1

Recommended Daily Protein Intake

<table>
<thead>
<tr>
<th>Grams protein</th>
<th>Approximate calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–4 cups of milk/yogurt</td>
<td>24–32</td>
</tr>
<tr>
<td>1/2 cake tofu</td>
<td>16</td>
</tr>
<tr>
<td>1 cup beans</td>
<td>16</td>
</tr>
<tr>
<td>and/or 2–4 oz. lean red meat</td>
<td>16–32</td>
</tr>
<tr>
<td>plus Protein in grains, breads</td>
<td>15–30</td>
</tr>
</tbody>
</table>

60–70% of total calories from carbohydrates, assuming the athlete is not restricting her caloric intake.

Amy, as coxswain, was not participating in a rigorous training program. Hence she could maintain sufficient energy to perform her every-other-day workouts with a lower than recommended carbohydrate intake. Since consuming extra protein seemed more of a priority than consuming extra carbohydrates, and since protein-rich foods tend to be more nutrient-dense than many carbohydrate-rich grains and starches, I planned a 1,500–1,700 calorie diet for Amy that approximated 4–5 grams of carbohydrate/kg (58–62 % CHO, see Table 2).

Concern 5: Amenorrhea, Osteoporosis

Although many sports active women think of athletic amenorrhea as being a desirable and benign side effect of hard training, more current knowledge indicates that amenorrhea in young women is associated with reduced bone density and may be accompanied by an increased risk for the early development of osteoporosis. Osteoporosis is a major cause of disability and death in elderly women. Fifteen to 20 million elderly persons in the United States are affected by it, and our nation is threatened by an even greater prevalence of osteoporosis as life expectancy increases (6). Lack of menses is related to loss of bone density, with short-term problems of increased risk of stress fractures (2) and long-term concerns regarding the premature development of osteoporosis.

The factors involved in the loss of normal menses are multifactorial, including hormonal changes, stress, too much exercise, and poor nutrition (15). Although more research is needed regarding the impact of inadequate nutrition upon menstruation, it is known that calorie restriction can alter the menstrual cycle (20), particularly when combined with exercise (4). Lack of protein may also play a role (14, 17). In order to protect Amy from the negative health consequences of amenorrhea, I recommended that she focus upon a protein-rich diet and consult with a sports gynecologist.
<table>
<thead>
<tr>
<th></th>
<th>Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast:</strong></td>
<td></td>
</tr>
<tr>
<td>2 oz. cereal, iron-enriched</td>
<td>220</td>
</tr>
<tr>
<td>1 cup milk, 1%</td>
<td>100</td>
</tr>
<tr>
<td>1 whole orange</td>
<td>100</td>
</tr>
<tr>
<td><strong>Lunch:</strong></td>
<td></td>
</tr>
<tr>
<td>2 cups spaghetti, protein-enriched</td>
<td>300</td>
</tr>
<tr>
<td>1/2 cup tomato sauce w/</td>
<td>100</td>
</tr>
<tr>
<td>1/2 cup kidney beans</td>
<td>100</td>
</tr>
<tr>
<td>1 cup sugar-free yogurt</td>
<td>100</td>
</tr>
<tr>
<td><strong>Dinner:</strong></td>
<td></td>
</tr>
<tr>
<td>3 cups stir-fried vegetables: broccoli, green peppers, carrots</td>
<td>150</td>
</tr>
<tr>
<td>2/3 cup rice</td>
<td>100</td>
</tr>
<tr>
<td>1/2 cake tofu</td>
<td>160</td>
</tr>
<tr>
<td>1 cup milk, 1%</td>
<td>100</td>
</tr>
<tr>
<td><strong>Snack:</strong></td>
<td></td>
</tr>
<tr>
<td>1 cup Alba sugar-free hot cocoa</td>
<td>70</td>
</tr>
</tbody>
</table>

Approximately 1,600 calories: 22% protein, 20% fat, 58% carbohydrate.

**Concern 6: Pathogenic Eating Behaviors**

According to some health professionals, dieting may be a key underlying factor that leads to eating disorders (1). Amy had never attempted a reducing diet until now, hence she entered this difficult project naively. Would she be able to complete the project without flirting with anorexic or bulimic tendencies? After completing her crew career, would she be able to resume a normal relationship with food? Would she have a distorted body image? Would she suffer long-term effects from this restrictive program? Only time would answer these questions. I hoped that the monthly nutrition consultations would resolve her eating concerns and that, with professional guidance, Amy would be able to maintain a healthy relationship with food.

**References**