

Perspectives in Practice

Clinical Observations from Nutrition Services in College Athletics

PAULA A. QUATROMONI, DSc, MS, RD

ABSTRACT

College athletes are vulnerable to nutritional risks because of the rigorous demands of their sport, and because of the realities of college lifestyles. Athletes often adopt rigid training diets that predispose them to undernutrition, fatigue, and injury. Disordered eating, a common concern for college-aged women, affects a substantial number of female collegiate athletes, and is a growing concern for their male counterparts. Few resources exist to promote nutritional well-being among college athletes, particularly for individuals who suffer from eating pathology that is subclinical and often perceived as benign. This article presents evidence of the need for nutrition services for college athletes and describes nutritional risks that affect individuals across a variety of athletic teams. A multidisciplinary treatment model is depicted, featuring a nutrition practice at the core of a sports medicine wellness program in Division I college athletics. Observations from this practice document a substantial burden of subclinical eating disorders and elucidate characteristics of high-risk individuals. The Female Athlete Screening Tool is advocated as a useful tool for identifying eating pathology and triggering timely interventions. These insights from clinical practice identify opportunities and behavioral targets for intervention, and promote an effective model for health promotion in college athletics.

J Am Diet Assoc. 2008;108:689-694.

Nutrition and hydration are central to athletic performance (1), yet nutritional risk among college athletes can be quite high. Nutritional issues facing college athletes span a spectrum from undernutrition and compromised nutritional status to high body fat percentage and overweight. In general, the demands of athletic

training and peak performance place athletes at risk for suboptimal energy intake, injury, and stress fractures, with females being particularly vulnerable (2,3). Nutritional concerns are easily magnified in college athletics, when competitive pressures mount, financial resources are limited, and life skills are not fully developed.

Eating disorders are common (4-11) and on the rise (7-9) among college-aged women, yet prevalence estimates are variable and unreliable because so few affected individuals seek treatment (7). Bulimia affects about 20% of college women (10), with dieting behaviors reported among 83% to 90% of college females surveyed (11,12). Female athletes are reportedly at greater risk for eating disorders than are nonathletes of similar ages (13-19) and male athletes (16,20,21), although statistics vary. It is estimated that one-third or more of female college athletes have clinical eating disorders (22). Subclinical disorders are thought to affect 10% to 15% of female college athletes (23,24).

Athletes with more nutrition knowledge make better food choices resulting, in better health, well-being, and athletic performance (25-27). Proper athletic training coupled with sound nutrition practices can help athletes maximize both health and performance (27,28). College athletics offers a unique opportunity to positively impact nutrition knowledge, attitudes, and behaviors that can translate into healthful habits throughout the lifecycle. The purpose of this article is to describe observations from a clinical practice where a sports dietitian functions as a member of a multidisciplinary sports medicine wellness program designed to identify, evaluate, and treat nutritional risks in college athletes.

METHODS

A comprehensive service program was designed to respond to the recognized prevalence of nutritional risk and disordered eating among college athletes (16,20,21). The program serves a diverse population of National Collegiate Athletic Association Division 1 athletes at a large urban university in the northeastern United States. The program has three components: (a) creation of a Sports Medicine Wellness Team, (b) provision of team-based nutrition education programs, and (c) referral of "at risk" student-athletes for individualized counseling and services. The third component is the primary focus of this article, with specific emphasis on the role of the sports dietitian and the nutrition consultation service within the context of the wellness team. Observations reported in this article are based on clients seen during the course of 2 academic years, between September 2004 and June 2006. This work was reviewed by the Boston University

P. A. Quatromoni is an assistant professor, Department of Health Sciences, Sargent College of Health and Rehabilitation Sciences, Boston University, Boston, MA.

Address correspondence to: Paula A. Quatromoni, DSc, MS, RD, Department of Health Sciences, Sargent College of Health and Rehabilitation Sciences, Boston University, 635 Commonwealth Ave, Boston, MA 02215. E-mail: paulaq@bu.edu

Manuscript accepted: July 3, 2007.

Copyright © 2008 by the American Dietetic Association.

0002-8223/08/10804-0009\$34.00/0

doi: 10.1016/j.jada.2008.01.008

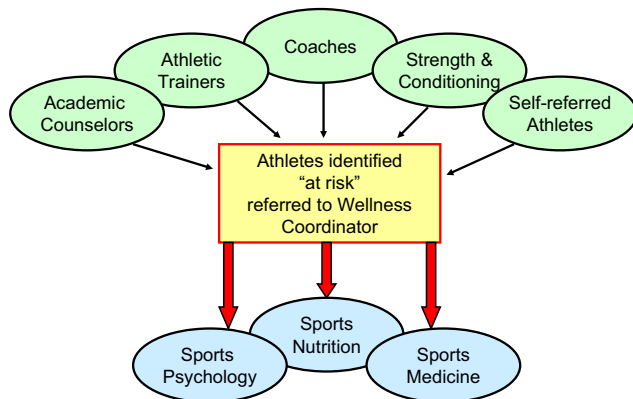


Figure. Multidisciplinary wellness team model for college athletics.

Institutional Review Board and was determined to be excluded from the regulations for protection of human subjects because it did not involve research.

The multidisciplinary sports medicine wellness team consists of sports medicine physicians, athletic trainers, strength and conditioning coaches, academic counselors, sports psychologists, sports dietitians, and related subspecialists. The team works collaboratively to serve all members of the athletic community, including student-athletes, coaches, and trainers. The team provides screening, referral, assessment, diagnosis, treatment, and educational programming (Figure).

The wellness team set out to identify “at-risk” athletes, specifically those with disordered eating behavior, and refer them to the sports dietitian. Nutrition referrals were also made for general sports nutrition guidance, healthful eating on campus, and healthful weight management. In addition, some athletes self-referred after attending a sports nutrition orientation lecture. Others were referred by teammates or coaches.

Disordered eating behavior includes clinically diagnosable eating disorders: anorexia nervosa (extreme food restriction and extremely low body weight), bulimia nervosa (recurrent binge eating with inappropriate compensatory behavior, such as vomiting, laxative abuse, or excessive exercise), or binge eating disorders (binging without purging). It also includes restrictive eating, binge eating, and purging behaviors that are less frequent or less intense, thus do not meet clinical criteria. These disordered behaviors, as assessed by the sports dietitian, represent subclinical risk that warrants timely intervention to prevent progression to more serious eating pathology. Clinical diagnosis of a particular type of eating disorder was based on the sports dietitian’s assessment using the criteria of the American Psychiatric Association’s *Diagnostic and Statistical Manual of Mental Disorders* (29).

Female athletes were asked to complete the Female Athlete Screening Tool (FAST) before their first visit to identify behaviors and belief systems that put them at risk for disordered eating. This tool was developed for use with female athletes as an eating disorder screening tool that accurately measures reasons for engaging in atypical exercise and eating behaviors (30). The FAST is a self-administered questionnaire that consists of 33 items and

generates a risk score ranging from 33 (healthy score) to 130 (high risk). The FAST has documented internal consistency, discriminant validity, and concurrent validity compared with other valid psychometric measures that identify eating pathology in the general population (30).

Nutrition consultations were provided by a registered dietitian with expertise in sports nutrition. Nutrition assessment and counseling strategies were guided by the sports nutrition medical nutrition therapy protocol recommended for female collegiate athletes (2). Nutrition counseling incorporated numerous strategies of cognitive behavioral therapy, including self-monitoring, journaling, motivational interviewing, assessment of readiness to change, behavioral goal setting, client-centered problem-solving, cognitive restructuring, and relapse prevention. Goals were to ensure nutritional adequacy for athletic performance, to build self-efficacy for healthful eating, to establish healthful relationships with food and body image, and, in the case of disordered eating, to normalize eating patterns and develop effective coping strategies. Close interaction with sports psychologists and other members of the wellness team was the hallmark of the therapeutic approach. In our practice, the sports dietitian did not weigh student-athletes. Weights were measured by strength and conditioning coaches in the setting of team-based evaluations. Body mass index (BMI; calculated as kg/m^2) data were computed from height and weight measures that student-athletes self-reported to the sports dietitian at their initial consultation visit.

RESULTS

Descriptive data collected during routine clinical assessment in the first 2 years of the sports nutrition service clearly demonstrate the need for nutrition services in college athletics. These data provide important insights to guide intervention planning, delivery, and allocation of resources to reach those most in need. In year 1, nutrition services were provided to 25 athletes across 10 varsity teams, comprising 89 consultative visits (Table 1). Of the athletes seen, slightly more than half were female and about one-third were participants in lean sports (track, cross country, and swimming). Almost half had disordered eating behavior. Some 58% of athletes with disordered eating characteristics were participants in lean sports. Athletes with disordered eating required substantial ongoing follow-up and used the majority of the program’s resources. Almost three-quarters of all nutrition visits were for disordered eating.

Common challenges for these athletes were chronic dieting, dissatisfaction with body weight or body composition, weight gain during the off season, maladaptive coping mechanisms where food was used to manage stress, pressures of the sports environment, academic pressures, difficult adjustments to college life, and overly restrictive vegetarian diets. Low self-efficacy and external locus of control were consistent themes. Alcohol indiscretion was a precursor to bulimia for some female athletes in this practice.

In year 2, the number of individuals served doubled and the number of consultations increased to 165 as the reputation of the program became established. Athletes

Table 1. Number of college athletes receiving nutrition services at a National Collegiate Athletic Association Division I university, by year of participation

| | Year 1 | | Year 2 | | Total | |
|---|--------|----|--------|----|-------|----|
| | n | % | n | % | n | % |
| Teams served | 10 | 45 | 19 | 86 | 19 | 86 |
| Athletes served | 25 | | 50 | | 68 | |
| Females | 13 | 52 | 41 | 82 | 49 | 72 |
| Athletes from "lean" sports ^a | 9 | 36 | 16 | 32 | 22 | 32 |
| Athletes with disordered eating behavior ^b | 12 | 48 | 24 | 48 | 31 | 46 |
| Athletes with disordered eating who participated in "lean" sports | 7 | 58 | 9 | 38 | 14 | 45 |
| Nutrition visits | 89 | | 165 | | 254 | |
| Nutrition visits for disordered eating behavior | 65 | 73 | 117 | 71 | 182 | 72 |

^aLean sports include track, cross country, and swimming. Nonlean sports include ice hockey, field hockey, crew, lacrosse, golf, soccer, basketball, softball, and tennis.

^bEating-disordered behavior includes clinically diagnosable eating disorders (29) as well as restrictive eating, binge eating, and purging behaviors (including excessive exercise) that do not meet clinical criteria but, based on either the Female Athlete Screening Tool inventory (30) and/or the dietitian's clinical assessment, constitute high-risk or subclinical behavior warranting intervention. Of athletes with disordered eating, only one was male.

Table 2. Female Athlete Screening Tool (FAST) scores^a used to detect eating pathology among female collegiate athletes (n=49)

| | Healthy score <77 | Subclinical score 77-94 | Clinical score >94 |
|-------------------------|--|-------------------------|------------------------|
| | <i>n (%)</i> | | |
| n | 22 (45) | 19 (39) | 8 (16) |
| Freshman/sophomore | 18/22 (82) | 12/19 (63) | 8/8 (100) |
| Athletes in lean sports | 7/22 (32) | 8/19 (42) | 1/8 (12.5) |
| | <i>mean ± standard deviation</i> | | |
| FAST score | 64.9 ± 8.9 | 82.4 ± 4.5 | 100.5 ± 3.5 |
| Age (y) | 19.1 ± 0.8 | 19.5 ± 1.1 | 19.00.8 |
| | <i>mean ± standard deviation (range)</i> | | |
| Body weight (kg) | 67.3 ± 11.2 (43.6-81.8) | 68.0 ± 11.1 (47.3-91) | 68.98.4 (59.0-79.5) |
| BMI ^b | 23.7 ± 3.4 (17.1-26.6) | 23.5 ± 3.4 (17.0-29.5) | 24.5 ± 1.2 (22.5-25.9) |

^aFemale Athlete Screening Tool (30); minimum score=33; maximum score=130; range of scores in this cohort 48 to 106.

^bBMI=body mass index (calculated as kg/m²) computed using self-reported height and weight information based on baseline weight at entry into the nutrition consultation service, measured by strength and conditioning coaches.

from 19 of 22 teams were now benefiting from nutrition interventions, and most were women (82%). Interdisciplinary collaborations became more common, where the sports dietitian and the sports psychologist worked effectively as a team counseling eating-disordered athletes in joint sessions. The relative proportion of consults for disordered eating remained fairly constant at 48% of individuals and >70% of all visits. The proportion of disordered-eating cases among athletes in lean sports was down to 38%, as more athletes from diverse teams sought treatment.

During 2 years combined, the majority of athletes receiving nutrition services were female. Among women, most were members of swim (20%), track and cross country (18%), crew (14%), and basketball (14%) teams. Male athletes seeking nutrition advice came mostly from ice hockey (58%), track and cross country (16%), and crew (11%) programs. While athletes with disordered eating were almost exclusively women, one male athlete was identified by the sports dietitian and was treated. Similarly, while eating-disorder services were provided to athletes in lean sports, they were also provided to athletes in nonlean sports at an equally high frequency.

Scores generated by the Female Athlete Screening Tool indicate that more than half of women seen in this practice were classified as at risk for disordered eating, scoring in either the subclinical or clinical category (Table 2). Athletes with subclinical FAST scores were less likely to be underclassmen than those with healthy scores, yet all who scored in the highest risk group were either freshman or sophomores. Participation in lean sports was not a strong correlate of high risk FAST score. Only one of eight (12.5%) in the highest risk category was from a lean sport, compared to 42% of those with subclinical scores and 32% of those with healthy scores.

Average body weight was relatively consistent across risk groups, within 1.6 kg (3.5 lb) on average. Women in the subclinical group displayed a wider range in body weight, whereas weight was notably less variable in the clinical group. Average BMIs were in the healthy range for all subgroups of women (23.7 to 24.5 on average), however, BMIs as low as 17.0 and as high as 29.5 were noted. BMI data showed a pattern strikingly similar to weight, with larger variability noted among women with subclinical scores and substantially less variability among those with clinical scores.

DISCUSSION

Applications in College Settings

College students are in need of nutritional guidance because they often skip meals, snack frequently, and have limited cooking skills and limited finances. They have 24-hour access to foods that are high in energy density, low in fiber, limited in fruits and vegetables, low in nutrient density, and often lacking variety. Social situations and peer pressure lead to overeating, alcohol indulgence, and unwanted weight gain. Academic, social, and interpersonal stressors can trigger disordered eating and risk for unhealthful dieting. Disordered eating usually begins as a diet, and its hallmark is an intense obsession with weight, dieting, and food (31).

Eating disorders were common among females in this practice, yet a substantial portion of affected individuals did not meet clinical diagnostic criteria (32). Common contributing factors, such as body image dissatisfaction; weight preoccupation; and chronic dieting (5), were noted in this student-athlete population. Other associated features (6), including low self-esteem; drive for perfectionism; struggles for independence; and family conflicts, were commonly observed. Consistent with these findings, other sources of data suggest that eating-disorder symptoms in college populations correlate with self-reported alcohol use (9,33-35), anxiety (8), stress (36), and vegetarianism (37). Some women in this practice reported that purging "to get rid of" calories after binge drinking was considered socially acceptable among their peers. For some, this led to purging to get rid of food calories, which eventually progressed to bulimia.

Applications in College Athletics

It is not uncommon for athletes to have misinformed beliefs about their nutritional needs, only a limited variety of foods in their daily diet, or an overly restrictive diet. Athletes who adopt rigid training diets find themselves underfueled, chronically preoccupied with thoughts about food, and with compromised athletic performance often concurrent with injury. Eating disorders compromise athletic performance by predisposing athletes to fatigue, decreased endurance, strength, and speed, dehydration, depleted fuel stores, and injury (38). Health consequences are serious and include poor nutritional status, compromised immunity, menstrual dysfunction, bone loss, delayed healing, cognitive deficits, coexisting depression, and death (1,3,22,28,38-40). Yet, many athletes, including some in this practice, falsely believe their disordered eating practices are harmless (41).

Individuals with subclinical eating pathology exhibit disordered behaviors that range from mild to moderate, with the potential to escalate and become sustained under periods of stress. Based on the observations from this clinical practice, key triggers for disordered eating in college athletes include injury or any condition that interferes with their ability to train and compete. The injured athlete loses substantial calorie-burning potential when activity is restricted, yet often has difficulty adjusting her caloric intake and subsequently experiences or fears weight gain. Personal dissatisfaction with athletic performance is another apparent vulnerability, as in the case of the disappointed scholarship athlete who finds

herself sitting on the bench with little, if any, playing time.

Maladaptive eating behaviors have the potential to spread. Unhealthful dieting practices are modeled, learned, and even admired as potentially successful training strategies by teammates struggling to gain a competitive edge. Individuals in this subclinical category are considered at risk (17) and are often difficult to identify and get into treatment. They are in need of assessment, education, and early intervention if disordered behaviors are to be reversed, yet resources rarely exist to serve them.

Disordered eating goes untreated when affected individuals choose not to seek help and for the many cases that remain clinically undetectable (17). The estimate that 39% of clients in this practice displayed subclinical disordered eating is higher than other reports (40,41) and warrants careful interpretation. The client base in this report represents those seeking treatment and was not a randomly drawn sample. Nonetheless, athlete-specific screening tools, such as the FAST, are particularly useful for uncovering subclinical risk, especially when used in a nonconfrontational setting within a collegiate athletics wellness program.

Finally, the prevalence of eating disorders among female athletes is reportedly higher among those competing in lean sports (16,21,42,43). The observations reported here, and findings from other sources (38,44-47), refute this statement. These experiences suggest that potentially all female student-athletes are vulnerable. In fact, unhealthful means of dieting and managing stress can be particularly contagious in a collegiate-level, team-based athletic community, regardless of the perceived connection between leanness and performance.

Implications for Intervention

Early intervention is essential (48) because disordered eating can be prevented (47), particularly when treatment is initiated before unhealthful behaviors become entrenched. In the setting of college athletics, the FAST (30) appears to be a reliable tool for identifying high-risk individuals that warrant clinical evaluation and timely intervention. The subgroup of 27 women identified by the FAST in this clinical practice included 19 athletes (70% of cases) who the sports dietitian independently and readily evaluated as being at risk, based on routine parameters of nutritional status assessment. Eight additional subclinical cases (30% of cases) whose behaviors and attitudes were less clearly revealed during early consultative sessions were identified solely on the basis of the FAST. Thus, the FAST appears highly reflective of experienced clinical judgment in this setting. The FAST may be particularly useful for discerning risk among athletes who are more challenging to assess in the short-term, before trusting therapeutic relationships are well-established, and disordered behaviors and belief systems are fully disclosed. In this practice, it was particularly effective to administer the FAST before the initial visit to avoid biased judgment in its administration and to avoid missing indicators of risk that could otherwise take months to uncover.

Others have documented the need for nutrition counseling and educational programs for college athletes (49-

52). Despite previous recommendations regarding nutrition education for this population, few athletes have access to qualified nutrition professionals (50). Observations from this collegiate sports medicine practice demonstrate that if nutrition services are provided, athletes will participate and even the hardest-to-reach individuals will benefit. Coupling individualized nutrition services with therapeutic support groups and team-based wellness education seminars has become an effective model for health-promotion activities in this setting. As competitive opportunities for female athletes continue to grow, demands for services are higher than ever.

LIMITATIONS

This report is based on observations from a sports nutrition practice in a university setting. Findings cannot be generalized to clients from other sources, including non-students or members of a gym who seek nutrition counseling. It is important to note that these findings are not based on rigorous scientific research. A formal hypothesis regarding efficacy of treatment regimens for disordered eating was not tested. The sample was not randomly selected and the sample size was limited by the capabilities of the nutrition services at this university. Nonetheless, in the absence of substantial research to guide clinical practice with this vulnerable population, these observations provide important insights into risk factors, target populations, and tools for assessing and addressing nutritional risk among competitive collegiate athletes.

Use of self-reported BMI is a potential limitation in this report. However, self-reported and measured BMI values are highly correlated in the general adult population, with r values exceeding 0.90 (53). Compared to the general US population, self-reported BMI data may be expected to be even more precise in a cohort of student-athletes who are being weighed on a regular basis and who are actively seeking nutritional guidance within the infrastructure of college athletics. It was noted that athletes in this practice were exceptionally well-informed and aware of their current weight as well as their weight histories prior to and during their time as collegiate athletes.

Men are underrepresented in this report, particularly men with disordered eating, because fewer men than women sought nutrition counseling services altogether. Men in this practice tended to seek nutrition counseling for generalized sports nutrition guidance, not for reasons related to disordered eating. Finally, while there is research that documents risk factors, prevalence rates, and health consequences of disordered eating in college-aged women, research that demonstrates effective treatment protocols is lacking. Intervention research that tests treatment strategies in both subclinical and clinical cases of disordered eating is needed to help move the field forward in important ways.

CONCLUSIONS

Sports teams can be effective vehicles to promote, model, and support healthful lifestyles. These experiences in a National Collegiate Athletic Association Division 1 athletics program suggest that student-athletes value, seek,

and participate in nutrition services that guide healthful eating and healthful weight control. A campus-based sports wellness team can be an effective model for providing consistent and integrated services to student-athletes. The need for high-quality, accessible, timely, and convenient nutrition services to meet the needs of a diverse student-athlete population is demonstrated by these observations.

Close collaboration with athletic trainers and sports medicine colleagues is an essential feature of a model program as these professionals are often the first to recognize nutritional risk because of their daily contact with athletes. Yet sports dietitians can assume a central role in a campus-based sports wellness program. The sports dietitian is the recognized expert who understands the nutritional needs as well as the athletic culture, physiological milestones, and life stressors of college athletes (50). Marketing services to underclassmen, harder-to-reach male athletes, and female athletes from a wide range of teams is appropriate, as preconceived notions about who is at risk appear faulty. In situations in this university-based practice where the sports dietitian has helped student-athletes develop a more healthful relationship with food, it has been possible to facilitate desirable body composition, recovery from injury, improved self-esteem, and self-confidence that translates into improved athletic performance. These transformations may benefit these young men and women long after they graduate by helping them lead healthful adult lives.

This work was supported by funds from Boston University's Department of Athletics.

The author would like to acknowledge the contributions of Julie Mullane, MS, RD and Mimi Borkan for assistance coding the FAST data, and Alison Books, MS, RD for providing editorial critique.

References

1. Beals KA, Manore MM. Nutritional status of female athletes with subclinical eating disorders. *J Am Diet Assoc.* 1998;98:419-425.
2. Skinner P, Kopecky L, Seburg S, Roth T, Eich J, Lewis NM. Development of a medical nutrition therapy protocol for female collegiate athletes. *J Am Diet Assoc.* 2001;101:914-917.
3. Thrash LE, Anderson JJB. The female athlete triad: Nutrition, menstrual disturbances, and low bone mass. *Nutr Today.* 2000;Sept/Oct: 168-174.
4. Arriaza CA, Mann T. Ethnic differences in eating disorder symptoms among college students: The confounding role of body mass index. *J Am Coll Health.* 2001;49:309-315.
5. Schwitzer AM, Bergholz K, Dore T, Salimi L. Eating disorders among college women: Prevention, education, and treatment responses. *J Am Coll Health.* 1998;46:199-207.
6. Schwitzer AM, Rodriguez LE, Thomas C, Salimi L. The eating disorders NOS diagnostic profile among college women. *J Am Coll Health.* 2002;49:157-166.
7. Hoek HW, van Hoeken D. Review of the prevalence and incidence of eating disorders. *Int J Eat Disord.* 2003;34:383-396.
8. Ross LT, Gill JL. Eating disorders: Relations with inconsistent discipline, anxiety, and drinking among college women. *Psychol Rep.* 2002; 91:289-298.
9. Prouty AM, Protinsky HO, Canady D. College women: Eating behaviors and help-seeking preferences. *Adolescence.* 2002;37:353-363.
10. Kessler LA, Gilham MB, Vickers J. Peer involvement in the nutrition education of college students. *J Am Diet Assoc.* 1992;92:989-991.
11. Kurth CL, Krahn DD, Nairn K, Drewnowski A. The severity of dieting and bingeing behaviors in college women: Interview validation of survey data. *J Psychiatr Res.* 1995;29:211-225.

12. Malinauskas BM, Raedeke TD, Aeby VG, Smith JL, Dallas MB. Dieting practices, weight perceptions, and body composition: A comparison of normal weight, overweight and obese college females. *Nutr J*. 2006;5:11.
13. Beals KA, Manore MM. The prevalence and consequences of subclinical eating disorders in female athletes. *Int J Sports Nutr*. 1994;4:175-179.
14. Johnson MD. Disordered eating in active women. *Clin Sports Med*. 1994;13:355-369.
15. Wiggins DL, Wiggins ME. The female athlete. *Clin Sports Med*. 1997;16:593-612.
16. Sundgot-Borgen J, Torstveit MK. Prevalence of eating disorders in elite athletes is higher than in the general population. *Clin J Sport Med*. 2004;14:25-32.
17. Beals KA. Disordered Eating Among Athletes: A Comprehensive Guide for Health Professionals. Champaign, IL: Human Kinetics; 2004.
18. Hausenblas HA, Carron AV. Eating disorder indices and athletes: An integration. *JSEP*. 1999;21:230-258.
19. Sundgot-Borgen J. Prevalence of eating disorders in elite female athletes. *Int J Sport Nutr*. 1993;3:29-40.
20. Johnson C, Crosby R, Engel S, Mitchell J, Powers P, Wittrock D, Wonderlich S. Gender, ethnicity, self-esteem and disordered eating among college athletes. *Eat Behav*. 2004;5:147-156.
21. Reinking MF, Alexander LE. Prevalence of disordered-eating behaviors in undergraduate female collegiate athletes and nonathletes. *J Athl Train*. 2005;40:47-51.
22. Beals K, Manore M. Disorders of the female athlete triad among collegiate athletes. *Int J Sports Nutr Exerc Metab*. 2002;12:281-293.
23. Johnson C, Powers PS, Dick R. Athletes and eating disorders: The National Collegiate Athletic Association study. *Int J Eat Disord*. 1999;26:179-188.
24. Sanford-Martens TC, Davidson MM, Yakushko OF, Martens MP, Hinton P, Beck N. Clinical and subclinical eating disorders: An examination of collegiate athletics. *J Applied Sport Psych*. 2005;17:79-86.
25. Wiita BG, Strombaugh IA. Nutrition knowledge, eating practices, and health of adolescent female runners: 13-year longitudinal study. *Int J Sports Nutr*. 1995;6:414-425.
26. Grandjean AC. Diets of elite athletes: Has the discipline of sports nutrition made an impact? *J Nutr*. 1997;127(suppl):874S-77S.
27. Elliot DL, Goldberg L, Moe EL, DeFrancesco CA, Durham MB, Hix-Small H. Preventing substance use and disordered eating. Initial outcomes of the ATHENA (Athletes Targeting Healthy Exercise and Nutrition Alternatives) Program. *Arch Pediatr Adolesc Med*. 2004;158:1043-1049.
28. Steen SN. Timely statement of the American Dietetic Association: Nutrition guidance for adolescent athletes in organized sports. *J Am Diet Assoc*. 1996;96:611-612.
29. American Psychiatric Association. *Diagnosis and Statistical Manual of Mental Disorders*. 4th ed. Text revision. Washington, DC: American Psychiatric Association; 2000.
30. McNulty KY, Adams CH, Anderson JM, Affenito SG. Development and validation of a screening tool to identify eating disorders in female athletes. *J Am Diet Assoc*. 2001;101:886-892.
31. Manore MM, Barr SI, Butterfield GE. Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and athletic performance. *J Am Diet Assoc*. 2000;100:1543-1556.
32. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed. Washington, DC: American Psychological Association; 2000:589, 594.
33. Dams-O'Connor K, Martens MP, Anderson DA. Alcohol-related consequences among women who want to lose weight. *Eat Behav*. 2006;7:188-195.
34. Krahn DD, Kurth CL, Gomberg E, Drewnowski A. Pathological dieting and alcohol use in college women—A continuum of behaviors. *Eat Behav*. 2005;6:43-52.
35. Bulik CM, Klump KL, Thornton L, Kaplan AS, Devlin B, Gichter MM, Halmi KA, Strober M, Woodside DB, Crow S, Mitchell JE, Rotondo A, Mauri M, Cassano GB, Keel PK, Berrettini WH, Kaye WH. Alcohol use disorder comorbidity in eating disorders: A multicenter study. *J Clin Psychiatry*. 2004;65:1000-1006.
36. McLean JA, Barr SI. Cognitive dietary restraint is associated with eating behaviors, lifestyle practices, personality characteristics and menstrual irregularity in college women. *Appetite*. 2003;40:185-192.
37. Klopp SA, Heiss CJ, Smith HA. Self-reported vegetarianism may be a marker for college women at risk for disordered eating. *J Am Diet Assoc*. 2003;103:745-747.
38. Committee on Sports Medicine and Fitness. Medical concerns in the female athlete. *Pediatrics*. 2000;106:610-613.
39. Clark N. *Sports Nutrition Guidebook*. 3rd ed. Champaign, IL: Human Kinetics; 2003.
40. Manore MM. Dietary recommendations and athletic menstrual dysfunction. *Sports Med*. 2002;32:887-901.
41. Rosen LW, McKeag DB, Hough DO, Curley V. Pathogenic weight control behaviors in female athletes. *Physician Sportsmed*. 1986;14:79-86.
42. Byrne S, McLean N. Elite athletes: Effects of the pressure to be thin. *J Sci Med Sport*. 2002;5:80-94.
43. Smolak L, Murnen SK, Ruble AE. Female athletes and eating problems: A meta-analysis. *Int J Eat Disord*. 2000;27:371-380.
44. Ashley CD, Smith JF, Robinson JS, Richardson MT. Disordered eating in female collegiate athletes and collegiate females in an advanced program of study: A preliminary investigation. *Int J Sport Nutr*. 1996;6:391-401.
45. Rhea DJ. Eating disorder behaviors of ethnically diverse urban female adolescent athletes and non-athletes. *J Adolesc*. 1999;22:379-388.
46. Rumball JS, Lebrun CM. Use of the preparticipation physical examination form to screen for the female athlete triad in Canadian inter-university sport universities. *Clin J Sport Med*. 2005;15:320-325.
47. Bass M, Turner L, Hunt S. Counseling female athletes: Application of the stages of change model to avoid disordered eating, amenorrhea, and osteoporosis. *Psych Rep*. 2001;88(3 Pt 2):1153-1160.
48. Golden NH. A review of the female athlete triad (amenorrhea, osteoporosis and disordered eating). *Int J Adolesc Med Health*. 2002;14:9-17.
49. Vinci DM. Effective nutrition support programs for college athletes. *Int J Sport Nutr*. 1998;8:308-320.
50. Jacobson BH, Sobonya C, Ransone J. Nutrition practices and knowledge of college varsity athletes: A follow-up. *J Strength Cond Res*. 2001;15:63-68.
51. Brandon TA, Lamboni P. Care of collegiate athletes. *Md Med J*. 1996;45:669-675.
52. Clark KL. Working with college athletes, coaches, and trainers at a major university. *Int J Sport Nutr*. 1994;4:135-141.
53. McAdams MA, Van Dam RM, Hu FB. Comparison of self-reported and measured BMI as correlates of disease markers in US adults. *Obesity*. 2007;15:188-196.