

CURRENT KNOWLEDGE, PERCEPTIONS, AND INTERVENTIONS USED BY COLLEGIATE COACHES IN THE U.S. REGARDING THE PREVENTION AND TREATMENT OF THE FEMALE ATHLETE TRIAD

Kathleen J. Pantano, PT, PhD^a

ABSTRACT

Background. Coaches play an important role in the prevention of female athlete triad, but their current knowledge level, perceptions, and practice behaviors are not known.

Objectives. The purpose of this study was to describe the knowledge, perceptions, and behaviors college coaches have about the female athlete triad. This study's purpose was to describe the relationships between these variables, and to compare coaches having high levels of general knowledge about the triad with coaches having low levels of general knowledge with their perceptions, behaviors, and more specific knowledge about the triad.

Methods. A questionnaire was sent to 300 Division I collegiate coaches in the United States. Descriptive statistics, the Pearson product-moment correlation, and independent t-tests were used to describe the participants, relationships between variables, and compare groups of coaches with high and low levels of knowledge about the triad.

Results. Forty-three percent of the 91 college coaches responding to the survey (30% return rate) were able to correctly list the specific components of the disorder. Coaches with high levels of general knowledge about the triad had statistically significant differences in their perceptions, behaviors, and more specific knowledge of the triad than coaches with low levels of general knowledge about the triad.

Conclusion. The best intervention for the female athlete triad is prevention. Future education about the triad should focus on treatment and prevention

as well as specific factors related to the syndrome, such as nutritional requirements, methods of assessing menstrual irregularities, and screening techniques.

Key words: female athlete, disordered eating, menstrual dysfunction, osteoporosis

INTRODUCTION

Greater participation of women in sports has increased competition among female athletes. The desire to succeed in athletics, combined with the pressure to maintain a lean appearance may cause female athletes to intentionally or inadvertently restrict their dietary intake and train excessively. This desire may be particularly true for athletes who participate in sports having a competitive or aesthetic value on maintaining a lean appearance (cross-country, gymnastics, figure skating, and ballet).^{1,2} Female athletes may engage in disordered eating patterns to achieve a low body weight believing that it will improve their sports performance.³ The internal desire to achieve an "ideal appearance" may be intensified by external stresses, such as societal pressure to be thin and demands placed upon the athlete by coaches or parents to excel in their sport. Women who chose disordered eating patterns to attain a desired body weight and athletic performance may be at risk for developing a condition known as the female athlete triad.^{4,5} The female athlete triad includes three interrelated components that are often expressed on a continuum: disordered eating, menstrual dysfunction, and osteoporosis.

Disordered eating is a continuum of abnormal patterns of eating ranging from mild or occasional abnormal eating behaviors (restriction of high fat foods or episodic fasting) to the more extreme conditions of anorexia (voluntary starvation) and

^aRocky Mountain University of Health Sciences
Provo, Utah

bulimia (binging, followed by purging). Nutritional deficiencies resulting from caloric restriction or over-exercising may cause an irregularity or disruption of the menstrual cycle, known as oligomenorrhea (less than 8 menstrual cycles per year) or amenorrhea (a complete cessation of the menstrual cycle).⁶ Eventually, this condition can lead to osteoporosis (a loss of bone mineral density that is 2.5 standard deviation or more below the average bone mineral density (BMD) of young adult women) or osteopenia (a loss of BMD that is between 1.0 and 2.5 standard deviation below the average BMD of a young adult women) at an early age. The premature onset of osteoporosis in the young female athlete occurs at a time when peak bone mass is normally reached. In time, if not treated appropriately, the effects of this syndrome may be irreversible and eventually detrimental to the health of the athlete later in life.

The athlete who engages in inappropriate eating patterns or excessive behaviors to improve athletic performance may become nutritionally deficient if their energy intake (the amount of calories taken in) is less than the energy they have expended through intense training and exercise.⁷ A lack of energy or nutritional availability can have an effect on hormones responsible for the normal function of the menstrual cycle.⁸ Normal concentrations of the lutenizing hormone (LH) in the blood can become disrupted, limiting the secretion of estrogen by the ovaries.⁹ Lutenizing hormone is secreted from the pituitary gland when triggered by the release of the gonadotropin-releasing hormone (Gn-RH) from the hypothalamus.⁷ Suppression of the Gn-RH, thought to be initiated by a deficiency in energy availability or caloric restriction^{7,9}, can inhibit the release of LH. Low serum LH levels can result in oligomenorrhea or amenorrhea, the second condition of the triad.¹⁰ A subsequent loss of estrogen, combined with calcium and vitamin deficiencies, can lead to osteoporosis (a loss of bone mineral density), or osteopenia, a more common, less severe form of osteoporosis. Recent findings indicate, however, that the disruption in LH secretion resulting in amenorrhea can be prevented by proper nutrition.⁷

In children, bone mass increases until it generally reaches peak by about age 20.¹¹ Nutritional and hormonal deficiencies can impede this process and result in low bone mineral density. Although not entirely understood, failure to reach peak bone mass is thought to occur when the amount of bone reabsorbed by the body exceeds new bone formation. Low bone mineral density has been associated with the presence of stress fractures in the female

athlete¹² and may be one of the first clinical signs of an irreversible osteoporotic state. Failure for young women to reach peak bone mass at the appropriate time could result in accelerated rates of bone loss with aging and a greater risk of osteoporotic fracture in adulthood.⁶ To date, it is not known if large bone density losses can be reversed even when a woman's menstrual cycle returns when nutrition is improved. Preliminary evidence suggests that opportunity may exist for skeletal development to "catch-up" in bone mineral density, when interrupted in adolescence, even into the third decade of life.¹³ But this evidence was based on a single case study about an elite female athlete and other studies are needed to support this conclusion. One way of ensuring that peak bone mass is achieved during teen-age years is to make sure that the female athlete is receiving adequate nutrition per day. For example, a diet that includes an adequate amount of total calories, as well as a sufficient amount of micronutrients (such as calcium), is needed to meet the needs of the athlete's training program. Adequate nutrition is imperative for the prevention of osteoporosis, the final and most deleterious condition of the female athlete triad.

Coaches play an important role in the prevention of the female athlete triad. They have the ability to positively impact the female athlete by educating and encouraging them to adopt healthy patterns of behavior. Proper nutritional advice, training programs, screening tools, and referral to appropriate sources are essential to the prevention and treatment of the female athlete triad, but knowledge and understanding of the condition is required. The extent to which coaches know how to recognize, treat, and prevent the female athlete triad is not known. Determining where gaps in knowledge exist gives direction as to where education about the female athlete triad should be focused. Determining specific strategies that are effective is important in the treatment and prevention of the syndrome so that other coaches, health professionals, and parents involved in the care of the athlete can adopt these methods, as well.

The purpose of this study was to: 1) describe levels of knowledge, perceptions (attitude), and skills (behavior) collegiate coaches have about the female athlete triad; 2) describe the relationships between coach's knowledge of the female athlete triad and demographic/general practice information; 3) compare coach's general knowledge of the components of the female athlete triad with their perceptions (attitude), skills (behavior), and more specific knowledge of the syndrome; and 4) describe current

strategies used by college coaches for the prevention and treatment of the female athlete triad.

METHODS

A questionnaire was developed to gather data for this study consisting of a 5-page questionnaire divided into two parts. The first two pages of the survey were to be completed by all respondents. This first part consisted of 31 questions, including demographic and general practice information about the survey participants and an assessment of the coach's knowledge and perceptions about the female athlete triad. The coaches' response to this first part of the survey was converted into scales that were used for subsequent data analysis. For example, one question asked was: "Do you ask your female athletes about their menstrual cycle?" The response of the question ranged from the highest score of 5 (yes, 100% of the time) to the lowest score of 1 (no, never).

The second part of the survey (the remaining two pages of the questionnaire) was to be completed only by those participants who had in the last 24 months coached female athletes suspected of having the female athlete triad (for example, through observation or discussion with other health care professionals) or athletes who were medically diagnosed with the condition. Coaches who did not fit the criteria for continuation of the survey were finished with the survey and thanked for their participation in the study.

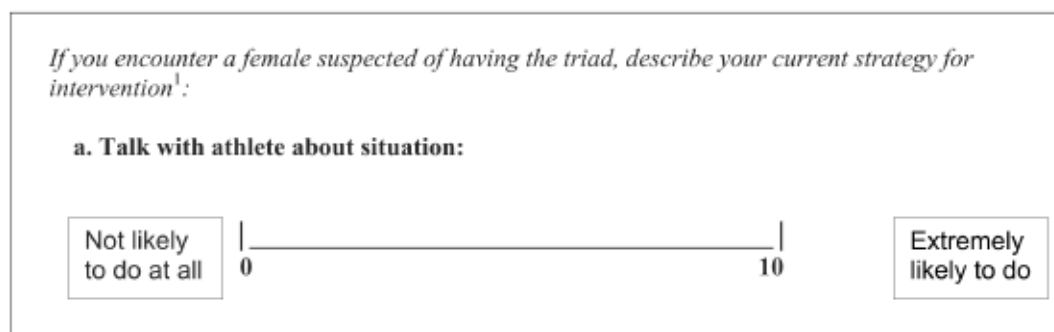
This second portion of the survey was designed to assess current strategies for treatment and prevention of the female athlete triad. Coaches were asked to describe the

likelihood they would use particular intervention strategies using 10-point Likert scales (0 indicating a behavior they were *not likely to do at all* and 10 indicating a behavior they were *extremely likely to do* (Figure 1). Finally, coaches were also asked if they currently screen or employ prevention strategies for the female athlete triad and were given an opportunity to describe in narrative form the specific strategies that they were using.

A prototype questionnaire was sent to a panel of 20 experts (90% response rate) who reviewed the survey for construct and content validity. Revisions were made to the survey based on recommendations made by the expert panel by consensus. The resulting 5-page survey consisted of a total of 36 questions, containing two parts.

The survey was sent to a systematic random sample of 300 Division I collegiate coaches involved in women's sports in the United States (U.S.), following approval by the Institutional Review Board at Drexel University. In the systematic random sampling process, subjects were selected from a database of coaches (a random selection of coaches in the U.S.) in a systematic fashion in that every third coach in the database was chosen for participation in the study. A cover letter and a self-addressed stamped envelope accompanied the survey. To increase the survey response rate, coaches who did not respond to the survey after one month of the first mailing were sent a letter of reminder and a second survey to complete. Survey questionnaires were returned anonymously. Completion of the questionnaire indicated informed consent to participate in the study.

FIGURE 1. An illustration of the 10-point scale used to determine the likelihood in which coaches incorporated intervention strategies for athletes suspected of having the female athlete triad. The results are listed in Table 7.



¹ Survey participants were asked to describe their current strategy for intervention by marking the scale (the horizontal line) with a vertical line or slash-mark that corresponded most closely with what they do (between not likely to do and extremely likely to do). The scale was measured in 10th's of a centimeter and entered into a database for subsequent statistical analysis.

Data analysis

Descriptive statistics were used to summarize demographic and general practice information supplied by the survey respondents. Participant responses to survey questions regarding general and specific knowledge about the female athlete triad were described as percentages. The Pearson product-moment correlation was used to describe the relationships between the coach's knowledge of the female athlete triad and demographic/general practice information (age, gender, years of practice, and the percentage of female athletes coached).

To allow the statistical comparison of general knowledge about the triad with perceptions (attitude) and behavior (skill) and more specific knowledge about the triad, coaches were divided into two groups: those who were "high" in their

general knowledge of the components of the female athlete triad and those who were "low" in their general knowledge about the triad. The classification of groups was based on the responses made to the

question which asked coaches to "list the 3 conditions of the female athlete triad". Respondents who were able to correctly identify all three components of the triad: disordered eating, menstrual dysfunction (amenorrhea, oligomenorrhea, or menstrual irregularity) and osteoporosis (osteopenia) scored the highest score of "3" for their responses. Participants who could not identify any of the components of the triad received a score of "0". Two-tailed independent sample t-tests were used to compare coaches who were "high" or "low" in their general knowledge of the components of the female athlete triad with their perceptions (attitude), behavior (skill), and more specific knowledge level about the prevention and treatment of the disorder. A correction for multiple comparisons using t-tests was made by adjusting the alpha level to $p < .002$ ($.05/25 = .002$). Qualitative information

about current strategies for treatment and prevention was analyzed, divided into themes, and summarized in narrative form.

RESULTS

Ninety-one U.S. collegiate coaches responded to the mailed survey (30% return rate). Demographic and general practice information about the survey respondents are summarized in Table 1 and Figure 2. The largest percentage of survey respondents were female (54.9%), between 25-35 years old (38.5%), and had 16 or more years of experience as a coach (45%). The primary sports that survey participants reportedly coached were basketball, track and field, gymnastics, cross-country, swimming, crew, rowing and diving. The sports coached by the respondents included many of the sports in which the

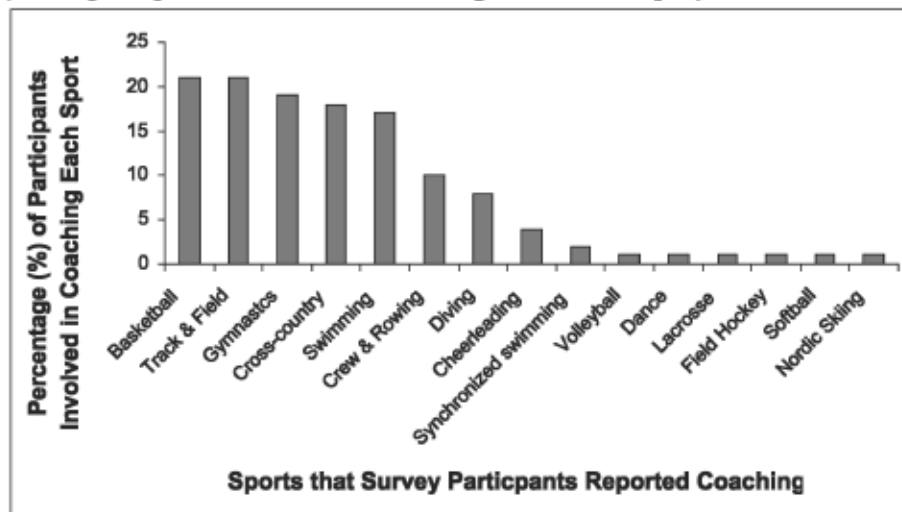
female athlete triad is considered to be most prevalent.¹⁵

Fifty-eight (64%) of the responding coaches reported having "heard of the female athlete triad" (Table 2). Forty-four of the 91 survey participants (48%) responded

"yes" when asked if they could identify the three distinct conditions of the female athlete triad, and approximately 39 coaches (43%) were able to correctly list the specific components of the triad (Table 2). A description of the coach's responses to questions reflecting specific knowledge, perceptions (attitudes), and behaviors (skills) about each of the three components of the triad are listed in Table 3.

A very low correlation was found between knowledge of the female athlete triad and gender of the coach ($r = .07$, $p = .52$). A coach's knowledge of the female athlete triad was also not related to the age of the coach ($r = -.035$, $p = .74$), years of experience as a coach ($r = -.06$, $p = .59$), and the number of female athletes coached ($r = -.13$, $p = .20$), respectively.

FIGURE 2: A description of the particular sports that the survey participant's reported coaching (several participants were involved in coaching more than one sport).



College coaches with a high level of general knowledge about the components of the female athlete triad (n = 52) had statistically significant differences in their perceptions (attitudes), behaviors (skills), and more specific knowledge of factors related to the female athlete triad than college coaches with low levels of general knowledge about the triad (n = 39). The results of these are detailed in Table 4 (a 3-point ordinal scale), Table 5 (a 5-point ordinal scale), and Table 6 (a 10-point ordinal scale). Specific strategies that coaches reported using for the treatment and prevention of the female athlete triad are described in Table 7.

DISCUSSION

The intent of this study was to determine the extent to which collegiate coaches in the U.S. know about the female athlete triad, the perceptions (attitudes) they have about the syndrome, and the behaviors (skills) that are currently being practiced. Understanding what coaches know about the female athlete triad and where information may be lacking helps direct where education needs to be focused. Based on the sample of collegiate coaches that responded to the survey, this study found that gaps in knowledge and misconceptions about the triad continue to exist. Although approximately 64% of the coaches participating in this study reported having heard of the female athlete triad, less than half (48%) thought

TABLE 1. Demographic and general practice information about the population of survey respondents

Demographic Variable	Frequency of Response (#)	Percentage (%) of Response
Gender: Female	50	54.9
Male	41	45.1
Age (years):		
< 25 years old	2	2.2
25-35 years old	35	38.5
36-45 years old	25	27.5
46-55 years old	24	26.4
56 years old or older	5	5.5
Years of Practice:		
Less than 1 year	2	2.2
1-5 years	11	12.1
6-10 years	18	19.8
11-15 years	19	20.9
16 or higher years	41	45.1
Estimated % of female athletes coached in last 12 months:		
0-5%	2	2.2
6-25%	4	4.4
26-50%	20	22.2
51-75%	65	71.1
76-100%		
How coach first came to know about the triad: (includes respondents who reported "knowing about the triad")		
Personal experience	11	12.1
Professional contact working with athletes	25	27.5
Research/literature	29	31.9
School/educational seminar	37	40.7
Other*	10	11.0

*From athletic trainers, athletes, teammates (college experience as an athlete), teaching, personal experience with daughter, HBO television special, internet, seminar at Princeton.

they could identify its components, and only 43% were actually able to correctly list all of the three components of the triad (Table 3). This finding suggests that although the majority of the survey respondents were familiar with the term "female athlete triad", many did not know what the specific components of the triad were and may have overestimated their knowledge level.

TABLE 2. Coach's responses to general and specific knowledge questions about the female athlete triad (n = 91).

Survey Question	Survey Response	Percentage (%) of Response
<i>"Have you ever heard of the Female Athlete Triad?"</i>	"Yes"	63.7
	"No"	33.0
	"Not sure"	3.3
<i>"Can you identify the 3 distinct conditions associated with the Female Athlete Triad?"</i>	"Yes"	48.3
	"No"	41.7
	"Not sure"	10.0
<i>"Please list each of the specific components of the Triad"</i> *	Disordered eating	43.9
	Menstrual dysfunction	56.0
	Osteoporosis	52.7
	All three components	42.9

*The percentages represent the total number of respondents able to correctly list the component(s) of the female athlete triad.

It was interesting to note that for the group of collegiate coaches studied, no relationship existed between knowledge of the female athlete triad and gender, years of experience as a coach, and the number of female

TABLE 3. Coach's responses to survey questions about the three components of the female athlete triad, reflecting specific knowledge, perceptions and skills used (n = 91).

Survey Question	Survey Response	Percentage (%) of Response
DISORDERED EATING		
"When coaching female athletes, have you noticed any disordered eating behaviors?"	Yes	87.9
	No	12.1
"Do you ask female athletes questions to try to expose any type of abnormal eating pattern?"	Yes, > 50% of the time	38.5
	Yes, 25-49% of the time	7.7
	Yes, < 25% of the time	35.2
	No	17.6
	Missing	1.0
"Are you comfortable discussing disordered eating with female athletes?"	Yes	86.8
	No	13.2
"Do you think emotions affect how a female athlete may eat or exercise?"	Yes	99.0
	I don't know	1.0
"Do you assess or have body fat assessed on your athletes?"	Yes	27.5
	No	57.1
	Sometimes	15.4
MENSTRUAL DYSFUNCTION		
"Do you believe that irregular menstruation or absent menstruation is a normal consequence of exercise in female athletes?"	Yes	24.2
	No	71.4
	Not sure	3.3
	Do not know	1.1
"Do you ask your female athletes about their menstrual cycle?"	Yes, 100% of the time	8.8
	Yes, @ 50-99% of the time	17.6
	Yes, @ 25-49% of the time	8.6
	Yes, < 25% of the time	28.6
	No, never	36.3
"Do you assess menstrual history in your female athletes if you are suspicious of irregular menstruation?"	Yes, 100% of the time	34.5
	Yes, @ 50-99% of the time	13.8
	Yes, @ 25-49% of the time	5.2
	Yes, < 25% of the time	24.1
	No, never 100% of time	22.4
"Are you comfortable discussing menstrual irregularity with female athletes?"	Yes	81.3
	No	18.7
"A loss or irregularity of the menstrual cycle may result in the following (mark all that apply):" *	Improved bone growth	1.0
	Improved athletic performance	8.0
	Hot flashes	11.0
	Stress fractures	69.3
	Do not know	28.4
OSTEOPOROSIS		
"What is the suggested intake of calcium for females, ages 11-24 years according to the NIH?"	401-800 mg	8.8
	801-1200mg	13.2
	1201-1500 mg	15.4
	Not sure	28.6
	Do not know	34.1
"Please indicate the age range in which peak bone mineral density in women is reached."	11-14 years	3.3
	15-18 years	26.4
	19-22 years	33.0
	Not sure	20.9
	Do not know	16.5
"How often have you encountered or treated a female athlete with a stress fracture?"	Never	11.0
	1-5 times	52.7
	6-10 times	19.8
	11 or more times	16.5
"Do you believe that bone mineral density needs to be measured in female athletes when they have abnormal or absent menstruation?"	Yes	72.5
	No	0.0
	Not sure	27.5
"Indicate when it might be appropriate for women to be screened for osteopenia or osteoporosis if they had a history of the female athlete triad in high school?"	Immediately when diagnosed	52.7
	Within 1 year	11.0
	Not sure	18.7
	Do not know	17.6
	Never	0.0
*Percent values represent those responding "yes" to each of the answers provided.		

TABLE 4: t-test results showing the items that were statistically significant when comparing coach’s “knowledge score” (ability to correctly list each of the three components of the female athlete triad) with perceptions, behaviors, and more specific knowledge factors related to components of the triad, by the survey respondents. The responses to the questions in this table were rated on a 3-point ordinal scale ($p < .05$) ($n=91$).

	Mean Values		t-value	p-value
	General Knowledge Level “LOW” Knows none of components of the triad. (n = 39)	“HIGH” Knows all three components of the triad. (n = 52)		
ATTITUDE, BEHAVIORS & SPECIFIC KNOWLEDGE				
<i>Do you believe that a loss/irregularity of the menstrual cycle may result in stress fractures?</i>	.36	.90	-6.60	.0001
<i>Have you encountered a female athlete with a stress fracture?</i>	2.05	2.69	-3.59	.001
<i>Indicate when it might be appropriate for women to be screened for osteopenia/osteoporosis if had a history of the triad in high school.</i>	.21	.77	-6.36	.0001
<i>Would you know how to recognize the signs and symptoms of the triad?</i>	1.31	1.93	-4.68	.0001
<i>Would you know how to treat a female athlete with signs and symptoms of the triad?</i>	1.15	1.62	-4.93	.0001
<i>Do you currently screen for any of the conditions associated with the triad during sport pre-participation evaluations?</i>	1.03	1.39	-4.17	.0001
<i>Do you currently use prevention strategies?</i>	1.13	1.87	-4.29	.0001

athletes coached. One might have predicted that since the triad occurs in female athletes; female coaches, coaches more exposed to female athletes, and those with more coaching experience may have been more knowledgeable about the syndrome, but this was not the case. The results suggest that knowledge about the female athlete triad is neither gender specific or based on the amount or type of coaching experience. The fact that knowledge about the triad was not influenced by certain demographics may be useful information to consider when educating coaches about the condition. It is the author’s opinion that all coaches, regardless of sex, years of experience and proportion of females athletes coached, should have an awareness and understanding about the female athlete triad.

Specific Knowledge

When comparing more specific knowledge items on the survey, coaches who had a high level of knowledge of the components of the triad, compared to those with low levels of knowledge, were more likely to recognize the signs and symptoms of the triad, understand that absent or irregular menstruation could lead to stress fractures, and knew when it was most appropriate for women, with a history of the female athlete triad in high school to be screened for osteoporosis (Table 5). The findings suggest that coaches with a more general

understanding of the components of the triad had better awareness of specific information related to the female athlete triad.

Behavior (skill)

Although knowledge and awareness about the female athlete triad is essential in the treatment and prevention of the condition, certain skills or behaviors need to be implemented to make this happen. The results of this survey indicate that the likelihood of asking female athletes about their menstrual cycle, assessing menstrual history with their female athletes, and encountering female athletes with stress fractures was significantly higher in coaches that had more knowledge about the triad than

TABLE 5: t-test results showing the items that were statistically significant when comparing coach's "knowledge score" (ability to correctly list each of the three components of the female athlete triad) with behaviors by the survey respondents, related to questions asked of female athletes about their menstrual cycle. The responses to the questions in this table were rated on a 5-point ordinal scale ($p < .05$) ($n=91$).

	Mean Values		t-value	p-value
	General Knowledge Level			
	"LOW" Knows none of components of the triad. (n = 39)	"HIGH" Knows all three components of the triad. (n = 52)		
ATTITUDE, BEHAVIORS & SPECIFIC KNOWLEDGE				
<i>Do you ask female athletes about their menstrual cycle?</i>	3.27	4.18	3.33	.001
<i>Do you assess menstrual history in your female athletes if you are suspicious of irregular menstruation?</i>	2.05 3.13	4.31	3.53	.0001

TABLE 6: t-test results showing the items that were statistically significant when comparing coach's "knowledge score" (ability to correctly list each of the three components of the female athlete triad) with current strategies used by survey respondents for intervention. The responses to the questions in this table were rated on a 10-point ordinal scale (refer to figure 1 for illustration). ($p < .05$) ($n=91$).

	Mean Values		t-value	p-value
	General Knowledge Level			
	"LOW" Knows none of components of the triad. (n = 39)	"HIGH" Knows all three components of the triad. (n = 52)		
<i>If you encounter a female athlete suspected of having the triad describe your current strategy for intervention:</i>				
Talk with athlete	1.17	5.10	4.69	.0001
Talk with athlete's parents, if a minor.	.68	3.28	3.94	.0001
Contact team or athlete's physician	1.36	5.05	4.16	.0001
<i>If you encounter a female athlete suspected of having the triad describe your likelihood in coordinating multi-disciplinary involvement with a:</i>				
Nutritionist	1.26	4.72	3.93	.0001
Athletic trainer	1.30	4.58	3.74	.0001
Physical therapist	.76	1.34	1.13	.243*
Mental/Behavioral health practitioner.	1.06	4.35	3.96	.0001

*This item was not statistically significant, but was included in this report to illustrate all the health professionals that coaches were asked to rate in this question.

those who had less knowledge about the triad (Table 5). Collegiate coaches who were more knowledgeable about the triad appeared to be more likely to apply skills that exposed components of the triad and were coaches who had more exposure to athletes with stress fractures. These findings suggest that knowledge influenced the coach's actions in discussing the menstrual cycle with female athletes. In addition, experience in dealing with an athlete with a stress fracture may have influenced the coach's knowledge of the triad.

Perceptions (attitudes)

One of the more interesting findings of this study was the fact that some coaches (24%) believe that irregular or absent menstruation is a "normal" consequence of exercise. Another 4% of the responding coaches stated they were "not sure" or "did not know" if this fact was true (Table 4). Some female athletes, as well as coaches, may erroneously believe that absent menstruation is a normal response in exercising women. The coaches may recognize amenorrhea as a sign of a dedicated, hard-working athlete who trains intensively, rather than as a warning sign that the athlete may be nutritionally deficient. Increasing knowledge and recognition of the female athlete triad among college coaches requires proper education about the syndrome, so that certain myths such as these can be discarded.

Treatment/Intervention

Coaches with higher levels of knowledge about the female athlete triad were more likely to know how to treat a female athlete with the signs and symptoms of the triad, employ preventative strategies, and screen for the triad during sports pre-participation physical evaluations than those with lower levels of knowledge (Table 5). The findings were not surprising given that the ability to treat and use preventative strategies and screening tools would be factors that knowledge would impact.

Because of the complex nature of the syndrome, intervention strategies are most likely to be successful when they include a multidisciplinary team approach. Coaches need to encourage and communicate healthy nutrition and training but must call on the support of other health care professionals when appropriate and necessary. Collegiate coaches having a high level of knowledge of the components of the triad, who encountered a female suspected of having the triad, were more likely to talk with the athlete about it, talk with the athlete's parents, if a minor, and contact a team or personal

physician about the athlete's condition, (Table 5) than those with a low knowledge level. Coaches with higher levels of knowledge about the triad were also more likely to coordinate a multidisciplinary assessment with a nutritionist, an athletic trainer, and a mental health practitioner, but not a physical therapist (Table 5). It was encouraging to note that coaches who had knowledge about the triad were employing a team approach that addressed important, but differing issues of the triad: dietary/nutritional, psychological, physical training, and general medical concerns. The methods in which coaches applied this approach are useful in that they can serve as a model for those who are not currently utilizing a specific plan for intervention.

It was interesting to note that physical therapists were not included in this multi-disciplinary team. This finding may be explained by the fact that coaches may work more closely with an athletic trainer than a physical therapist, and that the athletic trainer may fulfill the coach's need for advice about physical training and conditioning. It is also quite possible that coaches may not perceive physical therapists as having a role in the treatment of the female athlete triad. Perhaps this opinion is due to the limited extent that physical therapists may have in nutritional education or due to the thought that physical therapists may not become involved in the care of an athlete until an injury, such as a stress fracture, occurs. This time might be when the athlete may undergo a more formal rehabilitation program that is provided by a physical therapist before returning to sports participation. It is important for coaches to understand that physical therapists may also play a role in the treatment and prevention of this disorder, particularly when an athletic trainer may not be available. The physical therapist can give suggestions for maximizing bone health in young females, educate athletes in preventing future stress fractures by alternating impact training with weight training, and participate in school activities and educational programs for the athlete and the athlete's parents.¹⁴

Lastly, collegiate coaches using prevention strategies for the female athlete triad were given an opportunity to describe the methods they currently use in narrative form. These suggestions were compiled in Table 6. Strategies included educating individual and team members on healthy living and healthy eating, open communication between the coach and athlete, and referring to other health care professionals when necessary. More specific strategies included those that emphasized a

TABLE 7. A description of specific treatment and prevention strategies used by a sample of college coaches in the United States for the female athlete triad.

Specific Strategies Used by a Sample of Coaches in the U.S. for the Prevention of the Female Athlete Triad
<p>I. Direct Intervention by Coaches</p> <p><i>With athlete:</i></p> <ul style="list-style-type: none"> • Educate individual athlete and team on healthy living and healthy eating. • Have open communication between the athlete and coach. • Provide handouts on recent literature. • Engage individual/team in preseason discussions about triad. • Immediately address the emotional needs of the athlete. • May need to determine if athlete is in appropriate weight class for the sport and restrict supervised weigh-ins to lightweight rowing only. • Avoid “undersizing” uniforms; they encourage the athlete to lose weight. • A food journal or a menstrual cycle journal are required. • All athletes, men and women, are educated on the importance of nutrition. We provide packets of suggested meals and snacks that are easy to prepare on a college budget and talk openly about drug and alcohol abuse. • Eliminate athlete from competition, if diagnosed as anorexic or bulimic. • Weight lifting, impact sports are encouraged to increase bone mass. <p><i>With other health care professionals:</i></p> <ul style="list-style-type: none"> • Nutritionists consult athlete on a regular basis to discuss calcium, vitamin D, and nutritional needs. • Coaches, team physicians, athletic trainers, and nutritionists work together to discuss warning signs or symptoms that may be observed in the athlete and devise a comprehensive nutritional plan and training program for the athlete. • Mandatory meetings are held with nutritionists and sports psychologists who specialize in eating disorders. • Team physician monitors for the presence of amenorrhea during physicals. • Intervention starts with the team physician. As coaches, we never try to solve the problem ourselves; we involve a multidisciplinary team of medical professionals. • A comprehensive screening, assessment and educational program in place, which is supported by college staff and resources. • Behavioral contracts are used to assure that the athlete is compliant in behavioral changes, for example, if athletes do not keep appointments with health professionals, they cannot practice or compete.
<p><i>Referrals sources most frequently used and rationale:</i></p> <p>Nutritionist/Dietitian</p> <ul style="list-style-type: none"> • Educate individuals/team on healthy eating strategies • Educate about the components of the triad • Set realistic body image/goals for athlete

degree of accountability for the athletes’ actions, such as keeping a food journal, a menstrual cycle journal, and devising behavioral contracts that enforced exclusion from sports practice or participation if the contract was not kept. Information provided by the responding coaches included roles that other health professionals play in the treatment of the disorder and the support that they receive within their individual programs. This informa-

tion provides a glimpse of what collegiate coaches are currently doing for the prevention and treatment of the female athlete triad and is a valuable resource for others to draw from. For example, this information may educate other coaches and health care professionals on how to initiate a prevention and treatment program if they were previously unsure about how to proceed.

Clinical Relevance and Future Direction

Since the American College of Sports Medicine (ACSM) published its first position paper about the female athlete triad in 1992,⁵ an extensive amount of information about the female athlete triad has been published and made available to the general public. Despite efforts to increase exposure about the devastating effects that the female athlete triad may have on women, the condition may often go unnoticed. This lack of understanding can be attributed to the complexity of each of the conditions or due to the fact that each of the components is expressed on a continuum rather than as separate or discrete disorders. The different types of disordered eating patterns or the underlying psychological reasons an athlete may decide to practice inappropriate eating patterns may not be easily recognized or understood. Recognition and prevention of

the female athlete triad by coaches and other health care professionals requires knowledge and close attention to the athlete's nutrition and training habits. Preventative measures can begin by screening

athletes for the disorder and educating or guiding athletes to adopt healthy nutritional and training habits. Coaches should know when it is appropriate to refer the athlete to another health professional for treatment. When recognized early, treatment can avoid progression of the stages and the most severe effect, the development of osteoporosis.¹⁵⁻¹⁸

Coaches are involved first-hand in the care of the female athlete and may be the first ones to notice abnormal or inappropriate eating or training behaviors. It is therefore important that the coaches understand the female athlete triad and its complexities. This study was relevant in that it provided a base-line understanding of knowledge collegiate coaches had about the female athlete triad. This study was also important to describe how levels of knowl-

edge influenced the coach's perceptions and behaviors about the triad. While significant differences in attitude and behavior were found between groups of coaches with high levels of knowledge and those with low levels of knowledge about the triad, it is important to mention that 40% (21/52) of coaches who had a high level of knowledge did not report incorporating strategies for intervention. As evidenced by the low mean values for the high knowledge group when current strategies for intervention were assessed (Table 5). Using a scale of 0-10 (Table 1) the highest mean values for *current strategies for intervention* were "talking with the athlete" (5.1) and "contacting the team or athlete's physician" (5.05). This finding indicates that recognizing what the three components of the triad are does not necessarily mean there is an understanding of how the condition should be treated or prevented. Given the

results of this study, it is likely that educating collegiate coaches about the female athlete triad needs to be focused towards how the triad should be treated and prevented, as well as to increase specific knowledge about the condition.

Athletic Trainer <ul style="list-style-type: none">• Educate individual/team; monitors athlete with signs and symptoms.• Educate on triad and where to seek help (from other health professionals)
Team Physician/MD/Nurse Practitioner <ul style="list-style-type: none">• Prescribes bone density tests; prescribes birth control pills, if amenorrheic.• Blood testing• Calcium/Vitamin D supplements• Medication or estrogen supplements; sometimes administer fosamax.• Monitor athlete on a regular basis• Use of physicals to screen athlete for triad; for example, questioning athletes about their menstrual cycle during preseason physical exams.• Educate individual and/or team about the triad.
Health Centers <ul style="list-style-type: none">• Educate team on health center services.• Follow University protocol for treatment of athlete.• Collaborate athlete's plan of care with athletic trainer, team physician, nutritionist

Educating college coaches about the specifics of the condition should include nutritional requirements for the female athlete, recognizing behaviors or conditions that may signal a "red-flag" for medical intervention, recognizing individual coach's comfort levels with addressing the conditions of the triad with the athlete, and determining when medical screening and intervention is necessary. Future directions could include assessing levels of knowledge about the female athlete triad in high school coaches and educating them about prevention and treatment of the syndrome as necessary. High school coaches can instill and promote healthy habits in female athletes early on, so that by the time the athlete competes on a collegiate level, positive behaviors are already well established.

The information that collegiate coaches in the U.S. provided as to specific strategies for prevention and treatment of the female athlete triad was interesting and insightful. The suggestions provided can help others formulate decisions as to how they might implement these strategies in their athletic programs. While this study focused on collegiate coaches and collegiate female athletes, it is important to be aware that the conditions of the triad are also present in normal active females, who are not necessarily involved in college sports. Education and preventative measures regarding disordered eating, menstrual dysfunction, and the development of osteoporosis should then extend to include all physically active girls and young women.¹⁵

Lastly, a limitation of this study was the small sample of coaches that responded to the mailed questionnaire (30%). It is possible that the responses from the participating coaches did not accurately represent levels of knowledge, perceptions, and behaviors practiced by the majority of population of collegiate coaches in the U.S. Non-respondents to the survey may have had differing levels of knowledge, perceptions, and behaviors that may have not been reflected in the observed results. Another limitation of this study was the possibility that survey respondents may have consulted different resources to find answers to the survey questions prior to returning the survey, which may have inflated the reported results on knowledge about the female athlete triad. In addition, by classifying survey respondents into "high" and "low" knowledge levels by their ability to correctly list the components of the triad may not have necessarily tested their depth of understanding of the syndrome, including their ability to treat and prevent the condition.

CONCLUSION

Women's participation in sports will likely continue to increase, as might their risk of developing the female athlete triad, unless preventative strategies are put into practice. Coaches play an important role in the prevention of the female athlete triad by encouraging healthy patterns of behavior and recognizing when warning signs are present, but adequate knowledge of the condition is necessary. This study suggests that educating collegiate coaches about the female athlete triad should focus more on specific factors related to the syndrome, such as nutritional requirements, methods of assessing menstrual irregularities, and proper screening techniques. Prevention may include the use of comprehensive sports pre-participation examinations and carrying out some of

the methods of intervention suggested by the participating collegiate coaches surveyed in this study.

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CORRESPONDENCE

Kathleen J. Pantano, PT, PhD
Assistant Professor, College of Science
Department of Health Sciences,
Physical Therapy Program
Cleveland State University
2121 Euclid Avenue
Cleveland, Ohio 44115
Phone: 216-687-3661
Fax: 216-687-9316
Electronic mail: k.pantano@csuohio.edu

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