

Risk and trigger factors for the development of eating disorders in female elite athletes

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ABSTRACT

SUNDGOT-BORGEN, J. Risk and trigger factors for the development of eating disorders in female elite athletes. *Med. Sci. Sports Exerc.* Vol. 26, No. 4, pp. 414–419, 1994. This study examined risk factors and triggers for eating disorders in female athletes. Subjects included were all of the elite female athletes in Norway ($N = 603$), ages 12–35 yr, representing six groups of sports: technical, endurance, aesthetic, weight dependent, ball games, and power sports. The Eating Disorder Inventory was used to classify individuals at risk for eating disorders. Of the 117 athletes defined as at risk, 103 were administered a structured clinical interview for eating disorders. A comparison group was also interviewed, consisting of 30 athletes chosen at random from a pool not at risk and matched to the at-risk subjects on age, community of residence, and sport. Ninety-two of the at-risk athletes met criteria for anorexia nervosa, bulimia nervosa, or anorexia athletica. The prevalence of eating disorders was higher in sports emphasizing leanness or a specific weight than in sports where these are less important. Compared with controls, eating disordered athletes began both sports-specific training and dieting earlier, and felt that puberty occurred too early for optimal performance. Trigger factors associated with the onset of eating disorders were prolonged periods of dieting, frequent weight fluctuations, a sudden increase in training volume, and traumatic events such as injury or loss of a coach.

ELITE FEMALE ATHLETES, EATING DISORDERS, RISK AND TRIGGER FACTORS

In recent years, there has been growing interest in eating disorders in athletes (7,30). Studies have shown that athletes are more prone to developing eating disorders than nonathletes (4,5,21,28). In addition, the highest prevalence of eating disorders is in female athletes competing in sports where leanness and/or a specific weight are considered important for either performance or appearance (4,27,28).

There has been considerable speculation about why athletes are at increased risk for eating disorders. Predisposing personality or family interaction variables might be primary (3,26,32), so participation in sports favoring leanness could be a consequence of preexisting eating problems or could be coincidental. Alternatively, participation in certain sports could be related causally to the onset of eating disorders. In all likelihood, these factors

interact. One important area of inquiry, therefore, is to identify risk factors to help determine which athletes are most vulnerable, or which conditions or trigger factors elicit the pathological behavior.

The primary aim of this study was to examine risk factors for eating disorders along with trigger factors that may be responsible for precipitating the onset or exacerbation of eating disorders. Elite female athletes were studied to identify risk and trigger factors for anorexia nervosa, bulimia nervosa, and anorexia athletica (a sub-clinical but serious problem specific to athletes) (28).

METHODS

Subjects

This study took place in three phases: initial screening, identification of athletes at risk for eating disorders, and a detailed clinical interview of at-risk and control subjects. Subjects for the initial screening phase were 603 female athletes comprising the total population of elite female athletes in Norway ages 12–35 yr. Permission to undertake the study was provided by the Norwegian Confederation of Sports (NCS), the Medical Association of the NCS and the Data Inspectorate. The Secretary General of each Sport Federation of the NCS received detailed written information about the procedures and aims of the study, and was asked to return a list containing names, ages, and addresses of all eligible female athletes in their federation. Lists were obtained from all secretary generals.

In this study an elite athlete was defined as one who qualified for the national team at junior or senior levels, or was a member of a recruiting squad for those teams. They had to be ages 12–35, train at least $8 \text{ h}\cdot\text{wk}^{-1}$, and continue to compete during the next 6 months. All had to fill in the questionnaire completely. Ongoing pregnancy or the intention to stop training or competing within the next 6 months were exclusion criteria.

The 603 eligible athletes were sent a battery of assessment questionnaires. All subjects had to complete a consent form; written parental consent was required from those under age 18. Of the initial 603 individuals, 4 were

in treatment for eating disorders and refused to participate, and 36 did not respond for reasons unknown. An additional 41 did not meet inclusion criteria; 5 were too young, 7 were too old, 5 were pregnant, 11 did not meet the criteria for training volume, 5 intended to stop competing, and 8 did not fill the questionnaire completely. Complete responses were obtained from 522 (86%) of those contacted originally. This represents 93% of the eligible subjects.

The athletes represented 35 sports/events, which were divided into six different sport groups; technical, endurance, aesthetic, weight dependent, ball games and power sports (Table 1). The criteria for categorizing sports have been described elsewhere (29).

In the second phase of the study, subjects at-risk for eating disorders ($N = 117$) were identified by their scores on the Eating Disorder Inventory (described below). Fourteen of these did not participate in the subsequent phase (clinical interview); two had become pregnant, seven were studying abroad, two were not allowed to participate by parents, and three did not participate for unknown reasons. Thus, 103 athletes at risk were available for the clinical interview.

An athletic control group was formed during this second phase. A group of athletes from the initial pool was identified who did not have elevated scores on the Eating Disorder Inventory and who were matched to the at risk athletes on age, community of residence, and sport. Thirty athletes were chosen at random from this group and served as athletic controls.

The third phase of the study involved the interview and clinical examination described below. The sample for this phase consisted of the 103 at-risk athletes and the 30 athletic controls.

Assessment Procedures

General survey. A questionnaire was developed to assess weight history, menstrual history, physical activity patterns, dietary history, nutritional habits, and use of pathogenic weight control methods.

Eating Disorder Inventory (EDI). This 64-item test was developed by Garner and colleagues (13) to assess

attitudes and behaviors that occur in individuals with eating disorders. The psychometric properties of the EDI have been established, and the instrument has good validity and reliability (13). A Swedish version of the EDI has been developed and tested for psychometric properties (20) and was used in this study (after translation to Norwegian). There are few cultural differences between Sweden and Norway, hence this instrument was considered culturally appropriate.

The EDI has eight subscales: Drive for Thinness, Bulimia, Body Dissatisfaction, Ineffectiveness, Perfectionism, Interpersonal Distrust, Interoceptive Awareness, and Maturity Fears. Subjects at risk for eating disorders were defined as those with elevated scores on the Drive for Thinness and Body Dissatisfaction subscales (>15 and >10 , respectively). A conservative cutoff point for identifying college women as weight preoccupied is a score at or above the mean for anorectic patients on the Drive for Thinness subscale (i.e., a score > 15) (13). Therefore, the definition of at risk subjects in this study should provide a conservative definition of "at risk" and minimizes false positives, because high scores on these subscales are truly characteristic of individuals with eating disorders (13,14). Examples of questions from these two subscales are: "I am preoccupied with the desire to be thinner"; "If I gain a pound, I worry that I will keep gaining"; "I think my thighs are too large." The athletic control group did not have elevated scores on these two subscales.

Interview and clinical examination. Interviews were conducted on 133 subjects (103 at-risk and 30 control athletes). The interview protocol was developed as part of the Diagnostic Survey for Eating Disorders (16), a standardized instrument used to characterize various aspects of anorexia nervosa and bulimia nervosa. The interview is divided into 12 sections; demographic factors, weight history and body image, dieting history, binge eating and purging, training routines, affective disorders, sexual functioning, life adjustment, menstrual history, medical history, psychiatric history, and family history of eating disorders. Sport-specific questions were also asked, and athletes were questioned about their ideas on the development of disordered eating. The interviews

TABLE 1. Sport groups.

Technical G ₁ (<i>n</i> = 98)	Endurance G ₂ (<i>n</i> = 119)	Aesthetic G ₃ (<i>n</i> = 64)	Weight dep. G ₄ (<i>n</i> = 41)	Ball games G ₅ (<i>n</i> = 183)	Power G ₆ (<i>n</i> = 17)
Alpine skiing	Biathlon ^a	Diving	Judo	Badminton	Discus
Bowling	Cross country-skiing	Figure skating	Karate	Bandy ^b	Javelin
Golf	Cycling	Gymnastics	Wrestling	Basketball	Power lifting
High jump	Dog racing	Rhythmical gymnastics		Soccer	Shot put
Horseback riding	Middle-distance and long-distance running	Sports dance		Table tennis	Sprint
Long jump	Orienteering			Team handball	
Rifle shooting	Race walking			Tennis	
Sailing	Rowing			Volleyball	
Sky diving	Speed skating			Underwater rugby	
	Swimming				

^a Biathlon: a competitive event where cross-country skiing and rifle shooting are combined.

^b Bandy: landhockey on ice.

required from 40 min to 3 h, and all were taped. DSM-III-R criteria (1) were used to define anorexia nervosa and bulimia nervosa; anorexia athletica was defined using the criteria in Table 2.

The clinical examination included an extensive medical evaluation. Relative fat was calculated on the basis of skinfold measurements (25). Several hematologic and endocrine measures were also taken, but they will not be reported in this paper. Data concerning possible risk factors and trigger variables are presented here.

Statistical Methods

Results are expressed as mean values and standard deviations. Comparison between the two groups was carried out by using two sample student *t*-test (18). All tests were two-tailed. Differences were considered significant for *P*-values equal to or less than 5%. Chi-squared test for contingency tables were employed for test of significance (19).

RESULTS

Descriptive data on the athletic controls and on athletes who met the criteria for anorexia nervosa, bulimia nervosa or anorexia athletica in each sport category are provided in Table 3. Two athletes representing the power sports were classified as "at risk." One did not participate in the clinical interview and one met the criteria for bulimia nervosa. Since only one of the athletes representing the power sports met the criteria for an eating disorder, she was not included in the statistical analyses were the sport groups were compared (Table 3).

Athletes competing in the aesthetic and endurance sports were leaner and had a significantly higher training volume than athletes competing in the other sports ($P <$

0.05). The prevalence of eating disorders was significantly higher among athletes in aesthetic and weight dependent sports than in the other sport groups ($P <$ 0.05) (Table 3).

Ninety-two (89%) of the athletes classified as "at risk" of developing eating disorders fulfilled criteria for anorexia nervosa ($N = 7$), bulimia nervosa ($N = 42$), or anorexia athletica ($N = 43$). These athletes were grouped and considered the Eating Disordered (ED) athletes. Table 4 presents data on the primary variables of interest comparing the ED athletes ($N = 92$) with controls ($N = 30$). The ED athletes and controls had similar mean values for menarcheal age and body weight, while ED athletes had a lower self-defined "ideal" weight ($P <$ 0.01), and a lower percentage of body fat ($P <$ 0.01).

Thirty-two (35%) of the ED athletes and three (10%) of the controls reported they reached menarche and developed secondary sex characteristics "too early." The mean menarcheal age of these athletes was 12.8 ± 1.1 yr. Sixty-five percent of these 32 ED athletes competed in aesthetic sports; their mean menarcheal age was 12.5 ± 1.2 yr. ED athletes began sport-specific training (11.2 ± 2.4 yr) and dieting (14 ± 3.5 yr) significantly earlier than controls (13.0 ± 1.5 yr and 16.3 ± 1.9 yr, respectively) ($P <$ 0.01). Significantly more controls (62%) than ED athletes (34%) had participated in other sports (but not at a competitive level) prior to participation in their current sport ($P <$ 0.05).

Eighty-five percent of the ED athletes and 27% of the controls were dieting. The reported reasons for dieting are presented in Table 5. Key reasons were to improve performance or appearance, or to comply with recommendations by a coach. Of the 78 ED athletes who dieted to improve performance, 52 (67%) were told to do so by their coach. Only 10% of these ED athletes as opposed to 75% of the dieting controls were provided guidance for weight reduction.

All ED athletes were asked: "Do you have any suggestions as to why you developed an eating disorder?" Eighty-five of the ED athletes gave a reason, while 15% did not. The reasons are listed in Table 6.

Information collected during the interviews was combined with the specific reasons given by the athletes to define possible trigger factors associated with the development of eating disorders. These could be grouped into the three categories listed below; 41%, 48%, and 11% of the ED athletes were classified into groups 1, 2, and 3, respectively.

Group 1. Prolonged periods of dieting (defined by the athletes as caloric intake of $400\text{--}1800$ kcal·d⁻¹) or weight fluctuations (> 4 kg $>$ 6 times·yr⁻¹).

Group 2. Traumatic events, including illness or injury to self or a family member, new coach, casual comments about weight, leaving home, failure at school or work, family problems, problem in a relationship, death of a significant other, sexual abuse, and work transition.

TABLE 2. The criteria for anorexia athletica.

	Anorexia Athletica
Common Features	
Weight loss ^a	+
Delayed puberty ^b	(+)
Menstrual dysfunction ^c	(+)
GI complaints	+
Absence of medical illness or affective disorder explaining the weight reduction	+
Disturbance in body image ^d	(+)
Excessive fear of becoming obese	+
Restriction of caloric intake ^e	+
Use of purging methods ^f	(+)
Binge eating ^d	(+)
Compulsive exercising ^d	(+)

Modified from Pugliese, 1983 (22).

+ = criteria that all had to meet; (+) = AA athletes met one or more of these (relative) criteria.

^a $>$ 5% of expected body weight.

^b No menstrual bleeding at age 16 (primary amenorrhea).

^c a) Primary amenorrhea; b) secondary amenorrhea; c) oligomenorrhea.

^d Defined in DSM-III-R (1).

^e To initiate the weight loss they all reported the use of "diets" at or below 1200 calories (duration of period not defined).

^f Self-induced vomiting, laxatives, and diuretics.

TABLE 3. Characteristics of the eating disordered athletes representing the different sport groups and athletic controls.

Sport Groups	N	Age (yr)	BMI	Training Volume	% with High EDI*	% with ED**
Technical sports	13	19 (14-30)	21 (17-26)	14 (12-19)	21	14
Endurance sports	24	22 (15-28)	20 (15-22) ^b	21 (19-26) ^c	20	20
Aesthetic sports	22	17 (12-24) ^a	18 (15-21) ^b	18 (17-23) ^c	40 ^d	35 ^c
Weight-dependent sports	11	21 (15-23)	21 (17-23)	14 (11-16)	37 ^d	29 ^c
Ball game sports	21	20 (17-27)	21 (19-27)	15 (12-17)	14	12
Total sample	92	20 (13-28)	21 (15-27)	17 (12-26)	22	18
Athletic controls	30	20 (13-28)	22 (18-24)	15 (10-22)		

Values for age, BMI, and training volume are given as means with ranges in parentheses.

* % of total sample (N = 522); ** % of total sample (minus those with high EDI scores who did not have the clinical interview (N = 14).

^a Significantly different from all other sport groups and controls (P < 0.05).

^b Significantly different from technical, weight dep, ball game sports and controls (P < 0.05).

^c Significantly different from all other sport groups and controls (P < 0.05).

^d Significantly higher prevalence than in endurance and ball game sports (P < 0.05).

^e Significantly higher prevalence than in endurance, technical and ball game sports (P < 0.05).

TABLE 4. Characteristics of athletes.

	ED Athletes	Athletic Controls
N	92	30
Menarcheal age (yr)	13.1 (1.1)	12.6 (0.7)
Present weight (kg)	58.1 (6.5)	58.7 (7.8)
Ideal weight (kg)	54.6* (6.0)	58.7 (7.8)
Body fat** (%)	18.2* (4.7)	20.5 (2.5)

* P < 0.01.

** (25).

TABLE 5. Reasons for dieting.

	ED Athletes* (%)	Athletic Controls* (%)
To enhance performance	100	100
Recommended by coach	67	75
Recommended by parents	15	38
Recommended by friends	8	50
To improve physical appearance	40	25

Multiple answers were allowed.

* ED athletes and athletic controls who reported dieting.

Group 3. Significant increase in training volume. The 14 athletes who did not have a specific suggestion about why they developed an eating disorder all reported a significant weight loss due to either the loss or change of a coach who they regarded as very important to their athletic career, or an increase in training volume. They could be categorized into groups 2 or 3, respectively.

DISCUSSION

This study underscores the fact that eating disorders are a serious problem for elite female athletes. Of the 522 athletes responding to the first phase of this research, 117 (22.4%) could be classified as "at risk" by virtue of their scores on the Eating Disorder Inventory. Of the at risk

TABLE 6. The different reasons for the development of eating disorders reported by the eating disordered athletes.

	ED Athletes (%)
Prolonged periods of dieting/weight fluctuations	37
New coach	30
Injury/illness	23
Casual comments	19
Leaving home/failure at school/work	10
Problem in relationship	10
Family problems	7
Illness/injury to family members	7
Death of significant others	4
Sexual abuse	4

Multiple answers were allowed.

15% did not give any specific reason.

athletes who participated in the interview portion of this study, 89% could be classified with anorexia nervosa, bulimia nervosa, or anorexia athletica.

Other studies have suggested serious problems with disordered eating in female athletes, but most have focused on a single sport (10,12,23,24). This study supports what has been proposed—that eating problems occur with greatest frequency in sports where athletes are encouraged to be thin for either performance or appearance.

The present results stand in contrast to those of Wilmore (31) who found that scores on the Eating Disorder Inventory were not related to the existence of frank eating disorders. Wilmore and colleagues raised the important point that athletes with eating disorders may be reluctant to respond truthfully to questionnaires because of the secretive nature of the disorders and because of fear of negative reactions from coaches, teammates, and parents. In one of their studies, the Eating Attitudes Test was administered to 100 elite female athletes; none of the 87 respondents scored in the eating disordered range, yet in the subsequent 2 yr, 18% entered treatment for eating disorders (31). Estimates from self-reports, therefore, may be underestimates of true prevalence.

Several steps were taken in this study to ensure truthful responding. The coaches were not informed about the study or asked for permission to collect the data since this study was sanctioned by the NCS and the Medical As-

sociation of the NCS. The athletes were guaranteed 100% confidentiality. They also understood that no information about the study or the results would be given to coaches or parents (except for the parents of those below 18 yr). The questionnaires were mailed and were requested to be returned by mail to the investigators. Further, the information letter about the study explained that any athletes with problems would receive help (nutritional advice/guidance, psychological and or medical treatment) without cost and without disruption of their training schedule, and that the presence of an eating disorder would not result in losing their position on the team, if not medically indicated. The athletes were also told that the investigators would develop alternative training and competition programs if required.

This study identified several risk factors or trigger conditions associated with the development of eating disorders in athletes. Dieting at an early age appeared to be associated with the onset of eating disorders. A significant number of athletes who began dieting to improve performance reported that their coach recommended they lose weight. These athletes are young and impressionable and such a recommendation may be perceived as a requirement for improved performance. Rosen and Hough (23) reported that 75% of female gymnasts who were told by coaches that they were too heavy used pathogenic weight control methods.

To perform for the coach, who is often a key figure in the athlete's life, young athletes may feel driven to lose as much weight as possible by whatever means possible, and may dread the alternative (to remain heavier than the ideal). In the present study, the discrepancy between actual and the self-defined ideal weight was significantly greater in the athletes with eating disorders than in controls.

The present data also suggest that the risk for eating disorders is increased if dieting is unsupervised. Athletes with eating disorders may not seek supervision for fear their disorder will be discovered. In addition, most athletes have little knowledge about proper weight loss methods and receive their information in haphazard ways (from friends, crash diets in magazines, etc.) (8). Such diets are unlikely to account for the high energy requirements necessitated by strict training schedules or the fact that maturing females have special nutritional requirements. Crash diets may appeal to athletes if they feel that rapid weight loss is necessary to make the team or to remain competitive. Finally, the restrictive diets and weight cycling that accompany these efforts may also increase risk for eating disorders (6,15).

A significant number of eating disordered athletes felt they had reached menarche too early. Yet, none of the groups studied here could be characterized as early developers. Even though the athletes had reached menarche at the expected time, they felt burdened because they competed in sports where late menarche is more common

and extra weight is thought to impair performance and detract from appearance in the eyes of judges (gymnastics, modern rhythmical gymnastics, figure skating, sports dance, diving, etc.). This provides another incentive for extreme dieting. Hence, feelings of reaching menarche and developing secondary sex characteristics too early may be a warning sign as well as a risk factor for the development of eating disorders.

Early start of sport-specific training was also associated with disordered eating. A higher percentage of athletic controls than of eating disorder athletes participated in other sports before choosing their preferred sport. An individual's natural body type usually steers the athlete to specific sports, and body type dictates in part whether the athlete will be successful (6). Beginning training for a targeted sport before the body matures might hinder these athletes from choosing a suitable sport for their adult body type. This could provoke a conflict in which the athlete struggles to prevent or counter the natural physical changes precipitated by growth and maturity.

Extreme exercise has been cited as a precipitant of anorexia nervosa (11). In the present data, many of the athletes who did not give specific reasons for the onset of their eating disorder reported a large increase in training volume and a significant weight loss associated with the increased training. Athletes who increase their training volume may experience caloric deprivation (9), perhaps due to diminished appetite produced by changes in endorphins (17). Increased training may lead to energy deprivation, which in turn may create a biological or psychological climate in which eating disorders may arise (17).

The loss of a coach occurred in some athletes with eating disorders. These athletes described their coaches as vital to their athletic careers. Other athletes reported that they developed eating disorders at the time of injury or illness, which left them unable to train at high levels. The loss of a coach, injury, or illness might be conceptualized as traumatic events that serve as trigger conditions for the onset of eating disorders (2).

The results of this study support that notion that elite female athletes in specific sports are at increased risk for eating disorders. This study has identified potential risk factors and trigger conditions associated with the development of eating disorders. Longitudinal studies are necessary to determine whether these factors are necessary or sufficient for eating disorders to occur, or whether these and other factors such as age, gender, personality variables, or physiologic processes interact to create the disorders. These issues should be taken seriously; the personal cost to the athlete is high because of the severe and even deadly consequences of eating disorders. Ultimately, the cost to the sports will be high if participation is considered dangerous. Research on the development of eating disorders, treatment, and prevention must be considered a priority.

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