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Urinary incontinence in female athletes with inadequate eating behavior: a case–control study

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Abstract

Introduction and hypothesis Female athletes can develop symptoms of urinary incontinence (UI) as well as risk behaviors for eating disorders owing to the type of training and sports modality. Such symptoms are intensified by the demands for results and an idealized body composition. Our aim is to investigate the possible association between urinary incontinence and risk behaviors for eating disorders in female athletes.

Methods A case–control study was conducted with 270 female athletes who answered the International Consultation on Incontinence Questionnaire (ICIQ-SF) and the Eating Attitudes Test (EAT-26). Different sports modalities and their respective impact levels were considered in the study. Female athletes were divided into two groups, i.e., athletes with UI (case group) and those without UI (control group). Multiple logistic regression was used to calculate associated factors.

Results From all variables included in the study, only abnormal eating behavior was found to be associated with UI according to the multiple logistic regression test. Participants with UI were 2.15-fold more likely to have risk behaviors for eating disorders.

Conclusions Female athletes with UI were more likely to have risk behaviors for eating disorders. Multidisciplinary teams that provide care for these athletes should be attentive to symptoms that may not appear to be associated at first glance but may reflect a condition that needs to be treated.

Keywords Athletes · EAT-26 · Eating behavior · Female · ICIQ-SF · Urinary incontinence

Introduction

The practice of sports is considered a positive experience owing to the physical and psychological benefits. In recent years, however, young, nulliparous, female athletes have reported complaints of urinary incontinence, especially those who practice sports with a high impact on the pelvic floor [1].

The International Continence Society defines urinary incontinence (UI) as "any involuntary loss of urine" and this condition is commonly associated with age, childbirth, menopause, obesity, and other factors [2, 3]. The prevalence of UI in athletes varies widely depending on the sports modality, with reports of 0% among practitioners of golf (low impact) and up to 80% among trampolinists (high impact) [4].

Considering this association, it is important to consider a new concept of UI when occurring in athletes: athletic urinary incontinence (AUI). According to Araújo and collaborators, AUI affects young,

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nulliparous women with an adequate body mass index. AUI emerges only during the practice of the sport (training and competitions) and not when sneezing or coughing, for example. This definition would explain the occurrence of UI in women who do not have risk factors associated with this disorder, such as obesity, a history of childbirth, and older age [5].

According to the literature, the physiopathology of AUI involves biomechanical factors, such as the movement of the pelvic floor during exercise, the impact of the sports modality, an increase in intra-abdominal pressure, joint hypermobility, muscle fatigue during exercise, and a low availability of energy. The latter factor is related to greater caloric expenditure during exercise than caloric intake obtained through diet. The negative energy balance interferes with hypothalamic control of the menstrual cycle and results in the low production of estrogen levels, thereby contributing to UI in female athletes [3, 5, 6]. Impairments with regard to protein synthesis, bone health, as well as the immunological and cardiovascular systems, may also occur owing to the low availability of energy [7].

The quest for ideal beauty represented by a lean, athletic body and sport performance may explain the increased risk of eating disorders in female athletes compared with the general population [8, 9]. Eating disorders are mental problems associated with excessive concerns related to food, weight, and body shape. Such concerns can lead to the adoption of risk behaviors to achieve weight loss, such as fasting, induced vomiting, excessive physical exercise, and even compulsive eating [8]. Such disorders are described in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). Anorexia nervosa is characterized by eating restrictions in individuals who consider themselves to be overweight or fear gaining weight. Bulimia nervosa is a cycle of compulsive eating followed by purgative actions to compensate for the excessive food intake. The DSM-V also defines the concept of nonspecific eating disorders, which encompasses individuals who do not meet the criteria for anorexia and bulimia nervosa [10].

This scenario can be found in different sports modalities, especially those that require weight control or a very rigid esthetic standard, such as combat sports and artistic gymnastics respectively. Female athletes who perform synchronized swimming, marathonists and dancers have a greater tendency to develop some type of abnormal eating behavior [11].

As eating disorders and UI are frequent in this population [12], the investigation of a possible association between these conditions is important so that the multidisciplinary teams that provide care for these athletes are prepared to identify signs and symptoms or develop strategies to prevent these diseases.

Therefore, the aim of the present study was to investigate whether female athletes with UI also have abnormal eating behavior and identify associated factors.

Materials and methods

Study design and ethical considerations

The present observational case–control study received approval from the Human Research Ethics Committee of *Universidade Federal de São Paulo* (UNIFESP) (certificate number: 0705/2017). All volunteers signed a statement of informed consent prior to participation in the study.

Setting and period of study

This study was developed in the Sports Gynecology Sector of the Paulista School of Medicine (UNIFESP) between September 2020 and November 2021.

Selection of sample, sample calculation, and definitions

Female athletes of different sport modalities and on different competitive levels were asked to participate in the study. The selection of individuals was performed through an active search of the medical charts of the Sports Gynecology Sector and the sample was complemented with the consecutive inclusion of individuals who sought care at the same clinic.

The sample was divided into two groups: a study group composed of female athletes with UI and a control group composed of female athletes without UI. The term "female athlete" was defined as an individual after the menarche with a training routine of at least 150 min per week.

The diagnosis of UI was performed based on the final score of the International Consultation on Incontinence Questionnaire–Short Form (ICIQ-SF): 0 = absence of UI; ≥ 1 = presence of UI. The diagnosis of abnormal or risk behaviors for eating disorders was based on the score of the 26-item Eating Attitudes Test (EAT-26): ≤ 20 = normal eating behavior; ≥ 21 = abnormal eating behavior.

Impact was defined based on the biomechanical effect of the sport on the pelvic floor and was classified as low (sports involving movements with loads one to two times the body weight), moderate (sports involving rotational movements and sprints with loads two to four times the body weight), or high (sports involving jumping movements with loads more than four times the body weight) [13].

The sample size was calculated considering a 5% probability of an alpha error and an 80% test power. The prevalence of UI was assumed to be 40% among participants with adequate eating behavior and 60% among those with risk behaviors for eating disorders, with a 5% significance level. A sample of 135 individuals was determined per group (total: 270 individuals).

Questionnaires

The international consultation on incontinence questionnaire–short form

The ICIQ-SF is a self-administered questionnaire validated for Portuguese [14] that evaluates the impact of UI on quality of life. The ICIQ-SF is composed of five items – two addressing the intensity of urine leakage, two addressing the frequency of urine leakage and one quantifying the impact of UI on quality of life. At the end of the questionnaire, multiple choice options are offered for the respondent to select different possibilities of urine leakage in daily living. The final score is the sum of items 3, 4, and 5, and ranges from 0 to 21 points. A score of 0 means that the respondent does not have UI, whereas scores above 0 indicate the presence of UI, with a higher score denoting a greater impact of the condition on quality of life.

Eating attitudes test-26

The EAT-26 is a questionnaire that has been translated into Portuguese and validated by Bighetti and collaborators [15]. This is a self-administered screening tool designed to identify abnormal eating patterns in individuals who are vulnerable to the development of eating disorders, such as anorexia nervosa and bulimia nervosa. EAT-26 has 26 items distributed among three scales: Diet (13 items), Bulimia and Concern with Foods (six items), and Oral Control (seven items). The items are scored on a six-point Likert scale and the total ranges from 0 to 78 points. A score of 21 or more points is suggestive of abnormal eating behavior or the risk of eating disorders [16].

Variables

Dependent variable

Urinary incontinence in female athletes based on the ICIQ-SF score.

Independent variables

Sociodemographic: age (15 to 19, 20 to 24, 25 to 29, 30 to 34, or 35 + years) and schooling (primary school, high school, or college/university).
Clinical: abnormal or risk behaviors for eating disorders based on total EAT-26 score.
Anthropometric: abdominal circumference (<80 cm/≥ 80 cm), weight (kg) [17], height (m), and body mass index (BMI = weight divided by square of height [kg/m^2]) [18]. BMI categories were established for the classification of underweight, ideal weight range, or overweight/obesity.
Impact of sports modality: low, moderate, or high [13].
Nutritional: in nutritional follow-up (yes/no); use of dietary supplements (yes/no).

Inclusion criteria

Post-menarche, nulliparous, female athletes with a minimum of 1 year practicing the sports modality and a training routine of at least 150 min per week who answered the ICIQ-SF and EAT-26 upon the first appointment to the Sports Gynecology Clinic were included in the study.

Exclusion criteria

Female athletes who did not answer the questionnaires upon the first appointment at the clinic, those with a history of neurological disease, current urinary tract infection, previous history of surgical treatment for urinary incontinence, those in menopause or post-menopause, and those with positive obstetric history (pregnancy or childbirth) were not included in the study.

Statistical analysis

Statistical analysis was conducted with the aid of the STATA software program, version 15.1. Descriptive analysis was performed for quantitative variables, with the calculation of mean, standard deviation, minimum and maximum values. Fisher's exact test was used for the comparison of categorical variables between groups. Binomial logistic regression was performed for the estimation of odds ratios (OR) and respective 95% confidence intervals (CI) as well as the indicator recommended for studies of this nature: attributable risk percent. A p value < 0.05 was considered indicative of a statistically significant difference. All analyses were

Table 1 Distribution of demographic, clinical, and anthropometric characteristics among female athletes ($N=270$)

Variables	Mean	SD	Minimum	Maximum
Age (years)	25.8	8.63	15	55
Weight (kg)	62.44	13.45	41.6	138.20
Height (m)	1.63	0.07	1.43	1.85
BMI (kg/m^2)	23.40	4.46	17.32	50.25
Total ICIQ-SF score	2.75	4.09	0	19
Total EAT-26 score	16.39	9.68	1	44
Abdominal circumference (cm)	80.01	10.20	41.60	138.20

BMI body mass index, *ICIQ-SF* International Consultation on Incontinence Questionnaire–Short Form, *EAT-26* Eating Attitudes Test-26, *SD* standard deviation

performed following the recommendations of Franco and Passos [19].

Results

Two hundred and seventy female athletes participated in the study. Mean age was 25.8 ± 8.6 years (range: 15 to 55 years). Eighteen women (6.67%) had a complete primary school education, 124 (45.93%) had a complete high school education, and 128 (47.41%) had an incomplete or complete higher education. The prevalence of UI was 40% (108 participants) and the prevalence of risk behaviors for eating disorders was 31.85% (86 participants). Tables 1 and 2 display the distribution of the sociodemographic, clinical and anthropometric variables, and their respective categories.

Table 2 Distribution of demographic, clinical, anthropometric, and nutritional characteristics among female athletes according to categories ($N=270$)

Variables	Categories	*n*	Percentage
Age (years)	15–19	75	27.8
	20–24	72	26.7
	25–29	42	15.5
	30–34	37	13.7
	35+	44	16.3
BMI (kg/m^2)	Underweight	10	3.7
	Ideal range	196	72.6
	Overweight/obesity	64	23.7
Abdominal circumference (cm)	< 80 cm	152	56.3
	≥ 80 cm	118	43.7
Nutritional follow-up	No	98	36.6
	Yes	172	63.7
Use of dietary supplement	No	144	53.3
	Yes	126	46.7

BMI body mass index

Table 3 Distribution and frequency of sports modalities with classification of the degree of impact ($N=270$)

Impact	*n* (%)	Modalities	*n*	Percentage
High	78 (28.9)	Basketball	5	1.8
		Rugby	11	4.1
		Circus	1	0.4
		Flag football	12	4.4
		Football/soccer	3	1.1
		Futsal	13	4.8
		Gymnastics	1	0.4
		Handball	20	7.4
		Artistic leaps	2	0.74
		Triathlon	7	2.6
		Volleyball	4	1.5
		Beach volleyball	1	0.4
Moderate	152 (56.3)	Ultramarathon	2	0.7
		Table tennis	3	1.1
		Taekwondo	6	2.2
		Mixed martial arts	3	1.1
		Speed walking	2	0.7
		Marathon	2	0.7
		Track and field	92	34.0
		Boxing	8	3.0
		Judo	25	9.3
		Kung Fu	3	1.1
		Wrestling	4	1.5
		Aquathlon	1	0.4
Low	40 (14.8)	Shot put	3	1.1
		Ballet	2	0.7
		Cycling	3	1.1
		Dance	2	0.7
		Body building	1	0.4
		Mountain bike	1	0.4
		Weightlifting	3	1.1
		Synchronized swimming	2	0.7
		Swimming	16	5.9
		Water crossing	5	1.8
		Functional training	1	0.4

Table 3 displays the distribution and frequencies of the sports modalities practiced and the classification of the degree of impact. Most participants (56.30%) practiced sports considered to have a moderate impact.

Table 4 displays the results of the analysis of associations between the dependent variable (UI) and independent (sociodemographic, anthropometric, impact, and nutritional) variables. Eating behavior was the only independent variable significantly associated with UI ($p=0.012$, Fisher's exact test). Risk behavior for eating disorders was found in

Table 4 Presence/absence of urinary incontinence according to sociodemographic, clinical, anthropometric, impact, and nutritional variables ($N=270$)

Variable/categories	Case group *n* (%)	Control group *n* (%)	*p* value
Eating behavior			
EAT-26 < 20 (normal)	64 (59.3)	120 (74.1)	0.012*
EAT-26 ≥ 21 (risk)	44 (40.7)	42 (25.9)	
Age (years)			
15–19	29 (26.8)	46 (28.4)	0.442
20–24	35 (32.4)	37 (22.8)	
25–29	13 (12.0)	29 (17.9)	
30–34	14 (13.0)	23 (14.2)	
35+	17 (15.7)	27 (16.7)	
BMI (kg/m^2)			
Underweight	4 (3.7)	6 (3.7)	0.766
Ideal range	76 (70.4)	120 (74.1)	
Overweight/obesity	28 (25.9)	36 (22.2)	
Abdominal circumference			
< 80 cm	55 (50.9)	97 (59.9)	0.169
≥ 80 cm	53 (49.1)	65 (40.1)	
Nutritional follow-up			
Yes	72 (66.7)	100 (61.7)	0.440
No	36 (33.3)	62 (38.3)	
Use of dietary supplement			
Yes	44 (40.7)	82 (50.6)	0.135
No	64 (59.3)	80 (49.4)	
Impact of sports modality			
High	34 (31.5)	44 (27.2)	0.743
Moderate	59 (54.6)	93 (57.4)	
Low	15 (13.9)	25 (15.4)	
Schooling			
Primary school	7 (6.5)	11 (6.8)	0.835
High school	52 (48.1)	72 (44.4)	
Higher education	49 (45.4)	79 (48.8)	

BMI body mass index, *EAT-26* Eating Attitudes Test-26

*Fisher's exact test ($p \leq 0.05$)

25.93% of the control group and 40.74% of the study group (with UI).

Table 5 displays the ORs for eating behavior in the unadjusted logistical regression analysis and analysis adjusted by the variables of interest. Individuals in the study group (presence of UI) were 1.96-fold more likely to exhibit risk behaviors for eating disorders ($p = 0.011$). In the same table, all variables except weight were approximately two-fold more frequent in individuals with risk behaviors for eating disorders.

Table 6 displays the results of the multiple logistic regression analysis. Individuals with UI were 2.15-fold more likely to exhibit risk behaviors for eating disorders ($p = 0.007$).

Table 5 Odds ratio for eating behavior without and with adjustments by variables of interest in logistic regression analysis

Variables/adjustments	Odds ratio	*n*	95% confidence interval
Without adjustment	1.96	0.011	1.16—3.33
Adjusted by			
Age	2.06	0.008	1.19—3.56
BMI	1.97	0.011	1.15—3.36
Abdominal circumference	1.90	0.016	1.11—3,24
Nutritional follow-up	1.99	0.009	1.17—3.36
Use of dietary supplement	1.99	0.010	1.17—3.38
Impact of modality	2.02	0.008	1.19—3.43
Schooling	2.01	0.008	1.18—3.42
Height	2.25	0.006	1.02—3.15
Weight	1.95	0.154	0.76—4.99

Table 6 Multiple logistic regression for variables of interest ($N=270$)

Variable	Odds ratio	Standard deviation	95% CI	*p*
Eating disorder				
EAT-26 ≤ 20	1 (base)			
EAT-26 ≥ 21	2.15	0.61	1.2—3.7	0.007
Age				
15–19	1 (base)			
20–24	1.46	0.54	0.7—3.0	0.301
25–29	0.73	0.35	0.3—1.8	0.490
30–34	0.85	0.43	0.3—2.3	0.750
35+	0.78	0.37	0.3 – 2.0	0.610
BMI				
Underweight	1 (base)			
Ideal range	0.70	0.48	0.2—2.7	0.604
Overweight/obesity	0.68	0.52	0.1—3.1	0.615
Abdominal circumference				
< 80 cm	1 (base)			
≥ 80 cm	1.37	0.43	0.7—2.5	0.316
Nutritional follow-up				
No	1 (base)			
Yes	0.87	0.27	0.5—1.6	0.660
Use of dietary supplement				
No	1 (base)			
Yes	0.75	0.23	0.4—1.4	0.355
Impact				
High	1 (base)			
Moderate	0.93	0.30	0.5—1.7	0.826
Low	0.88	0.39	0.4–2.1	0.787
Schooling				
Primary school	1 (base)			
High school	1.10	0.59	0.4—3.1	0.869
Higher education	0.99	0.55	0.3 – 3.0	0.988

BMI body mass index, *EAT-26* Eating Attitudes Test-26

Discussion

The prevalence of urinary incontinence in sports varies depending on the sports modality, training intensity, and associated clinical conditions [6]. In the present study, the prevalence of UI was high (40%) in a young, nulliparous population with an adequate BMI. Furthermore, a significant association between UI and BMI was found in a study involving former Olympic female athletes [4].

No significant differences were found between the case and control groups regarding BMI or abdominal circumference. These results may be explained by the characteristics of the sample, with a predomination of sports modalities that require a body composition within the standards of normality, such as track and field athletics [9], which was the most frequent modality among the participants in the present study. The adequate BMI and abdominal circumference found in the women with UI contrast the classic risk factors for the condition, which lends strength to the hypothesis that specific factors related to women's sports determine involuntary urine loss in these athletes [20, 21].

The impact (low, moderate or high) that the type of sports modality exerts on the pelvic floor was not significantly associated with the dependent variable in the present investigation. In contrast, a systematic review analyzing women of different ages who practiced sports with different levels of impact (professional and amateur athletes) concluded that the prevalence of UI is related to high-impact sports modalities [13]. The lack of an association in the present study may be explained by the small sample size and the predominance of sports modalities with moderate impact, such as track and field.

Regarding the variables "in nutritional follow-up" and "use of dietary supplements," although no significant differences were found between the groups with and without UI, this was to our knowledge the first time that these variables had been considered in the evaluation of UI in female athletes.

The occurrence of abnormal eating behavior or risk behavior for eating disorders was associated with UI in this study. The identification of risk did not consider whether the athletes suffered from anorexia nervosa, bulimia nervosa, or any other eating disorder classified by the criteria of the DSM-IV. It was not within the scope of the present study to identify tendencies toward these types of eating behavior based on the cutoff point of the EAT-26 score.

Athletes with UI were 2.15-fold more likely to develop abnormal eating behavior or risk behavior for eating disorders. In a study comparing women non-athletes and elite female athletes (irrespective of a history of childbirth), Carvalhais and collaborators [12] found that athletes with eating disorders were threefold more likely to have UI. This association was not confirmed in the comparison between the groups of athletes and non-athletes. Comparing the present results with those of the study cited, only nulliparous women were included in the present investigation. Pregnancy often causes changes to one's body composition, which does not always correspond to the expectations of female athletes and can generate conflicts and dissatisfaction with one's own body image, leading to abnormal eating behavior or risk behaviors for eating disorders.

Athletes often use unhealthy weight loss strategies to meet their goals in the sport. Extremely restrictive diets and the use of laxatives, diuretics, fasting, appetite suppressors, and purgative methods are not rare, especially among female athletes who practice sports that place excessive value on body composition as a form of improving yield, such as artistic gymnastics, ballet, and synchronized swimming [12]. This restrictive behavior culminates in low intakes of macronutrients (carbohydrates, proteins, and lipids) and micronutrients (vitamins and minerals). The nutritional and/or energy deficit may explain the association between UI and risk behaviors for eating disorders, as B-complex vitamins, vitamin D, iron, and calcium play important roles in the maintenance of skeletal muscle function. Thus, low carbohydrate intake could lead to premature muscle fatigue [22–24]. It was not within the scope of the present study to analyze the nutritional quality of the diet of these athletes and, therefore, it is not possible to reach a cause-and-effect conclusion regarding the nutritional findings.

A previous study used a specific questionnaire for the diagnosis of bulimia nervosa, identifying risk behavior and even the condition itself in young female runners, despite being within normal standards for weight and body fat [25]. In contrast, another study compared artistic female gymnasts with non-athletes using the EAT-26 and found that behavior suggestive of eating disorders in the competitive environment seems to have a similar probability to that in any other social context in which the expectation of body esthetics is the main reference factor [26].

It should be pointed out that EAT-26 was not developed for athletes. Most studies use eating behavior questionnaires designed for the general population or specific questionnaires for athletes that are not yet available in Portuguese. Female athletes differ from the general population. The pace and intensity of training may place value on aspects that would be considered symptoms of eating disorders in the general population but are not necessarily pathological in a population of athletes [27].

Most athletes have access to a multidisciplinary team (physician, nutritionist, physiotherapist, and psychologist). The results of the present study can enable this team to have a broader view with regard to signs and symptoms that athletes may present. A symptom could serve as a

warning; it may not appear to be associated at first glance but may reflect an undiagnosed condition that needs to be treated.

As the present sample has peculiar characteristics, the use of nonspecific questionnaires for these individuals constitutes a limitation of the present study. Moreover, the variety of sports modalities, not stratifying the athlete's training time by differentiating their competitive levels, the substantial differences in the number of practitioners, as well as the imbalanced distribution of these sports in terms of impact on the pelvic floor may have exerted an influence on the results.

In conclusion, female athletes with urinary incontinence have a greater likelihood of exhibiting risk behaviors for eating disorders. These findings suggest a different approach for athletes to improve both sports performance and quality of life. Moreover, the prevention and/or treatment of urinary incontinence may reduce the chances of developing risk behaviors for eating disorders.

Authors' contributions F.M. Laino: conception, design, data collection, interpretation of data, and writing of manuscript; M.P. Araújo: conception, design, and critical review of intellectual content; M.G.F. Sartori: critical review of intellectual content; R.A. Castro: critical review of intellectual content; J.L.F. Santos: statistical analysis; J.T.N. Tamanini: conception, design, critical review of intellectual content, and final approval of version to be published.

Declarations

Conflicts of interest None.

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