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Urinary incontinence and disordered eating in female elite athletes

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ABSTRACT

Objectives: To evaluate the association between urinary incontinence and disordered eating, in elite female athletes.
Design: This cross-sectional study included 744 young and healthy Portuguese women: 372 elite athletes and 372 age-matched non-athletes, mean age 21 ± 5.3 years.
Methods: Data regarding clinical, demographic, and sport practice characteristics were collected by questionnaire. The International Consultation on Incontinence Questionnaire-Urinary Incontinence-Short Form was applied to identify urinary incontinence. The Eating Disorder Examination Questionnaire was applied to identify disordered eating. Odds ratios with 95% confidence intervals (95% CI) were used to estimate the association between UI and disordered eating.
Results: The prevalence of urinary incontinence in athletes and non-athletes was 29.3% and 13.4%, $p < 0.001$, respectively. No difference in prevalence of disordered eating was found between athletes (17.7%) and non-athletes (20.2%), $p = 0.435$. Urinary incontinence was associated with disordered eating only in the athletes. After adjustment for age, type of sport, smoking and alcohol intake, athletes with disordered eating presented increased odds of urinary incontinence of any type over athletes without disordered eating (OR = 3.09; 95% CI: 1.74–5.50).
Conclusions: Athletes with disordered eating were three times more likely to present urinary incontinence than women without disordered eating. There is a need for further studies to elaborate on mechanisms for this association.

1. Introduction

Urinary incontinence (UI) is defined as "the complaint of any involuntary leakage of urine"[1] and has shown to be common among athletes[2] especially in sports involving high-impact activities.[3,4] Some research groups report a higher prevalence of UI in athletes compared to non-athletes.[2,4] However, some research groups also report contradictory results.[5]

The Academy of Nutrition and Dietetics, Dietitians of Canada/The American College of Sports Medicine[6] stated that, "the performance of, and recovery from, sporting activities are enhanced by well-chosen nutrition strategies". Female athletes, in order to optimize body size and composition for competitive success, may have abnormal disordered eating attitudes and behaviours such as, restrictive eating, fasting, frequent skipping meals, use of diet pills, laxatives, diuretics, enemas, overeating, binge-eating and purging.[7,8] This may result in lack of some important key macro and micro-nutrients important for proper skeletal muscle function.[6] Consequently it can be hypothesized that disordered eating also may weaken skeletal muscles, including the pelvic floor muscles. The prevalence of disordered eating have been shown to be higher in female athletes compared to non-athletes.[9] Furthermore, athletes competing at an elite level present higher rates of disordered eating than those who are not engaged in competition or compete at a recreational level.[8] Despite an increased risk of both UI[2] and disordered eating[9] in female athletes, few studies have addressed the association between UI and disordered eating. The aim of the present study was to assess the association between urinary incontinence and disordered eating among Portuguese female elite athletes and non-athletes.

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2. Methods

This is a cross-sectional study of Portuguese elite female athletes. Details of the study population were fully reported in a former study on the prevalence of UI among elite female athletes and controls.[2]

The sample included 372 elite female athletes (AG) aged 15–48 years, actively competing in their respective national teams for at least one year and who had reached an international competition level. A control group of 372 non-athlete females (NAG), exercising twice weekly or less were recruited in high schools, universities and public areas, matched by age (±1 year) in a 1:1 ratio. Exclusion criteria were pregnancy at the time of the study or during the past year, any illnesses and inability to understand the Portuguese language.

Data regarding general background variables, such as age, weight, height, parity, smoking habits (yes/no) and intake of alcohol beverages (<1/week/≥1/week) on a regular basis; general medical and gynecological history, menstrual status in the last 4 months and the use of hormonal contraceptives; exercise practice characteristics such as type of sport, years of sport participation, and volume of training (hours/week), were collected through self-reported questionnaires.

UI was assessed by the International Consultation on Incontinence Questionnaire-Urinary Incontinence-Short Form (ICIQ-UI-SF)[10] which is a reliable and valid questionnaire for assessing prevalence, severity, overall impact on quality of UI, and type of UI.[10] The ICIQ-UI-SF has been translated into the Portuguese language and validated.[11] The questionnaire includes three scored items. The first item assesses frequency of leakage (0, never to 5, all the time), the second item assesses amount of leakage (0, none to 6, a large amount) and, the third item determines the overall impact of UI on health related quality of life (a numeric scale is used, ranging from 0, not at all, to 10, a great deal). A fourth non-scored item asks about the patient's perception of the type of leakage. For the purpose of the present study, UI was operationalized to participants reporting involuntary urine loss of any type (one or more positive responses to the fourth item of the ICIQ-UI-SF). Positive responses to involuntary loss of urine associated with coughing, sneezing, physical activity or exercise was classified as stress urinary incontinence (SUI). Involuntary loss of urine before reaching the toilet was classified as urgency urinary incontinence (UUI).

Disordered eating was evaluated through the Eating Disorder Examination Questionnaire (EDE-Q),[12] which assesses the core features of eating disorder psychopathology. The EDE-Q has been translated and validated for the Portuguese language.[13] The 22 items are scored using a 7-point (i.e. 0–6), forced-choice rating scheme focusing on the past 28 days. It comprises four subscales: Restraint, Eating Concern, Shape Concern, and Weight Concern. The average of the four subscales generates a global score, with higher scores indicating greater psychopathology. Cut-off values for the global score and for the specific subscales have been previously reported for young Portuguese women (global score: 2.12; Restraint: 1.49; Eating Concern: 1.37; Weight Concern: 2.63; and Shape Concern: 2.12).[13] Participants were classified as having disordered eating if they had a score above the global cut-off score. Pathogenic weight-control behaviours were assessed by 3 items of the EDE-Q: use of laxatives, self-induced vomiting and exercise specifically to control their weight.

In women who did not use hormonal contraceptives methods, the criteria for classifying participants with menstrual dysfunction were: absence of onset of menarche (primary amenorrhea); 3 or 4 missed periods reported after menarche (secondary amenorrhea); menstrual cycles of 35 days or more (oligomenorrhea).[14]

The sports included in the present study were classified as low or high-impact sports (Supplementary Table 1), modified from Simeone et al.[15] Low impact sports involve activities where one foot is always in touch with the ground e.g. roller hockey, swimming, water polo. High-impact sports included those characterized by hops or jumps in which the athlete's legs temporarily leave the ground e.g. ball games and sprint.[15]

The study was carried out according to the principles of the Helsinki Declaration and was approved by the Ethics Committee of the Faculty of Sports of the University of Porto (CEFADE 17.2014). Written informed consent was obtained from all participants.

Statistical analyses were conducted using SPSS (IBM Corp. Released 2014. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). Categorical data are presented as counts and proportions and continuous data as mean and standard deviation (SD). Chi-square test was used to test the independency between categorical variables, and the Mann–Whitney test to compare medians between groups. The magnitude of the association between urinary incontinence and disordered eating (global score of the EDE-Q) was estimated using odds ratio (OR) with 95% confidence intervals (CI) through binary logistic regression models. Estimates were adjusted for age, type of sports (low vs. high-impact), smoking and alcohol intake. Significance level was set at 0.05 for two-sided tests.

3. Results

The sample included young women with no reported comorbidities. Athletes presented a higher prevalence of any UI and SUI than non-athletes. A full description of the prevalence rates of the different UI types has been published elsewhere.[2] All participants had reached menarche and therefore no cases of primary amenorrhea were reported. Few athletes and non-athletes reported menstrual dysfunction (Table 1). Concerning pathogenic weight control methods, more athletes than non-athletes reported intensification of exercising to control their weight. Athletes reported less frequently being smokers or drinking alcoholic beverages, in comparison to non-athletes. More non-athletes than athletes were parous. Regarding disordered eating, no differences between athletes and non-athletes were found in the global score of the EDE-Q (>2.12 in the global score was found in 17.7% of athletes and 20.2% of non-athletes). Regarding the subscales, there were differences only in the prevalence of restraint between athletes and non-athletes.

Fewer athletes than non-athletes used hormonal contraceptive methods (34.4% and 57.8%; $p < 0.001$, respectively). No association between menstrual dysfunction and UI was found in any of the groups ($p > 0.05$).

There was no statistical significant difference in prevalence of disordered eating between those practicing low impact sports compared with high impact sports (Supplementary Table 2).

There was no association between UI and disordered eating (any UI, SUI and UUI) in non-athletes, neither considering the EDE-Q global score nor the different EDE-Q subscales (Supplementary Table 3). In athletes, the prevalence of UI of any type was higher among those with disordered eating, classified according to the global score of EDE-Q. Differences were also found in the prevalence of SUI and UUI according to the global score of the EDE-Q. When considering the EDE-Q subscales, prevalence of any UI and SUI was higher among those with higher scores in each of the subscales, but no statistically significant differences were found for UUI, although there was a similar trend (Table 2).

When combining athletes and controls, the interaction between the groups and disordered eating on UI was $p = 0.020$. Since no association between UI and disordered eating was found in non-athletes, the magnitude of the association was only estimated in athletes.

Table 1
Participants' characteristics, prevalence of urinary incontinence and disordered eating behaviours among athletes and non-athletes.

	Athletes n = 372 Mean (SD)	Non-athletes n = 372 Mean (SD)	p-Value
Age (years)	20.8 (5.2)	20.9 (5.4)	0.859
Sports practice duration (years)	9.8 (5.1)	–	
Sports practice frequency (hours/week)	11.6 (6.7)	0.4 (0.7)	<0.001
	n (%)	n (%)	p-Value
Urinary incontinence			
Any	109 (29.3)	50 (13.4)	<0.001
SUI	95 (25.5)	16 (4.3)	<0.001
UUI	35 (9.4)	23 (6.2)	0.133
Menstrual dysfunction			
Yes	26 (7.0)	21 (5.6)	0.547
Parous			
Yes	9 (2.4)	20 (5.4)	0.037
PWCM			
Vomiting	6 (1.6)	8 (2.2)	0.611
Laxatives	8 (2.2)	9 (2.4)	0.828
Increased exercise	70 (19.1)	34 (9.1)	<0.001
Smoking			
Yes	17 (4.6)	91 (24.5)	<0.001
Alcoholic beverages			
<1/week	329 (88.7)	107 (28.8)	
≥1/week	42 (11.3)	264 (71.2)	<0.001
EDE-Q global score			
≤2.12	298 (82.3)	296 (79.8)	
>2.12	64 (17.7)	75 (20.2)	0.435
EDE-Q subscales restraint			
≤1.49	230 (61.8)	280 (75.3)	
>1.49	142 (38.2)	92 (24.7)	< 0.001
Eating concern			
≤1.37	311 (85.4)	323 (87.1)	
>1.37	53 (14.6)	48 (12.9)	0.595
Shape concern			
≤2.12	275 (74.7)	266 (71.5)	
>2.12	93 (25.3)	106 (28.5)	0.365
Weight concern			
≤2.63	287 (78.0)	277 (74.5)	
>2.63	81 (22.0)	95 (25.5)	0.298

EDE-Q, Eating Disorder Examination Questionnaire; SD, standard deviation; SUI, stress urinary incontinence; UUI, urgency urinary incontinence; PWCM, pathogenic weight control methods.

The vast majority of athletes (2.4%) were nulliparous and therefore, parity was not considered a confounding variable. After adjustment for age, type of sports, smoking and alcohol intake, athletes scoring higher than 2.12 in the global EDE-Q score, were about 3 times more likely to present UI of any type (OR = 3.09; 95% CI 1.74–5.50) in comparison to those without disordered eating. Athletes with disordered eating also presented increased odds of SUI and UUI, 3.4 and 2.6, respectively (Table 3).

Analyses were repeated using continuous scores of the EDE-Q and the associations observed between UI and disordered eating retrieved similar results (data not shown).

4. Discussion

This study aimed to examine the association between UI and disordered eating in elite athletes. Elite female athletes with disordered eating were 3 times more likely to present UI than athletes without disordered eating. The prevalence of any UI and SUI was higher in athletes. No difference was found in the prevalence of disordered eating, neither between athletes and non-athletes, nor between athletes participating in low and high-impact sports.

In the present study, UI was associated with disordered eating only in the athlete group. Two studies, one in a small sample of female runners[16] and another in a large sample of elite female athletes,[5] found a higher prevalence of UI in athletes with disordered eating than in those with non-disordered eating. However, these studies did not report the magnitude of the association between UI and disordered eating and did not control for confounding factors. In the present study, athletes with disordered eating presented 3 times higher odds of UI after adjusting for potential confounders, suggesting that disordered eating could play a role in UI in female athletes.

Although reporting different prevalence estimates of disordered eating, other studies have reported different trends of disordered eating prevalence between female athletes from different sports and controls.[9,17] Reported prevalence rates of disordered eating in elite athletes vary from 3% in ballgame sports athletes[18] to 32.2% in athletes competing in weight-sensitive sports.[17] The wide range of prevalence of disordered eating described in the literature can be due to different sample sizes,[9] type of sports included,[8] use of different definitions,[17,18] investigations at different seasons, investigators (coach, researchers), age groups[19] and psychological factors.[8] All the athletes included in the present study competed at the highest level and were closely monitored by a multidisciplinary team. Besides information and advice about proper nutrition, the clinical teams of all the Portuguese Sports Federations have a careful dietary plan both during the training and competition periods. This might be one explanation for our results.

Regarding the EDE-Q subscales, more athletes than non-athletes reported restrictive eating behaviour. A lack of proper nutrition has been demonstrated in high-level female athletes,[20,21] compromising the intake of essential macro (carbohydrates, proteins) and micro-nutrients (vitamins B and D)[21] needed to support proper skeletal muscle function.[6] A suboptimal intake of carbohydrates could result in premature muscle glycogen depletion during training and competition, leading to muscle fatigue.[22] Also, the lack of some key micronutrients, such as iron, vitamin D and calcium have been referred to play an important role on skeletal muscle function.[6] Striated muscles of the pelvic floor, including the urethral sphincter muscle, contribute to the urethral support system and increase in maximal urethral closure pressure during increases in intra-abdominal pressure.[23] However, in the present study we have no data on PFM function and no data on nutrition. The underlying mechanism is therefore still unknown, and needs further investigation.

Participation of young girls in sports at a high competition level is increasing. Due to the intensity of training there may be an increased risk of musculoskeletal injuries.[24] However, there are no studies on the PFM structures in teen elite female athletes. Nygaard et al.[25] found in a sample of middle-aged women, that greater strenuous activity during teen years increased the odds of SUI later in life (OR, 1.37 per 7 additional h/wk; 95% CI, 1.09–1.71; P = 0.006). Also, UI during sport practice can lead to decreased sport performance.[26,27,28] Further studies are needed to identify risk factors for UI related to sport practice.

Disordered eating and menstrual dysfunction may be interrelated conditions in female athletes.[7] Menstrual dysfunction such as delayed menarche and disruption of normal menstrual cycles has been recognized to be frequent in female athletes performing high intensity training.[20,21] In the present study, and as observed for disordered eating, no difference in menstrual dysfunction prevalence between athletes and non-athletes was found. However, a higher prevalence of menstrual dysfunction among athletes than non-athletes have been reported in another study[29] while results of one study corresponds with our results.[15] The finding that a large number of the participants of the present study used hormonal contraceptives could mask menstrual dysfunction and should be considered when interpreting the results.

Table 2
Prevalence of urinary incontinence according to disordered eating, in athletes.

	No UI	Any UI	p	No SUI	SUI	p	No UUI	UUI	p
EDE-Q global score									
≤2.12	223 (74.8)	75 (25.2)		235 (78.9)	63 (21.1)		275 (92.3)	23 (7.7)	
>2.12	32 (50.0)	32 (50.0)	<0.001	34 (53.1)	30 (46.9)	<0.001	52 (81.3)	12 (18.8)	0.013
EDE-Q subscales restraint									
≤1.49	173 (75.2)	57 (24.8)		182 (79.1)	48 (20.9)		211 (91.7)	19 (8.3)	
>1.49	90 (63.4)	52 (36.6)	0.020	95 (66.9)	47 (33.1)	0.012	126 (88.7)	16 (11.3)	0.434
Eating concern									
≤1.37	227 (73.0)	84 (27.0)		238 (76.5)	73 (23.5)		284 (91.3)	27 (8.7)	
>1.37	29 (54.7)	24 (45.3)	0.011	32 (60.4)	21 (39.6)	0.021	45 (84.9)	8 (15.1)	0.226
Shape concern									
≤2.12	205 (74.5)	70 (25.5)		217 (78.9)	58 (21.1)		254 (92.4)	21 (7.6)	
>2.12	54 (58.1)	39 (41.9)	0.004	56 (60.2)	37 (39.8)	0.001	79 (84.9)	14 (15.1)	0.057
Weight concern									
≤2.63	210 (73.2)	77 (26.8)		222 (77.4)	65 (22.6)		264 (92.0)	23 (8.0)	
>2.63	50 (61.7)	31 (38.3)	0.063	52 (64.2)	29 (35.8)	0.024	69 (85.2)	12 (14.8)	0.104

Data are presented as numbers with (%).
EDE-Q, Eating Disorder Examination Questionnaire; UI, urinary incontinence; SUI, stress urinary incontinence; UUI, urgency urinary incontinence.

Table 3
Association between disordered eating and urinary incontinence (any urinary incontinence, stress urinary incontinence and urgency urinary incontinence) in athletes.

	Any UI Crude OR (95% CI)	SUI	UUI
EDE-Q global score			
≤2.12	Ref.	Ref.	Ref.
>2.12	2.97 (1.71–5.18)	3.29 (1.87–5.79)	2.76 (1.29–5.89)
	Adjusted[a] OR (95% CI)		
EDE-Q global score			
≤2.12	Ref.	Ref.	Ref.
>2.12	3.09 (1.74–5.50)	3.44 (1.92–6.17)	2.61 (1.21–5.62)

EDE-Q, Eating Disorder Examination Questionnaire; UI, urinary incontinence; SUI, stress urinary incontinence; UUI, urgency urinary incontinence; OR, odds ratios.
[a] Adjusted for age, type of sports (low- vs. high-impact), smoking, alcohol intake.

The strengths of the present study are the large sample size, with inclusion of athletes competing at an international level and from a wide variety of sports, the high response rate and the comparison with an age-matched control group. However, some limitations should be acknowledged: disordered eating and menstrual status were assessed by self-reporting and clinical evaluation was not performed. The prevalence of disordered eating may be underreported due to self-report. Torstveit et al.[17] emphasized the importance of a clinical interview in order to identify disordered eating, especially for leanness sport athletes, since, over 14% of athletes were classified as false-negatives in their study. The EDE-Q was not developed for use in athlete populations, however, it has been used to assess disordered eating in athletes and the cut-off points considered in the present study were estimated for young Portuguese women. The lower number of participants in the low impact group may have influenced the results. The fact that we had no data on PFM function (assessment of PFM resting condition, strength and endurance) is also a limitation. The ICIQ-UI-SF was validated by Avery et al.[10] in older men and women. Tamanini et al.[11], included a sample of young women (minimum 16 years old) in the translation and validation process into the Portuguese language and the authors did not report any problems with its use.

5. Conclusion

Athletes with disordered eating were 3 times more likely to report urinary incontinence than women without disordered eating. Stress urinary incontinence was the most prevalent type of urinary incontinence among athletes and the prevalence was higher in athletes than non-athletes. We therefore recommend that elite female athletes should be screened for both UI and disordered eating. Prevention and treatment strategies for both conditions in female athletes should be evaluated in future high quality RCTs.

Practical implications

- Elite athletes presented high prevalence of stress urinary incontinence. Athletes may abandon their favourite sport or limit their practice due to urine leakage. Identifying potential related risk factors for urinary incontinence is crucial to developing preventive measures for this condition.
- Both urinary incontinence and disordered eating can have a negative impact on the athletes' wellbeing. The data in the current study suggests that athletes with altered eating behaviours have higher odds of presenting urinary incontinence than women without disordered eating.
- Restrictive eating behaviours may compromise the intake of important nutrients that support high performance sports activity. Athletes should be screened for disordered eating and educational programs should be implemented in this population in order to avoid unhealthy eating behaviours.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.jsams.2018.07.008.

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