Acta Scientiarum
http://periodicos.uem.br/ojs/acta
ISSN on-line: 1807-8648
Doi: 10.4025/actascihealthsci.v44i1.58236

Factors associated with urinary incontinence in volleyball athletes: a cross-sectional study

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ABSTRACT. The article has the purpose of identify the factors associated with the occurrence of urinary incontinence (UI) among volleyball athletes. This is a cross-sectional study conducted with female athletes of court volleyball. An interview was conducted to identify the factors associated with UI. The presence of urinary loss was identified using the Urinary Distress Inventory 6 (UDI-6). The associated factors found were divided into those related to sociodemographic (education and marital status), behavioral (constipation occurrence), obstetric (previous pregnancies), hereditary (skin color), and sports practice variables (sports level, volleyball position, time of sports practice in years, physical and tactical training routine, and daily water intake). The Chi-square test or Fisher's exact test, Mann-Whitney U test, and binary logistic regression model were used. This study included 83 volleyball athletes with a mean age of 26.6 (± 7.2) years. It was found that 25.3% of the volleyball athletes presented UI and those that reported symptoms of constipation were 10 times more likely to develop UI than those without constipation. Women who practice high-impact sports in a professional manner, such as volleyball, should be aware of the symptoms of pelvic floor dysfunction, since they will be predisposed to urine leakage. The finding that a considerable number of athletes report UI and that long-term sports practice exposes athletes to a higher risk of UI indicates that pelvic exercises should be proposed in order to reduce these symptoms.

Keywords: prevalence; urinary incontinence; women's health; athlete.

Received on March 15, 2021.
Accepted on June 29, 2021

Introduction

Pelvic floor dysfunction (PFD) includes biomechanical disorders, potentially causing voiding, defecatory, and/or sexual changes. These problems are often associated with risk factors such as age, multiparity, menopause, and obesity (Vergeldt, Weemhoff, IntHout, & Kluivers, 2015; Almeida et al., 2016). Recent research indicates that, among PFD, urinary incontinence (UI) is the most prevalent and among young people, the group most likely to develop UI is female athletes (Almeida et al., 2016; Louis-Charles, Biggie, Wolfinbarger, Wilcox, & Kienstra, 2019).

Urinary loss in this population may occur due to strenuous exercise (Da Roza, Brandão, Mascarenhas, Jorge, & Duarte, 2015). The impact with the ground, associated with increased intra-abdominal pressure (IAP) that occurs during training, can lead to downward dislocation of the pelvic organs and consequent damage to the pelvic floor muscles (PFM), connective tissues, and fasciae (Almeida et al., 2016; Hagovska, Švihra, Buková, Dračková, & Švihrová, 2018).

Although the high impact is strongly associated with UI (Hagovska et al., 2017), the frequency of sports training and length of practice can also be considered important factors associated with the outbreak of these symptoms (Da Roza et al., 2015; Martins et al., 2017). Among the studies with athletes, Da Roza et al. (2015) observed that the longer the athlete is submitted to training, the greater the severity of UI. Although it is prevalent among athletes, UI is not openly discussed, which justifies the lack of knowledge among athletes regarding the therapeutic proposals that treat and prevent the occurrence of this PFD (Casey & Temme, 2017).

In 2004, Kari Bø published a review on UI, pelvic floor dysfunction, exercise, and sport. In the article, the author raised two hypotheses related to vigorous physical activity and the pelvic floor: a) the athletes have strong MAP; b) female athletes can stretch, overload, and weaken the pelvic floor. The second hypothesis is

based on the idea that the repetitive increase in intra-abdominal pressure can cause damage to the pelvic floor (Bø, 2004). Therefore, it is clear that the practice of PA (or physical exercise) has a complex interaction with the pelvic floor.

Knowing that UI is a highly incapacitating and costly condition that directly affects quality of life (Wang et al., 2017) and that the annual public cost of therapies for gynecological disorders is more than 1.2 million reais for individuals who use the Unified Health System (SUS) (Ramos, 2011), it is essential that studies further investigate pelvic function.

Studies in this area are scarce, and it is important for health professionals to know the factors associated with UI among young female athletes so that prevention and treatment actions can be promoted, according to the occurrence of an associated factor. In clinical practice, physical therapists can then feasibly insert exercises for the PFM in the athlete's routine (Da Roza et al., 2015). Therefore, the objective of the current study was to identify the factors associated with the occurrence of UI among volleyball athletes.

Material and methods

This is a cross-sectional, observational, and quantitative study conducted with volleyball athletes who participated in national and international competitions. We intentionally included female athletes of indoor volleyball aged 18 to 60 years. We excluded pregnant women or athletes who work in a recreational way.

To identify the factors associated with UI, an interview was conducted through a questionnaire on the Internet and/or in person, individually. This strategy was adopted to ensure a greater number of responses. The associated factors found were divided into sociodemographic (education and marital status), behavioral (constipation occurrence), obstetric (previous pregnancies), hereditary (skin color), and sports practice variables (sports level, volleyball position, time of sports practice in years, physical and tactical training routine and daily water intake). This assessment questionnaire was based on known UI factors from the literature (Aniuliene, Aniulis, & Steibliene 2016; Alves et al., 2017).

The presence of urinary loss in daily life was identified through the Urinary Distress Inventory 6 (UDI-6) questionnaire, which assessed whether the volunteer had the symptom of urinary incontinence and how much it caused discomfort. This questionnaire is part of the Pelvic Floor Distress Inventory (PFDI-20), which further assesses anorectal and pelvic symptoms using the Colorectal-Anal Distress Inventory 8 (CRADI-8) and the Pelvic Organ Prolapse Distress Inventory 6 (POPDI-6), respectively (Arouca et al., 2016).

Anthropometric measurements were collected in two ways: for participants who were interviewed in person, measurements were collected using a Digital Scale - G-Tech - Glass 200 and a Sanny Portable Stadiometer, while the athletes who answered the questionnaires through the internet, on Google Forms, self-reported their measurements. Through these data, it was possible to calculate the Body Mass Index (BMI) from the ratio of body mass (kg) to the square of height (m^2).

After the study was approved by the institution's Research Ethics Committee, under record number 2.256.031, initial contact was made with the volleyball club's medical team and, with their permission, the athletes were invited to participate in the research through signing the Informed Consent Form (ICF). The athletes who participated in the study using Google Forms, gave their authorization in the first question before answering the questionnaire. On this page, the ICF was available for any clarification.

For data analysis, Statistical Package for Social Sciences (SPSS) version 17.0 was used. All variables were descriptively analyzed using simple frequency and percentages (categorical variables) and position and dispersion measures (numerical variables). For associations between categorical variables, the Chi-square test or Fisher's exact test was used, and the Mann-Whitney U test was used to compare numerical variables. The variables that presented $p<0.20$ in the univariate analysis were inserted in the binary logistic regression model. The model included four explanatory variables, requiring a minimum sample of 80 athletes (20 per variable). A significance level of 5% was adopted.

Results and discussion

This study included 83 volleyball female athletes with an average age of 26.6 (± 7.2) years. Considering the sociodemographic characteristics, 49 (59%) were single and 40 (48.2%) had completed high school. Regarding urinary loss, 21 (25.3%) athletes reported this symptom (Table 1).

Table 1. Sociodemographic characteristics (n = 83).

Characteristics	
Age n (%)	
Up to 20 years	20 (24.1)
21 to 30 years	47 (56.6)
31 to 40 years	10 (12.0)
41 to 50 years	6 (7.2)
Civil status n (%)	
Single	50 (60.2)
Married	33 (39.7)
Education n (%)	
Complete elementary school	2 (2.4)
Incomplete high school	3 (3.6)
Complete high school	40 (48.2)
University education	28 (33.7)
Postgraduate	10 (12.0)
Gestation n (%)	
Yes	19 (22.9)
No	64 (77.1)
Number of normal deliveries median (IQ)	0 (1)
Number of cesarean deliveries median (IQ)	1 (1)

Legend: n - number of athletes; IQ - Interquartile range.

The behavioral, obstetric, hereditary, and sports factors associated with UI in volleyball athletes are presented in Table 2. The presence of constipation was higher among athletes with UI (n = 11; 52.4%) when compared to athletes without UI (n = 6; 9.7%). Regarding the sports level, professional athletes presented more symptoms of UI (n = 15; 71.4%) when compared to amateur athletes (n = 6; 28.6%). Although without significant difference, it was observed through the residual adjustment (2.2) that there is a tendency of athletes in the position of setter not to have symptoms of UI (n = 17; 27.4%).

Table 2. Behavioral, obstetric, hereditary, and sports factors associated with UI in volleyball athletes with (n = 21) and without UI (n = 62).

Associated factors	With UI n (%)	Without UI n (%)	Total n (%)	$\chi 2$	p
Behavioral					
Intestinal Constipation					
Yes	11 (52.4) ¥	6 (9.7)	17 (20.5)	17.56	<0.001*
No	10 (47.6)	56 (90.3)	66 (79.5)		
Obstetrics					
Previous pregnancy					
Yes	6 (28.6)	13 (21)	19 (22.9)	0.51	0.47
No	15 (71.4)	49 (79)	64 (77.1)		
Hereditary					
Skin Color					
White	20 (95.2)	88.7% (55)	75 (90.4)	0.76	0.34
Black	01 (4.8)	7 (11.3)	8 (9.6)		
Sports					
Level					
Amateur	6 (28.6)	33 (53.2)	39 (47)	3.82	0.05*
Professional	15 (71.4) ¥	29 (46.8)	44 (53)		
Position					
Sweeper	5 (23.8)	9 (14.5)	14 (16.9)	4.97	0.08
Setter	01 (4.8)	17 (27.4) ¥	18 (21.7)		
Other	15 (71.4)	36 (58.1)	51 (61.4)		

Legend: n - number of athletes; UI - urinary incontinence; $\chi 2$ - Chi-square test. ¥ - residual adjustment > 2.0; *p ⩽ 0.05.

In the comparison of anthropometric and sports factors associated with the occurrence or not of UI (Table 3), it is possible to observe that only the time of sports practice showed a significant difference, being higher in athletes with symptoms of UI.

Table 4 shows the associated factors, with $p < 0.200$ in the bivariate analysis, of the occurrence of UI among the study participants. Volleyball athletes who report constipation are 10 times more likely to develop UI (OR= 10.43; CI95% 2.65-41.04) compared to athletes without intestinal constipation, even when controlling for sports level, position in the game, and time of sports practice.

Table 3. Comparison of anthropometric and sports factors associated with UI in volleyball athletes with (n = 21) and without UI (n = 62).

Factors	With UI Median (IQ)	Without UI Median (IQ)	U	p
Anthropometric				
BMI	22.4 (1.9)	22.4 (2.2)	629.0	0.81
Sports				
Practice time (years)	7.0 (10.0)	11.0 (5.0)	414.5	0.01*
Daily water intake	2.0 (0.5)	2.0 (1.0)	587.5	0.49
Tactical training (weekly hours)	4.0 (5.0)	4.0 (5.0)	612.5	0.68
Physical training (weekly hours)	4.0 (2.0)	4.0 (3.0)	634.0	0.85

Legend: BMI - Body Mass Index; IQ - Interquartile range; p - significance level; UI - Urinary Incontinence; U - Mann-Whitney. *p ⩽ 0.05.

Table 4. Regression analysis on the factors associated with the occurrence of UI in volleyball athletes (n = 83).

Variables	Crude Analysis		Adjusted Analysis	
	OR	(CI 95%)	OR	(CI 95%)
Level				
Amateur	0.35	(0.12-1.02)	0.59	(0.15-2.24)
Professional	1.00		1.00	
Position				
Sweeper	1.33	(0.38-4.64)	2.66	(0.61-11.60)
Setter	0.14	(0.01-1.15)	0.17	(0.01-1.70)
Other	1.00		1.00	
Intestinal Constipation				
Yes	10.26	(3.08-34.11)	10.43	(2.65-41.04)
No	1.00		1.00	
Practice time (years)	0.90	(0.81-0.99)	0.95	(0.85-1.05)

Legend: OR - Odds ratio; CI95% - 95% Confidence Interval.

This study sought to identify the factors associated with the occurrence of UI among volleyball athletes. A prevalence of 25.3% of UI was observed among female athletes. This value was lower than that found in a systematic literature review (Teixeira, Colla, Sbruzzi, Mallmann, & Paiva, 2018), in which 36% of female athletes reported UI, regardless of sports practice. In another study (Cardoso, Lima, & Ferreira, 2018) that evaluated the prevalence of UI among high-impact athletes, 70% of participants reported urinary loss. Among volleyball players, Hagovska et al. (2018) found a UI prevalence of 19.6%.

The mechanism that generates urinary loss in high-impact sports, such as volleyball, involves the chronic increase in IAP during jumps that can overload, lengthen, and weaken the PFM with descending pelvic organ dislocation (Almeida et al., 2016; Hagovska et al., 2018). This mechanism was identified in a study by Alves et al. (2017), in which the impact with the ground caused by the sport, with the high training loads, was the main factor associated with the occurrence of UI in female athletes.

In the bivariate analysis, the presence of UI was higher among professional athletes and those with longer practice in years, since athletes with symptoms of UI had a median of 7 years of sports practice. Strengthening the hypothesis that urinary loss may be associated with training time, Cardoso et al. (2018) identified that sports practice for over 8 years is 2.5 times more likely to cause UI.

According to Lose (2012), pelvic function depends on several factors, among them; the location of the urethra, state of the urethra (rest or dilation), voluntary contraction of the pelvic floor, impact, and age.

In 2012, researchers Nygaard, Shaw and Egger published a theoretical model of the relationship between moderate and vigorous PA and pelvic dysfunction. In this model, physical activities can also have a bidirectional influence on the pelvic floor (Nygaard, Shaw, & Egger, 2012). In the negative direction, the activity can cause urinary loss and prolapse, and this situation can lead to a decrease in the practice of PA, thus leading to a decrease in the symptoms of UI and prolapse. On the other hand, the decrease in the practice of physical activity leads to an increase in body weight and a worsening of muscle strength, which in turn increases UI and prolapses (Nygaard et al., 2012). Therefore, it is clear that the practice of PA (or physical exercise) has a complex interaction with the pelvic floor.

In the present study, it was possible to identify that athletes with intestinal constipation are 10 times more likely to develop UI (OR = 10.43; 95% CI 2.65-41.04) when compared to athletes without constipation. Similar results were found by Carvalhais, Natal Jorge, and Bø (2018), who investigated potential UI risk factors among elite athletes and found that intestinal constipation increases the odds of developing UI by 1.79 times. These

results are important to modify the concept that young and nulliparous athletes do not present risk factors, such as intestinal constipation, for the development of UI (Araujo et al., 2015).

In Brazil, there are no data on the prevalence of constipation in volleyball athletes, since most studies are conducted with practitioners of any physical activity. Moreover, although little investigated, it has been observed that intense and long-term aerobic exercise can cause gastrointestinal symptoms (Costa, Snipe, Kitic, & Gibson, 2017; Karhu et al., 2017). The etiology of these symptoms during exercise is multifactorial and includes reduced intestinal blood flow, the release of gastrointestinal hormones, mechanical stress on the gastrointestinal tract (GT), and dehydration (Costa et al., 2017). For Higa, Lopes and Reis (2008), chronic constipation often affects the force performed during bowel evacuation, which can damage the pelvic muscles and, through this strain, traumatize the muscles and cause ischemia.

This duality between being an athlete and having intestinal constipation can be observed in a systematic review by Oliveira and Burini (2009), which showed that physical exercise can be both beneficial and harmful to GT, depending on its intensity and the athlete's health. Mild to moderate intensity exercise plays a protective role against colon disease and intestinal constipation, while acute strenuous exercise can cause heartburn, nausea, vomiting, abdominal pain, diarrhea, and even gastrointestinal bleeding (Oliveira & Burini, 2009). To avoid these problems, the athlete should be informed about the consequences of intense sports practice and the possibility of urinary loss, so that preventive practices are initiated for PFD in sports (Cardoso et al., 2018).

Among the limitations of this study, the measurement of UI through self-report stands out, generating subjective data for the main outcome. It is known that this type of evaluation indicates the same results in quantitative measures as the use of urodynamic examination and the pad test, providing evidence of its authenticity (Fernandes, Fitz, Silva, Filoni, & Filho, 2014). For future studies, the inclusion of measurements of PFM functionality and forms of quantitative assessment of urine leakage is suggested for better control of the variables studied. In addition, it should be noted that the results of this study are restricted to volleyball athletes, so it may not be possible to extrapolate them to other sports.

Conclusion

This study found that 25.3% of volleyball athletes had UI and that those who reported symptoms of intestinal constipation are 10 times more likely to develop UI than those without constipation. Thus, women who practice high-impact sports in a professional manner, such as volleyball, should be aware of the symptoms of PFD, since they will be predisposed to urine leakage. The finding that a considerable number of athletes report UI and that long-term sports practice exposes athletes to a higher risk of UI indicates that pelvic exercises should be proposed in order to reduce these symptoms.

Preventive strategies for assessing and treating PFD in women practicing high-impact sports are necessary to improve women's quality of life and sport performance. Through pelvic floor evaluation, it is possible to include exercises with pelvic contractions in the training routine.

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