Urinary Incontinence in Women Who Practice Recreational Exercise: A Cross-Sectional Study

A Incontinência Urinária em Mulheres Praticantes de Exercício Recreativo: Um Estudo Transversal

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Acta Med Port 2021 Nov;34(11):724-732 ▪ https://doi.org/10.20344/amp.14004

ABSTRACT

Introduction: Urinary incontinence affects up to one third of women in Portugal. Exercise can be a precipitating/aggravating factor but also protective, if appropriate. The aim of this study was to determine the prevalence of urinary incontinence in women who practice recreational exercise, to assess its relationship with the type of exercise and other coexisting risk factors, and assess whether the topic is addressed in gyms.

Material and Methods: Cross-sectional study using self-reported questionnaires in gyms in Porto and Vila Nova de Gaia, Portugal.

Results: Two hundred and ninety women completed the questionnaires. From these, 67.6% were under 40 years old, 25.2% reported incontinence, and 53.4% had at least one risk factor unrelated to exercise. There was a statistically significant association ($p < 0.05$) between incontinence, obesity and constipation. High impact exercises were included in the training of 62.1% continent and 50.9% incontinent women. The topic of incontinence and strengthening of the pelvic floor muscles was addressed in only 5.5% in the initial assessment, 9.7% in collective training, and in 13.5% of the 37 women with individualized training.

Discussion: The higher proportion of continent women - compared to incontinent - who practiced strenuous exercise suggests that this might be a provocative factor for some, although there was no statistically significant association between incontinence and type of exercise.

Conclusion: Urinary incontinence affects women who practice recreational exercise, regardless of age and exercise characteristics. It is rarely addressed in gyms, and it is necessary to raise the awareness of professionals to enhance the preventive/therapeutic effects of exercise on the function of the pelvic floor and in the control of modifiable risk factors.

Keywords: Exercise; Sports; Urinary Incontinence

RESUMO

Introdução: A incontinência urinária afeta até um terço das mulheres em Portugal. O exercício pode ser fator precipitante/de exacerbação, mas também protetor, se for adequado. O objetivo deste estudo é determinar a prevalência de incontinência urinária em mulheres praticantes de exercício recreativo, avaliar a relação com o tipo de exercício e outros fatores de risco coexistentes, e aferir se o tema é abordado nos ginásios.

Material e Métodos: Estudo transversal através de questionários de auto-preenchimento em ginásios do Porto e Vila Nova de Gaia.

Resultados: Duzentas e noventa mulheres completaram os questionários. Destas, 67,6% tinham menos de 40 anos, 25,2% referiam incontinência e 53,4% tinham pelo menos um fator de risco não relacionado com exercício. Verificou-se uma associação estatisticamente significativa ($p < 0,05$) entre incontinência, obesidade e obstipação. Exercícios de alto impacto eram incluídos nos treinos de 62,1% das mulheres continentes e 50,9% das incontinentes. O tema incontinência e fortalecimento muscular do pavimento pélvico foi abordado em apenas 5,5% na avaliação inicial, 9,7% em treinos coletivos e em 13,5% das 37 mulheres com treinos individuais.

Discussão: A maior proporção de mulheres continentes, comparativamente às incontinentes, que praticavam exercício extenuante, sugere que este era um fator provocativo para algumas, não se verificando, contudo, uma associação estatisticamente significativa entre incontinência e tipo de exercício.

Conclusão: A incontinência urinária afeta mulheres praticantes de exercício recreativo, independentemente da idade e características do exercício. É raramente abordada nos ginásios, sendo necessário sensibilizar os profissionais para potenciar os efeitos preventivos/terapêuticos do exercício na função do pavimento pélvico e no controlo de fatores de risco modificáveis.

Palavras-chave: Desporto; Exercício; Incontinência Urinária

INTRODUCTION

Urinary incontinence (UI) was defined by the International Continence Society (ICS) as the "complaint of involuntary loss of urine".[1] The definition of a real prevalence is a challenging task due to the different definitions of UI, different populations and methodologies considered by the different studies, with prevalence rates ranging between 25 and 45%, affecting non-pregnant women aged over 20.[2] A 21.4% prevalence rate of UI has been found in one study carried out in 2009 in the Portuguese population involving women aged over 40; stress UI (SUI) was the most frequently found type of UI (42.2%).[3] Recently, a new study has found a 35.1% prevalence rate in women aged 19-90

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Recebido: 28 de abril de 2020 - **Aceite:** 07 de julho de 2020 - ***Online issue published*:** 02 de novembro de 2021

and SUI as the most frequent (76.2%) aetiology.[4] Despite this high prevalence, only 25 to 61% of the patients seek treatment.[2]

UI is likely related to a pelvic floor dysfunction. Urinary continence depends on a lower intra-vesical pressure when compared to intra-urethral pressure and therefore any factor increasing the former over the latter may cause UI.[5,6] Different factors may contribute to the development of UI, including parity, vaginal delivery, advanced age, menopause and conditions with a significant and/or chronically increased intra-abdominal pressure (IAP) including obesity, chronic cough and heavy load weight lifting.[2,3,7,8]

Even though it is not considered as a life-threatening condition, UI has a negative impact on the quality of life, leading to social isolation, depression and anxiety. Episodes of unintentional passing of urine interfere with daily activities as well as with professional activity, sexual life, sports and leisure activities.[7,9,10]

UI is a relevant constraint to physical exercise and may lead to quit exercise,[11,12] depriving patients from the recognised benefits to a healthy life, with a positive effect on the outcomes of different diseases (e.g., diabetes mellitus, high blood pressure, dyslipidaemia, obesity) and in mental health promotion.[13] In fact, physical inactivity is considered by the World Health Organization as the fourth risk factor for mortality worldwide.[13]

On the one hand, activity and physical exercise should be encouraged while, on the other, their effect on the pelvic floor and UI is not completely understood.[14,15] During exercise, there are several moments when the balance between intra-bladder and intra-urethral pressures may be affected, due to the reaction forces of the pelvic floor and the increase in IAP, leading to the development or aggravating UI. The very definition of SUI, as "a complaint of involuntary loss of urine on effort (such as sports activity, coughing or sneezing)" shows the significant relationship between effort and unintentional passing of urine.

In 1994, Bø K *et al.*[16] found that the contraction of the abdominal region muscles, hip adductors or gluteal muscles produce a synergic contraction of the pelvic floor muscles (PFM). Later, in 2004, two hypotheses were suggested by the same authors explaining the effect of exercise on PFM: (1) the increase in IAP and the co-contraction of PFM during physical exercise lead to the strengthening and hypertrophy of PFM, raising the level of the urethra and pelvic organs and therefore reducing the risk of UI; (2) strenuous exercise or heavy load lifting lead to significant, repetitive increases in IAP, increasing stress on the pelvic floor and its impairment.[17] There is evidence to support both theories,[14,15] although the relationship between UI and strenuous or high-impact exercise is better studied than the relationship with light to moderate exercise.[14]

To the best of our knowledge, epidemiological studies on UI in Portugal are scarce and no study involving the Portuguese female population engaged in recreational physical activity and women of different age groups was ever carried out. Considering that physical exercise is a modifiable factor, understanding the relationship between physical activity, pelvic floor dysfunction and UI is crucial in order to prevent UI and to reduce drop out from exercise.

This study was primarily aimed at the identification of the prevalence and characterisation of UI affecting women engaged in physical activity and the assessment of its relationship with demographic characteristics and known risk factors, namely the type of exercise. The secondary endpoint was the assessment of the approach to UI and the potential effects of exercise at different moments of working out at a gym (physical assessment, group and individual training sessions).

MATERIAL AND METHODS

This was a cross-sectional observational study involving the collection of a paper-based questionnaire applied in nine gyms located in the municipalities of Porto and Vila Nova de Gaia (Portugal), during the months of January and February 2020. Only women aged over 18 and who have attended the gym at least once a week were included. The sample was selected by convenience and the participants' cooperation was requested on arrival at the gym.

An anonymous self-completion survey has been developed (see Appendix 1: https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/14004/6466) mostly including closed questions, based on the questionnaire by McKenzie *et al.*[18] and the International Consultation on Incontinence Modular Questionnaire - Urinary Incontinence Short Form (ICIQ-UI SF), validated for Portuguese.[19] The survey was designed into six sections: general data (age, weight, height, education), medical history, gynaecological and obstetric history, physical activity, urinary incontinence and pelvic floor muscle training (PFMT). Questions regarding the interference of UI with the practice of exercise, knowledge about PFMT, approach to the subject of UI and PFMT at the gym at some point (physical assessment, group or individual training) and discussion of this health concern with the participant's attending physician were also included.

The following factors considered as risk factors were considered[2,3,7,8]: menopause and hormone replacement therapy, obesity, parity and route of delivery, genitourinary surgery, pelvic treatment or injuries, type of physical exercise, chronic diseases (diabetes, depression, hypertension, chronic cough, constipation and stroke), high competition and heavy weight lifting.

The characterisation of UI was carried out through the ICIQ-UI SF and the presence of 'incontinence' was considered in participants who described urinary losses within the previous four weeks in relation to the date of completion of the questionnaire. The classification by Klovning *et al.*, correlating the ICIQ-UI SF with the Incontinence Severity Index, was used to determine the level of severity.[20]

Two different categories were considered for the characterisation of the type of physical exercise: (1) strenuous exercise with significant increase in IAP (such as repeated heavy weight lifting) and/or high impact; and (2) low impact

exercise. Body Attack, Body Combat, Body Pump, Power Jump, Step, Cross Fit, total conditioning and circuit/functional classes were included in the first category, as well as gym machine workout routine or with a personal trainer (PT), mostly heavy weight lifting and other activities including running. Low impact category included Body Balance, Yoga, Pilates, Water aerobics, Core/CXWorx, Cycling/RPM, localised gymnastics and Zumba classes, as well as swimming, machine workout or with a PT, mostly weight training with no heavy weight lifting, in addition to other activities including walking or dancing.

The sample size was estimated assuming an expected 21.4% prevalence rate of UI[3] and a significance level of 5%. A sample size of 259 women was considered as required to achieve a 5% level of accuracy.

Descriptive statistics were used to characterise the population, with continuous variables being summarised by median (first and third quartile) and categorical variables by percentage in each category; odds ratio [the ratio of the odds of having UI in the exposed group (e.g., presence of constipation) to the odds of having UI in the unexposed group (e.g., no constipation)] was used to measure the association between UI and risk factors. Uni- and multivariate logistic regression were used to estimate unadjusted and adjusted odds ratio, respectively, for possible confounding variables. Risk factors were only included in multivariate

Table 1 – Univariate and multivariate association between urinary incontinence and risk factors

	Continent n = 217	**Incontinent** n = 73†	**Non-adjusted OR** (95% CI)	***p*-value**	**Non-adjusted OR** (95% CI)	***p*-value**
Age (years)	31 (26; 41.5)	34.5 (27; 46)	1.01 (0.99 - 1.03)	0.184	0.99 (0.95 - 1.03)	0.691
Age						
18 - 39 years	152 (70.4)	44 (60.3)	Ref			
40 - 59 years	50 (23.1)	24 (32.9)	1.66 (0.92 - 3.00)	0.094		
≥ 60 years	14 (6.5)	5 (6.8)	1.23 (0.42 - 3.61)	0.702		
Education						
4th grade	6 (2.8)	1 (1.4)	Ref			
9th grade	5 (2.3)	1 (1.4)	1.20 (0.06 - 24.47)	0.906		
12th grade	21 (9.7)	12 (36.4)	3.43 (0.37 - 31.97)	0.279		
University	184 (85.2)	58 (80.6)	1.92 (0.23 - 16.31)	0.548		
BMI						
< 25 kg/m^2	174 (80.6)	46 (63.9)	Ref		Ref	
≥ 25 kg/m^2	42 (19.4)	26 (36.1)	2.34 (1.30 - 4.21)	0.005*	2.18 (1.16 - 4.09)	0.015*
Constipation						
No	205 (94.5)	57 (78.1)	Ref		Ref	
Yes	12 (5.5)	16 (21.9)	4.80 (2.15 - 10.71)	< 0.001*	4.91 (2.06 - 11.68)	< 0.001*
Genitourinary surgery						
No	195 (96.1)	59 (89.4)	Ref			
Yes	8 (3.9)	7 (10.6)	2.89 (1.01 - 8.31)	0.049*		
Menopause						
No	185 (86.7)	59 (81.9)	Ref			
Yes	29 (13.6)	13 (18.1)	1.41 (0.69 - 2.88)	0.352	0.74 (0.21 - 2.55)	0.632
Hormone replacement therapy						
No	211 (97.2)	71 (97.3)	Ref			
Yes	6 (2.8)	2 (2.7)	0.99 (0.20 - 5.02)	0.991		
Parity (nº gestations)						
0	161 (74.2)	45 (61.6%)	Ref		Ref	
≥ 1	56 (25.8)	28 (38.4)	1.79 (1.02 - 3.14)	0.042*	1.57 (0.57 - 4.32)	0.381
Vaginal deliveries						
0	183 (84.3)	56 (76.7)	Ref		Ref	
≥ 1	34 (15.7)	17 (23.3)	1.63 (0.85 - 3.14)	0.142	1.49 (0.53 - 4.15)	0.450

Data are shown as median (1st/3rd quartile), percentage (%) or OR (odds ratio)
† All types of UI were included
* Statistically significant considering a 0.05 level of significance.
BMI: body mass index; Ref: reference group

regression when statistically significant in univariate regression or as considered in literature as strongly associated. The Hosmer-Lemeshow test was used to assess model fit. Urgency UI (UUI) subtype was excluded from the analysis of exercise-related parameters due to the unlikelihood of its pathophysiological relationship.

For statistical treatment purposes, all surveys were considered for analysis, even uncompleted surveys. For each variable, omitted cases were excluded from the calculations (fail to respond to the referential question of the questionnaire) and 'valid percentage' was used in the descriptive analysis.

SPSS Statistics 26 software was used. Two-sided statistical tests were considered and statistical significance was considered with a *p*-value < 0.05.

This study was approved by the Ethics Committee of the *Centro Hospitalar Universitário São João*.

RESULTS

The questionnaire was completed by two hundred and ninety responders [n = 290, median age 31 (26; 43), range 18-80]. Most responders had a Bachelor's degree or higher (84.1%, n = 243). A 26-month median period of regular exercise practice has been found (12; 84), range 1-480 months. A 25.2% prevalence rate of UI has been found (n = 73), with SUI mostly prevalent (13.6%, n = 39), followed by mixed UI (5.6%, n = 16) and UI (5.2%, n = 15). Only 28.6% (n = 20) of incontinent patients had described the condition to their doctor. The comparative descriptive analysis between both groups (continent and incontinent) is shown in Table 1 (sociodemographic characteristics, risk factors for UI) and Table 2 (exercise-related variables, UI). One hundred and fifty-five responders (53.4%) have described at least one risk factor for non-exercise-related UI: 71.2% (n = 52) of incontinent women and 47.5% (n = 103) of continent women. No statistically significant differences were found between the type of exercise, frequency of weekly training sessions, heavy weight lifting and history of professional or high competition, as shown by *p*-values in Table 2.

A significant association between UI and body mass index (BMI), constipation, history of genitourinary surgery and parity was found in unadjusted analysis. When adjusted, only the presence of constipation and BMI remained significant, as shown by the *p*-values of the unadjusted and adjusted odds ratio in Table 1. An increase of around five times the odds of developing UI has been found with the presence of constipation in exercisers, while an increase of approximately twice was found in obese or pre-obese people (Constipation, OR = 4.91, 95% CI 2.06 - 11.68; BMI ≥ 25 kg/m^2 vs. < 25 kg/m^2, OR = 2.18, 95% CI 1.16 - 4.09). The Hosmer-Lemeshow test has shown that the model was fit to data (p > 0.05).

Data regarding behaviours adopted in exercise are shown in Table 3 and the characterisation and interference of UI in Table 4. Going to the toilet before training was the behaviour adopted by most responders, followed by the use of absorbent pads. Most of incontinent women (50.7%, n = 37) presented with leaks of urine with daily activities and while exercising and only a minority presented leaks of urine while exercising only (9.6%, n = 7). Most women presented with mild to moderate UI, with mild leak of urine at least once a week, with interference in daily life or exercise.

As regards the approach to UI in gyms, only 5.5% (n = 16) have described that the subject was approached at the time of the initial fitness assessment; 9.7% (n = 28) described that the exercises were oriented towards pelvic floor strengthening and UI prevention in a group class, while 13.5% (n = 5) of the 37 responders working with a

Table 2 – Univariate association between stress or mixed UI and physical exercise

	Continent n = 217	Incontinent n = 55†	Non-adjusted OR (IC 95%)	*p*-value
Regular exercise (months)	26 (12; 84)	36 (12; 120)	1.00 (1.00 - 1.01)	0.084
Type of exercise				
Low impact only	77 (37.9)	26 (49.1)	Ref	
High impact or both	126 (62.1)	27 (50.9)	0.64 (0.35 - 1.17)	0.143
Training frequency				
Once or twice a week	19 (10.6)	7 (14.6)	Ref	
≥ 3 times a week	160 (89.4)	41 (85.4)	0.70 (0.27 - 1.77)	0.445
High load weight lifting				
No	126 (60.9)	36 (67.9)	Ref	
Yes	81 (39.1)	17 (32.1)	0.74 (0.39 - 1.39)	0.345
High competition athlete				
No	209 (96.3)	51 (92.7)	Ref	
Yes	8 (3.7)	4 (7.3)	2.05 (0.59 - 7.07)	0.256

Data are shown as median (1st/3rd quartile), percentage (%) or OR (odds ratio)
† Stress of mixed UI
* Statistically significant considering a 0.05 level of significance.
BMI: body mass index; Ref: reference group

PT have described that the same happened in individual training. One hundred and ninety-eight responders (68.3%) were aware of PFMT.

DISCUSSION

A 25.2% prevalence rate of UI has been found in this study, involving a population of recreationally active women attending gyms and SUI was the most frequently found type of UI. Variable rates of UI (14.9% to 49.3%) have been found in previous studies carried out in recreationally active women aged 14-83,[18,21-24] as shown in Table 5. A 19.9% prevalence rate has been found in a study[25] involving young nulliparous women living in the same region as in the present study. The prevalence of UI was lower than in 2019 (35.2%)[4] even though higher than in 2009 (21.4%),[3] when compared to previous studies in the Portuguese general population. It is worth mentioning that a 31.2% prevalence rate of UI was found in the latter study involving only women aged over 40.

As regards age distribution, a similar median between continent and incontinent women has been found and, in the case of incontinent women, 60.3% were aged under 40. UI has been associated to aging and menopause[2,3,7,8] even though it is expected that when only physically active women were analysed, ages tend to be lower. The highest prevalence rate has been found in the 40-59 age group (32.4%), while urinary leakage has affected 26.3% of women aged over 60 and 22.4% of those aged under 40. Different reasons for having obtained an underestimated number of incontinent women in the older age groups must be taken into consideration when these results are analysed. First of all, this may still be associated to a feeling of embarassment[2,26] and perhaps this happens mainly in older age groups. Women who quit the gym due to UI and potentially presenting with a more severe UI were excluded from the study, which may explain the fact that a higher prevalence rate of mild to moderate UI was found in our sample. Finally, as the sample is smaller in these groups, small variations could have a greater impact on the rate.

Several studies have been carried out trying to understand whether there was an association between exercise and UI. A significant prevalence rate of UI has been mostly found, predominantly associated to high impact activities[27-29] (jumping, running and exercises combining

Table 3 – Behaviours in physical exercise

	Continent n = 217	Incontinent n = 73†
Exercise modification	4 (1.9)	9 (12.7)
No fluid intake	2 (0.9)	8 (11.0)
Go to the toilet first	40 (18.4)	50 (68.5)
Use of absorbent pads	5 (2.3)	19 (26.0)

Data are shown as percentage (%)
† All types of UI were included

Table 4 – Characteristics of UI at daily activities and with physical exercise

	Incontinent at daily activities and with physical exercise n = 37†		Incontinent at daily activities only n = 29†	Incontinent with physical exercise only n = 7†
	Daily activities	Exercise		
Frequency				
≤ once a week	18 (48.6)	24 (64.9)	24 (82.8)	6 (85.7)
2 or 3 times/week	12 (32.4)	7 (18.9)	3 (10.3)	0 (0)
Once a day	2 (5.4)	4 (10.8)	2 (6.9)	1 (14.3)
Several times a day	5 (13.5)	2 (5.4)	0 (0)	0 (0)
All the time	0 (0)	0 (0)	0 (0)	0 (0)
Leak of urine				
Minor	33 (89.2)	34 (91.9)	27 (93.1)	7 (100)
Moderate	4 (10.8)	2 (5.4)	2 (6.9)	0 (0)
Major	0 (0)	1 (2.7)	0 (0)	0 (0)
Interference with daily activities or exercise ‡				
Yes	33 (91.7)	32 (88.9)	23 (79.3)	4 (57.1)
No	3 (8.3)	4 (11.1)	6 (20.7)	3 (42.9)
Severity (ICIQ-IU SF score)				
Mild (1-5)	17 (45.9)	21 (56.8)	19 (65.5)	5 (71.4)
Moderate (6-12)	17 (45.9)	13 (35.1)	9 (31)	2 (28.6)
Severe (13-18)	3 (8.1)	3 (8.1)	1 (3.5)	0 (0)
Very severe (19-21)	0 (0)	0 (0)	0 (0)	0 (0)

Data are shown as percentage (%)
† All types of UI were included.
‡ Regardless of the level of interference.

Table 5 – Prevalence of UI

Study	UI prevalence (%)	n	Age (years) Mean (standard)	Age (years) Range (Min; Max)	Specific characteristics of study participants	Country
Reis de Carvalho *et al*[4] (2019)	35.1	2226	56 (40; 68)†	19 - 90	--	Portugal
Correia S *et al*[3] (2009)	21.4	1483	--	≥ 40	--	Portugal
Da Roza *et al*[25] (2015)	19.9	386	21.4 (3.3)	14 - 33	Nulliparous Physically active	Portugal
Alves JO *et al*[21] (2017)	22.9	245	21.6 (3.5) 22.0 (3.9)‡	18 - 40	Nulliparous High impact *vs*. low impact groups BMI < 25 kg/m^2	Brazil
McKenzie S *et al*[18] (2016)	49.3	361	39 (11)	18 - 83	Attending the gym	Australia
Fozzatti C *et al*[24] (2012)	24.6	488	25.68 (5.32) 24.45 (4.97)§	20 - 45	Nulliparous Attending the gym *vs*. controls	Brazil
Salvatore S *et al*[22] (2009)	14.9	679	36¶	14 - 51	Recreational exercise	Italy
Nygaard I *et al*[23] (1990)	47	326	38.5¶	17 - 68	Mostly physically active women	USA

n (number of participants).
† Shown as median (1st/3rd quartile).
‡ Data regarding high impact and low impact groups, respectively.
§ Data regarding the group engaged in physical activities and the control group, respectively.
¶ Data regarding standard deviation were not available
Min: minimum age; Max: maximum age.

abdominal and pelvic movements), both in athletes (organised sports in a competition context)[30-32] and in recreational exercisers.[11,18,21-24,33,34] On the other hand, other studies have associated UI with sedentarism.[35-37] Data on the effect of long-term exercise on pelvic floor function and UI are still scarce in literature.[29,38] A high prevalence rate of UI has been found by Eliasson *et al*.[39] in ex-trampolinists but other authors did not find significant differences between athletes and controls,[41] or between athletes of different modalities.[40,41] As regards the higher weekly frequency[21,25,28,29,39] and the temporal history of sports practice,[39] a positive association with UI and the ICIQ score had already been described.[30] Da Roza *et al*.[25] found that female athletes (who trained weekly for longer than the other participants in the study) had a 2.5 times higher risk of UI than inactive women. However, among recreational exercisers, there no increase in the relative risk had been found.

A statistically significant association has not been found in this study between exercise-related parameters and UI (Table 2). We found that 62.1% of continent women opted for training including strenuous or high impact exercises, which is explained by the high prevalence of young people in the sample, who tend to engage in more vigorous exercise. Nevertheless, a lower percentage (50.9%) of those engaged in strenuous exercise has been found in the group of incontinent women, in all age groups. It may be considered that incontinent women have changed their workout patterns, giving up more strenuous classes and opting for low impact sports, in order to reduce leakage or have even quitted exercise.[11,12,22,23]

The presence of a continence threshold in every woman has been suggested in 1994 by Nygaard *et al*.[32] and, when exceeded, there is a leak of urine, even in the absence of any risk factor for UI. This theory was confirmed in a recent review by Nygaard and Bø[14] adding the hypothesis that strenuous exercise may have a detrimental effect on women with dysfunctional pelvic floor, unable to perform unconscious PFM co-contraction in a timely manner, even though it may have a positive effect on muscle strengthening in women with a functional pelvic floor. Knack's manoeuvre (voluntary contraction of the PFM before and during an increase in IAP) has been shown to be effective in preventing urine leaks with coughing.[42,43] This technique of coordination of pre-contraction with exercise may be applied in some workouts, although it will be difficult in workout involving high rotation of different exercises and rapid or high number of repetitions.

Increased IAP as a predisposing factor to unintentional passing of urine has also been debated and the specific effect on PFM is still unknown.[14] Some studies have shown that, on average, higher values than coughing were not obtained during exercises such as abdominal exercises or when rising from a sitting position[44] and there is a great inter-individual variability in the values that are obtained and tolerated by each woman.[14] Another study compared IAP during 'normal' exercise with alternative workout plans considered as safe for the pelvic floor and found no significant differences.[45] In the same review,[14] the authors have proposed that IAP may have an impact on PFM not because of its absolute load value on the pelvic floor but rather because

it is applied repeatedly and dynamically.

Finally, the effect of including low impact modalities in the workout plan to 'counterbalance' the effect of strenuous exercise is unknown. Physically active women may require a stronger pelvic floor.[17,27] The symptoms of all types of UI can be improved or resolved with PFMT[46] as part of a conservative treatment, recommended both for prevention and first line therapy by the ICS and the Portuguese Gynaecological Society.[2] Exercises that can strengthen the core and PFM, such as Pilates and Yoga, have been explored as potential alternatives, but there are still not enough data available.[47-50] In fact, Bø *et al.* had already found a similar UI prevalence rate in female teachers of these modalities when compared to the general population, even though most of the participants in this study were engaged in other modalities simultaneously.[51] In a 2018 paper, the author, together with Kruger *et al.*, have reached the conclusion that PFM only contracted 30 to 50% of a contraction within a PFMT context during the activation of other muscle groups (including abdominal and gluteal muscles) and therefore any therapeutic efficacy and impact of co-contractions on PFM are questionable.[52]

It is worth mentioning the subjectivity and what may have been a source of bias for the classification of the type of exercise, including the fact that (i) most participants engaged in a wide variety of classes with different weekly frequencies; (ii) weekly sport practice time was not considered, only the number of workouts; (iii) 'cardio' workouts were not considered due to the lack of discrimination of the intensity and typology of training, as well as all responses that did not specify the type of exercise, and (iv) categorisation of weight training was based on self-perception of the loads rather than on any objective assessment.

A positive association of constipation and BMI ≥ 25 kg/m^2 with UI has been found, in line with literature, considering these two conditions as risk factors for UI.[2,3,7,8] Gymnasiums again play an important role in this context, not only through the promotion of physical activity but also with nutritional and hydration counselling services. Non-surgical weight loss programmes associated with lifestyle changes appear to have a modest benefit on the improvement of UI within the first three years[53] and a 5 to 10% decrease in body weight has been shown to be associated with less episodes of urine leaks in overweight women.[54] As regards constipation, exercise may be a treatment option, although its effect has not yet been quantified,[55] together with high-fibre diets and adequate fluid intake.[56] It is worth mentioning that 'genitourinary surgery' variable was not included in the logistic regression model, despite its significant association with UI in univariate analysis, due to the very low sample size.

In the analysis of the association between UI and potential risk factors (Table 1 and 2), we must take into account that the sample size was not calculated with this purpose and rather based on the desired precision for prevalence estimates, which may have contributed to the absence of statistically significant differences for some of the parameters that were analysed. In addition to the limitations already described, no cause-effect relationship could have been established, as this is an observational cross-sectional study and the date of symptom onset for each respondent was not available. Therefore, we could not determine whether the respondents had already presented with urine leaks in the past (although not within the previous four weeks) and whether UI symptoms had started before or following the moment when women engaged in physical exercise.

The behavioural measures described in Table 3 had already been identified in previous studies.[11,18,22,23] It was found that some women adopted preventive behaviours even with no incontinence. We may reach the conclusion that there is a fear among women (even with no incontinence) of having some urine leak in the future or that some women may have had UI in the past, since the ICIQ-UI SF is only focused on the previous four weeks.

Less than 30% of incontinent women had sought medical help, which is in line with what has been found by other authors.[22,23,32] Accepting UI as just part of getting older was one of the mostly found attitudes described by Esparza *et al.*, considering this health problem as age-related and related to the biological characteristics of being a woman, mainly affecting older women.[9]

As found in this study, UI is rarely addressed in physical assessments and training sessions at gymnasiums, which may contribute to underdiagnosis, undertreatment, inactivity and to the perpetuation of 'embarrassment' and accepting it as part of getting older. Physical and health status assessment, carried out in most gyms as part of the initial and periodic assessments, is an opportunity for UI screening but also for health education in prevention and giving a contribution to the conservative treatment of UI, promoting the adoption of pelvic floor protection measures within the workout plan.

Further studies for the clarification of the relationship between UI and the different types of exercise are required, including the investigation of the influence of a PFMT workout plan in addition to high impact or strenuous exercise plans, as well as the assessment of the knowledge and awareness of coaches towards this condition.

CONCLUSION

This study has shown that UI is highly prevalent in women engaged in regular recreational physical activities, affecting older and younger age groups as well, with no relationship with the frequency and intensity of physical exercise. A significant association of constipation and overweight (both modifiable risk factors) has been found with UI, which is rarely addressed in gyms. Awareness raising among professionals and promotion of their active role in the identification of UI are required, considering the high prevalence and significant impact of UI on quality of life, addressing the modification of risk factors and implementation of preventive strategies in physical exercise.

ACKNOWLEDGMENTS

The authors would like to acknowledge all the participants in this study and the gyms that made the collection of surveys possible.

AUTHOR CONTRIBUTIONS

MFS: Design of the project; data acquisition, analysis and interpretation; final revision.

RPC, CMO: Data analysis and interpretation; final revision.

SM: Design of the project; data acquisition, analysis and interpretation; final revision.

HUMAN AND ANIMAL PROTECTION

The authors declare that this project complied with the regulations that were established by the Ethics and Clinical Research Committee, according to the 2013 update of the Helsinki Declaration of the World Medical Association.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in writing this manuscript.

FINANCIAL SUPPORT

The authors declare that there was no public or private financial support in writing this manuscript.

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