Original Article

The prevalence of urinary incontinence in women practicing high-impact exercises

A prevalência da incontinência urinária em mulheres praticantes de exercícios físicos de alto impacto

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ABSTRACT | INTRODUCTION: UI affects about 10 million Brazilians of all ages, being twice as common in females, according to the Brazilian society of urology. Any involuntary loss of urine according to the ICS is considered, and can be classified into IUU, IUE and MUI. Treatment for UI can be surgical, pharmacological or physiotherapeutic. **OBJECTIVE:** To identify the prevalence of urinary incontinence in women, who practice high-impact physical exercise, compared to women who do not practice physical activity. **MATERIALS AND METHODS:** The study was a cross-sectional study, where a case study was carried out on the involuntary loss of urine by women during impact physical exercise. The participants were divided into two groups: Group 1, women practicing high-impact physical exercises and Group 2, women not practicing physical exercises. The volunteers performed the one-hour Pad test, standardized by ICS. In addition, all responded to the International Consultation on Incontinence Questionnaire - Short Form (ICIQ-SF). **RESULTS:** SUI symptoms were present in both investigated groups. However, it was possible to prove that in the group where women practiced high-impact exercises, the loss of urine was much greater in quantity and quality, with results exceeding 60% in the practitioners of high-impact exercises. **CONCLUSION:** Women who practice high impact exercises showed greater urinary loss as evidenced by the Pad test and a greater interference of these urinary symptoms in the quality of life proven by ICIQ-SF.

KEYWORDS: Urinary incontinence. Physical exercise. Pelvic floor.

RESUMO | INTRODUÇÃO: A IU atinge cerca de 10 milhões de brasileiros de todas as idades, sendo duas vezes mais comum no sexo feminino, de acordo com a Sociedade Brasileira de Urologia (SBU). Considerada qualquer perda involuntária de urina de acordo com a ICS, podendo ser classificadas em IUU, IUE e IUM. O tratamento para a IU pode ser cirúrgico, farmacológico ou fisioterapêutico. **OBJETIVO:** Identificar a prevalência de incontinência urinária em mulheres praticantes de exercício físico de alto impacto, em comparação com mulheres que não praticam atividade física. **MATERIAIS E MÉTODOS:** O estudo foi do tipo transversal, onde se realizou um estudo de caso, sobre a perda involuntária de urina por mulheres, durante o exercício físico de impacto. As participantes foram divididas dois grupos: Grupo 1, mulheres praticantes de exercícios físicos de alto impacto e Grupo 2, mulheres não praticantes de exercícios físicos. As voluntárias realizaram o *Pad Test* de uma hora, padronizado pela ICS. Além disso, todas responderam o questionário Internacional Consultation on Incontinence Questionnaire – Short Form (ICIQ-SF). **RESULTADOS:** Houve a presença de sintomas de IUE em ambos os grupos investigados. Entretanto, foi possível comprovar que no grupo onde as mulheres praticavam exercícios de alto impacto a perda de urina foi bem maior em quantidade e em qualidade, observando-se resultados superiores a 60% nas praticantes de exercícios de alto impacto. **CONCLUSÃO:** As mulheres praticantes de exercícios de alto impacto apresentaram maior perda urinária comprovada pelo *Pad Test* e uma maior interferência desses sintomas urinários na qualidade de vida comprovada pelo ICIQ-SF.

PALAVRAS-CHAVE: Incontinência urinária. Exercícios físicos. Assoalho pélvico.

Submitted 08/18/2020, Accepted 11/05/2020, Published 11/27/2020
J. Physiother. Res., Salvador, 2020 November;10(4):634-641
Doi: 10.17267/2238-2704rpf.v10i4.3237 | ISSN: 2238-2704
Designated editors: Adriana Saraiva, Cristiane Dias, Katia Sá

How to cite this article: Mesquita VC, Aragão MIC, Correia SA, Pereira AS, Gomes SCL, Azevedo KM et al. The prevalence of urinary incontinence in women practicing high-impact exercises. J Physiother Res. 2020;10(4):634-641. doi: 10.17267/2238-2704rpf.v10i4.3237

Introduction

The regular practice of physical exercises, whether aerobic, muscle strengthening or flexibility, is generally recommended in the treatment process and in the prevention of heart disease, hypertension, osteoporosis, obesity, diabetes, among others[1]. Furthermore, it has undeniable positive effects on the emotional aspects, reducing the harmful effects of stress, promoting tension relief, and mood, anxiety and depression improvement[2].

Despite all known benefits of practicing exercises, some modalities demand better specific neuromuscular functional capacity. High-impact exercises, for example, require greater restraint and support from the pelvic floor muscles (PFM)[3]. Dysfunctions in this musculature associated with high intra-abdominal pressure created during this type of exercise may result in urine loss episodes even in the absence of other risk factors[4].

The International Continence Society (ICS) defines urinary incontinence (UI) as any involuntary loss of urine[5]. UI is categorized as: Urgency Urinary Incontinence (UUI), characterized by a strong urge to urinate followed by loss of urine[6]; Stress Urinary Incontinence (SUI), which is related to loss of urine due to the increase of intra-abdominal pressure resulting from physical effort, when the intra-bladder pressure is higher than the urethral pressure in the absence of the detrusor muscle contraction; and Mixed Urinary Incontinence (MUI), which results from a combination of the other two types[7].

In women, some factors tend to be considered predisposing to urinary disorders. Obstetric and gynecological history may contribute to the appearance of urine loss as well as age, where over the years there is a decrease in collagen fibers, replacement of muscle tissue by adipose tissue and consequent decrease in the contraction strength of the pelvic floor muscles, decrease in bladder storage capacity and low estrogen levels in postmenopausal women[8-11].

In the pelvis there is a set of interconnected structures, such as muscles, ligaments, fascias and the pelvic floor musculature itself, which are responsible for the support of the bladder and urethra that close the pelvis and stand on the viscera vertically, all of this anatomical junction is held responsible for the intra-abdominal and bladder neck position, therefore any change may interfere with continence[12].

Some sports and/or laborious practices may overload, stretch and interfere with the ability of the perineal musculature to withstand repetitive efforts, exceeding its sustaining capacity and thereby altering continence effectiveness[13]. In this sense, high-impact exercise becomes one of the risk factors for the development of urinary incontinence in physically active women who are athletes and non-athletes[4].

Nevertheless, incontinent women should not stop practicing sports. There is scientific evidence that proves that physical exercise, when properly oriented, generates positive results, reducing loss of urine. Low-intensity exercises, for example, may be used for prevention[14].

This study aimed to identify the prevalence of urinary incontinence in women who practice high-impact physical exercise, in comparison with sedentary women.

Methodology

A cross-sectional, prospective study was carried out, which documented the loss of urine in two groups of women, each group consisted of 10 volunteers and the protocols were carried out in a higher education institution in Teresina, Piauí.

Data collection was carried out after approval by the Ethics and Research Committee (CEP) under report No. 820,748 (CAAE - Certificate of Presentation of Ethical Appreciation) and participants' authorization by signing the Informed Consent Form (ICF), as advocated in the resolution 466/12 of the National Health Council.

The study was carried out by capturing young women between 20 and 30 years old, divided into two groups: Group 1 (G1), women practicing high-impact physical exercises (fitness trampoline jumping, running,

CrossFit training) who had practiced them for any time equal to or longer than 3 months regularly, at least 3 days a week; and Group 2 (G2) with women who had been sedentary for at least 3 months.

To detect and quantify urine loss, the Pad Test was used as method. The test is based on the weight gain of the pad during the test period under standard conditions and was carried out on a scheduled date and time, before starting their training. The day before the test, the participants received a kit containing a 500 ml bottle of water at room temperature, a pad previously weighed on a precision electronic scale with a sensitivity of 0.01 g, and guidance on the activities that would be carried out.

On the day of the test, the volunteers were instructed to urinate two hours before the activities, using a cotton sanitary pad which was 23 cm long, 7 cm wide, 5 mm thick and an average weight of 5.5 g. The measurement of its weight, at the beginning and at the end of the test, was made using a Brinox digital scale 5 kg maximum capacity with the "tare" function which subtracts the standard pad weight.

Initially, a pad which had been previously weighed was placed close to the patient's external urethral meatus. Then, the patient ingested 500 ml of water and was made to rest for 15 minutes. Afterwards, the patient was asked to perform certain actions simulating daily life activities (going up and down the stairs for 15 minutes, sitting and standing up ten times, coughing ten times, picking up objects on the floor five times, running in the same place for one minute and washing their hands under running water for one minute). After performing the proposed activities, the pad was removed and weighed on the precision scale. Urine losses were assessed and assorted: losses of up to 1 g were considered insignificant; losses between 1.1 and 9.9 g were categorized as light losses; between 10 to 49.9 g as moderate losses; and above 50 g as severe losses[15].

They also answered the International Consultation Incontinence Questionnaire - Short Form (ICIQ-SF) translated into Portuguese. The ICIQ-SF is a simple, brief and self-admissible questionnaire, used to assess the impact of UI. The higher the score, the greater the impact on quality of life, graded in scores considering the points: 0 no impact; 1 to 3 light impact; 4 to 6 moderate impact; 7 to 9 serious and lastly 10 or more points very serious.

The data were analyzed, tabulated with graphical representation and comparison between groups by the SSP statistic software, in which $p<0.05$ was considered significant.

Results

The initial population investigated was of 30 women, among which 10 were excluded either because they had menstrual periods on the day of the test or because they did not agree with the ICF. Consequently, 20 volunteers were researched, divided into two groups: G1 with 10 high-impact physical exercise partaker and G2 with 10 sedentary women.

The average age of women in G1 was 23.2 ± 1.32 years old and in G2, 22.5 ± 1.96 years old. In both groups, 80% of women were nulliparous, 75% had not completed Higher Education, 15% had completed Higher Education and 10% had completed High School.

The high impact activities performed by G1 volunteers were thus distributed: 20% practiced CrossFit training, 50% running and 30% fitness trampoline jumping. All followed the criteria of performing the exercise with practice time equal to or greater than 3 months and minimum frequency of 3 times a week.

Urinary symptoms and the impact of urine loss on the groups' quality of life were researched according to the International Consultation on Incontinence Questionnaire - Short Form (ICIQ-SF). Graph 1 shows the frequency of urine loss in relation to the group according to their daily routine and Table 1 describes the perception of the amount of urine lost by the participants in both groups.

According to the Pad Test, 60% of physical exercise partakers showed positive results with values in grams ranging from 3.8g to 11.4g. Among the exercise modalities, the one which drew more attention in relation to losses of urine was CrossFit training, in which all participants presented urine

loss with an average of 8.0g. In G2, 20% presented average loss of 1.8 g in the Pad Test. According to the ICIQ-SF, it is possible to assess the impact of UI on the quality of life, graduated in scores. The closer to 10, the greater the interference of urine loss is in the participant's life. In Table 2 it is possible to observe the significant difference (p <0.05) in the value of the Pad Test and the ICIQ-SF score between the groups.

Graph 1. Frequency of urine loss according to ICIQ-SF

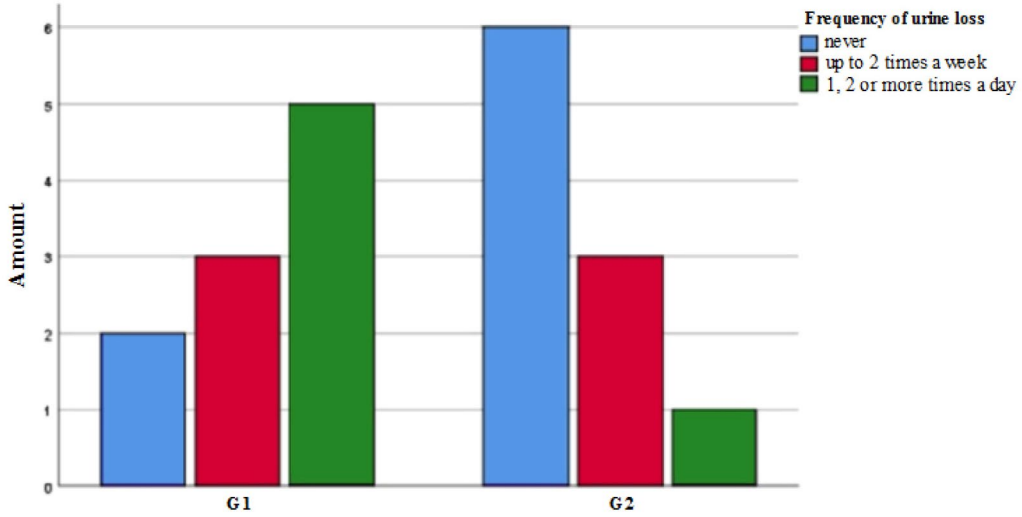

Table 1. Groups' urinary symptoms according to ICIQ-SF

Urine amount	G1	G2
Small	30%	30%
Moderate	40%	10%
Large	10%	-

Table 2. Data referring to mean ICIQ-SF scores of participants and Pad Test

	Groups	Mean	Deviation	p
ICIQ-SF score	G1	7,60	1,78	< 0,05
	G2	2,20	0,92	
Pad Test (g)	G1	7,44g	2,43	
	G2	1,86g	0,72	<0,05

Discussion

This study aimed to verify the prevalence of UI in women who practice high-impact exercises compared to sedentary women through two assessment methods, the Pad Test and the ICIQ-SF. Despite some points of imprecision, such as: the reduced number of investigated participants; the lack of a control group consisting of women who performed other types of exercise than those of impact; and further investigation of other factors involved in the cause of loss of urine besides exercise; it was possible to prove that the prevalence of UI and the interference of these urine losses in the quality of life in women who practice high-impact exercises was much higher when compared to the group of sedentary women.

Physical activity has been identified as a risk factor for acquiring some type of urinary dysfunction16. This is believed to occur due to the impairment of the mechanisms of support, suspension and restraint of the pelvic floor muscles (PFM), which undergo repeated overload, thus promoting their weakening[17]. Some exercises increase intra-abdominal pressure, causing an overload on the PFM, favoring the appearance of involuntary loss of urine[18]. High-impact physical exercises may cause excessive increase in intra-abdominal pressure, which can overload the pelvic organs, pushing them downwards, causing damage to the muscles responsible for supporting these organs[19].

Athletes tend to have stronger and more resistant abdominal musculature. When performing a high-impact exercise, for example, the diaphragm and abdominal muscles contract at a greater intensity, which makes intra-abdominal pressure higher. The pelvic floor is the part which suffers with these sudden force loads exerted onto it, since the impact against the ground during training may reveal pelvic muscles weakening, which decreases its contraction capacity, which then favors episodes of urine loss[20].

Strenuous exercise results in lower vaginal contraction pressure, as there would be compromise in blood supply and low oxygen levels in type I muscle fibers, responsible for maintaining tone, which would indicate pelvic floor muscle fatigue, besides there being a reduction of neural signaling after prolonged muscle activity, thus reducing muscle contraction efficiency and favoring the loss of urine[21].

Studies carried out in women who practice high-impact physical exercises involve several factors which need prior analysis, such as the increase in intra-abdominal pressure during physical activity, since although some women presented strengthened pelvic floor muscles (PFM) , constant exercising can increase abdominal pressure and weaken the pelvic floor, resulting in UI[22].

However, the causes of UI are multifactorial and cannot be exclusively limited to a single risk factor with the practice of high-intensity exercise. Such other factors were not investigated in this study, this stands out as a potential source of research bias, however findings suggest that exercise may as well be one of these causes.

Another probable etiology of UI in women, for example, is related to changes in the cardinal, urethral-sacral ligaments and connective tissue, which may be damaged and lose their mechanical efficiency owing to repetitive increases in abdominal pressure, caused by repetitive, heavy manual labor and/or chronic cough. Since young and nulliparous women physiologically do not have ligament tears, fascia lesions, nerve muscle fibers and pelvic floor injuries, incontinence among these women may be owed to genetic weakness of the connective tissue, of the location below the pelvic floor and a smaller number of muscle fibers in the area[16].

All of these factors justify the results obtained by this study, which demonstrated the presence of SUI symptoms in both groups investigated. However, it was possible to prove that among the group where women practiced high-impact exercises, the loss of urine was more accentuated and this interfered directly with their quality of life. Several studies have already been showing high prevalence and greater risk of urinary incontinence in physically active

women 23 and results described by Silva et al.[24], point out that the most reported incontinence among athletes is SUI, which is directly related to PFM injuries, reinforcing the hypothesis that high-impact activities may be responsible for causing urinary dysfunctions.

This research participants' assessment involved three different high-impact sports (CrossFit training, Running and Fitness trampoline jumping), and a total of 60% of the partakers presented UI as proven by the Pad Test. In comparison with the results by Filoni E. et al.[25] there was similarity, given that they presented results greater than 54% of athletes with UI. The modality which stood out, despite the sample limitation, was CrossFit training, among which all partakers presented loss of urine. In their results, Yang, J. et al.[26] found an incidence of 50% of SUI among young women for this practice and mentioned that, for using different exercises with specific biomechanics for each one of them, CrossFit training may be potentially more strenuous for the pelvic floor support.

As for the group of sedentary volunteers, 20% of the participants had significant loss of urine in the Pad Test, which once again demonstrates that UI involves multiple factors and these must be investigated. Filoni E. et al.[25] found higher results, where 40% of sedentary women lost urine.

In the clinical evaluation, the Pad Test was used, which represents an objective way of quantifying loss of urine. By measuring the loss of urine in the pad, it is possible to categorize urinary incontinence as mild (with losses between 1.1 and 9.9 g), moderate (with losses between 10 and 49.9 g) and severe (over 50 g)[26]. The average amount of loss of urine in the physical exercise group was of 7.44 g and in the sedentary group it was of 1.86 g, which confirms this objectively demonstrable urine loss[27]. According to a study carried out by Dias e Rodrigues[28], there were similar results among young and nulliparous women, concluding that multiparity or aging are not the sole factors which contribute to the prevalence of UI.

Another point investigated in this study was the interference that urine loss causes in the women's quality of life. According to Frade et al.[29], it is extremely important to assess the impact and perception of quality of life in women with UI, since it can have a negative impact in wide realms, such as emotional, physical and mental realms, personal and social relationships, as well as biological changes, affecting their self esteem above all. Thereby, we can bring forth the data obtained in the study by Fernandes et al30 where they described that 38.4% of the women investigated reported how much urinary incontinence can cause negative subsidies to their quality of life.

Through the scores obtained by the ICIQ-SF, a higher frequency and perception of the amount of urine lost among high-impact physical exercises partakers was verified, consequently, such factors affect these women's quality of life more negatively. Literature holds several studies which corroborate such results, among them the one by Alves et al.[31] and the one by Carvalhais 32 that even when evaluating different sports modalities, they agree with a higher prevalence in the frequency and amount of loss of urine among athletes when compared to sedentary women or those practicing low or medium-impact exercises.

According to Ludviksdottir et al.[33], to reduce the rate of urinary incontinence it is imperative that coaches pay attention to the strengthening and training of pelvic floor muscles, as it is noticeable that they are not strengthened during general training sessions. Caetano et al.[34] also suggests that professionals start working on SUI prevention by establishing supporting approach to the prevention of urinary incontinence caused by physical exercise.

Conclusion

According to the data obtained in the research, it was observed that in relation to the sedentary women group, the women who practice high-impact exercises showed greater loss of urine, which was proven by the Pad Test, as well as a greater negative interference of these urinary symptoms with the their quality of life, which was proven by the ICIQ-SF, thus being able to cause losses in their domestic and professional tasks, influence on their sexual life and social conviviality. However, it is noteworthy that some of the characteristic symptoms of urinary incontinence were also observed in the group of women who did not perform the exercises. This suggests the existence of other factors that may be

related to loss of urine and therefore more studies should be carried out to identify them.

Author contributions

Mesquita V. C. was responsible for performing research data collection, interpreting data and writing the manuscript. Aragão M. I. C. organized the manuscript, wrote the abstract, contributed with writing the manuscript's discussion and conclusion, revised the article. Pereira A. S. organized the manuscript, wrote the English version of the abstract, contributed with writing the manuscript's methodology, revised the article. Azevedo K. M. and Lima W. S. revised the article. Correia A. S. e Gomes S. C. L. revised the writing, data interpretation and bibliography used in the manuscript. Dias S. F. L. conceived the project, interpreted the results and approved the final draft.

Competing interests

No financial, legal or political conflicts involving third parties (government, companies and private foundations, etc.) have been declared for any aspect of the submitted work (including, albeit not restricted to, subventions and funding, participation in advisory council, study design, manuscript preparation, statistical analysis, etc.).

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