Reeducation of pelvic floor muscles in volleyball athletes

Silvia Ferreira[1], Margarida Ferreira[2]*, Alice Carvalhais[3], Paula Clara Santos[4], Paula Rocha[5], Gabriela Brochado[6]

[1]Visiting Professor, Department of Physiotherapy, North Polytechnic Institute of Health, CESPU-Gandra (Portugal).
[2]PhD student at the Research Centre in Physical Activity, Health and Leisure, Faculty of Sport, University of Porto (Portugal); Visiting Professor, Department of Physiotherapy, North Polytechnic Institute of Health, CESPU-Gandra (Portugal).
[3]Associate Professor, Department of Physiotherapy, North Polytechnic Institute of Health, CESPU-Gandra (Portugal).
[4]Associate Professor, Department of Physiotherapy, School of Health Technology of Porto, Institute Polytechnic of Porto (Portugal).
[5]Associate Professor, Department of Physiotherapy, North Polytechnic Institute of Health, CESPU-Gandra (Portugal).
[6]Coordinated and associate professor, Department of Physiotherapy, North Polytechnic Institute of Health, CESPU-Gandra (Portugal).

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***Correspondence:**
Centro Hospitalar do Alto Ave
Address: Rua dos Cutileiros,
Medicina Física e Reabilitação
Postal Code: 4835-044
Guimarães – Portugal
margasufer@gmail.com

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Summary

Objective: to verify the effectiveness of the pelvic floor muscles rehabilitation program (PFMRP) in female volleyball athletes, analyzing the amount and frequency of urinary leakage.
Methods: experimental study. The sample consisted of 32 female athletes from Famalicão Athletic Volleyball Club (Portugal). The athletes were selected by convenience and distributed randomly into two groups: experimental group (EG = 16 athletes) and the control group (CG = 16 athletes). The EG underwent PFMRP for three months. The PFMRP was the awareness and identification of the pelvic floor muscles (PFM), pre-timed PFM contraction prior to occasions of increased intra-abdominal pressure, and 30 daily contractions of MPP at home. The CG had only access to the pamphlet. The assessment instruments included the questionnaires, the Pad Test (amount of urinary leakage) and frequency record of urinary leakage (7-day diary) before and after PFMRP.
Results: the amount of urine leakage decreased in 45.5% of athletes under PFMRP intervention, and in 4.9% of athletes in CG, with statistical differences between the groups ($p < 0.001$). The reduction in the frequency of urinary leakage was 14.3% in EG, and 0.05% in CG, a statistically significant difference between the groups ($p < 0.001$).
Conclusion: PFMRP in this study was effective to reduce stress urinary incontinence in female volleyball athletes. The program allowed significant improvement of symptoms of quantity and frequency of urinary leakage.

Keywords: sports athletes, stress urinary incontinence, physical therapy.

Introduction

There is a general consensus among authors that despite the distinct benefits of sport in young athletes, such as improved cardiovascular and respiratory systems, the reduction of adipocytes, increased endurance, muscular hypertrophy and increased strength, and higher bone density, adversely urogynecologic problems arising from physical activity may occur, including amenorrhea, oligomenorrhea, short phase of the *corpus luteum*, anovulation and urinary incontinence.[1]

In the last decade, several studies have demonstrated and reflected the association between urinary incontinence (UI) and high-impact sports.[1,2]

Epidemiological studies related pregnancy and childbirth as probable primary etiologic factors of stress urinary incontinence (SUI). In fact, the prevalence of SUI is higher in multiparous women than in nulliparous.[3] However, a recent study of SUI in young nulliparous athletes showed a prevalence of 36.4%.[4]

Some studies have shown that the high prevalence of SUI in nulliparous athletes is associated with the type of sport. A systematic review conducted in 2004,[2] revealed that the prevalence of UI during sports practice varied between 0% (golf) and 80% (trampoline).

Modalities that include activities such as jumping and running seem to have an increased risk of triggering urinary leakage in athletes, due to sudden increase in intra-abdominal pressure.[5] Hay[6] noted that the impact on the pelvic floor while running is three to four times the body weight, five to twelve times while jumping, nine times in the case of pole vault, and more than nine times in the practice of high jump. The sudden increase in intra-abdominal pressure associated with sports and abdominal and pelvic muscle imbalance is the main risk factor for SUI in young nulliparous athletes.[7] Some theories based on risk factors have been developed to explain the occurrence of UI in young nulliparous athletes. The muscle dysfunction in pelvic floor associated with the stretching of the pubocervical fascia results in hypermobility of the bladder neck. This dysfunction is triggered by the action of jumping, which causes direct injury to the structures of the pelvic floor. The fatigue of the Pelvic Floor Muscles (PFM) caused by high repetition of running and jumping activities results in decreased blood flow to the muscle fibers with depletion of nutrients and oxygen.[2,8]

The pelvic floor muscles rehabilitation programs (PFMRP) are currently the first-line intervention in the treatment of SUI in women with incontinence and associated risk factors.[9] These PFMRP include different treatment approaches such as biofeedback, electrical stimulation, manual strengthening techniques, vaginal cones and exercises to strengthen the pelvic floor muscles (PFM).[9,10] PFMRPs that only include teaching proper PFM contraction, awareness of pelvic floor in the body function, and functional interaction between PFM and the muscles forming the abdominal wall have shown cure rates from 56 to 70% in women with urinary incontinence and associated risk factors.[10] Investigations showed a reduction in the frequency and amount of UI episodes and increased strength of PFM in 6 to 12 weeks.[10-12]

The relevance of this study lies in the lack of randomized controlled studies in athletes, the lack of awareness among health professionals, coaches and athletes for the prevention and treatment of UI. Therefore, the aim of this investigation was to verify the effectiveness of a program of rehabilitation of the pelvic floor muscles (PFMRP) in federated nulliparous athletes.

METHODS

The study is experimental in nature, and the initial sample consisted of sixty-six female athletes from Famalicão Athletic Volleyball Club (Figure 1). The final sample consisted of thirty-two athletes with symptoms of stress urinary incontinence, randomly divided in two groups: experimental group and control group, both with sixteen athletes (Figure 1). A lottery design was used for randomization of the sample, i.e., 32 folded pieces of paper were placed in a common box, so that 16 were assigned the number 1 (control group) and the remaining were marked as number 2 (experimental group). Each athlete withdrew from the box a single piece of paper, without knowledge of the meaning of that number, which ensured blinding of participants.

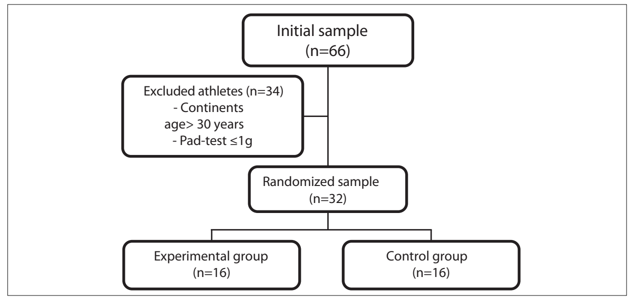

FIGURE 1 Sample selection.

Sample selection began in the last week of December 2011, using a baseline questionnaire and pad-test. Inclusion criteria included nulliparous female volleyball athletes, symptoms of stress UI, age between 13 and 30 years, and amount of urinary leakage greater than 1 g. Exclusion criteria were treatment for less than six months, sport practice for less than two years, repeated urinary infections or at the time of sample selection, body mass index below 18 kg/m^2 or above 25 kg/m^2, and PFMRP adherence under 50%.

The study was previously approved by the president of the club, and informed consent given by either the athletes or their legal guardians.

In the last week of December 2011, both groups underwent a baseline questionnaire, pad test and assessment of frequency of urinary leakage (urinary diary). Three months after introduction of PFMRP, in the first week of May 2012, the groups were once again assessed through a final questionnaire (attached), pad test and frequency of urinary leakage. The frequency of UI episodes consisted of a daily log of urinary leakage for seven consecutive days.[13] The amount of urinary leakage was assessed by pad test, in the first 15 minutes of volleyball practice.[14] A preweighed sanitary pad branded Carefree Essentials™ was properly placed before training. After 15 minutes of physical activity, the pad was removed and weighed on a Kenwood Ds700 digital scale. Athletes were considered incontinent with losses exceeding one gram.[15]

EG underwent PFMRP, which initially consisted of educational action, awareness of PFM and receipt of the information pamphlet. CG only had access to the pamphlet, which displayed a summary of the educational action.

The educational action included teaching of the anatomy and physiology of the lower urinary tract, concepts of UI and SUI, etiology of SUI in athletes, preventive strategies for urinary leakage, exercise-related disorders in athletes, location of the PF muscles, identification and awareness of correct contraction of PFM, types of PFM contraction, *Knack* technique and knowledge of PFM exercises to be performed at home.

The educational action also included a urinary diary for EG. The urinary diary consisted of daily records of the amount of liquid intake, urinary frequency and volume for three consecutive days. The urinary diary enabled an improved perception of the changes in everyday life behavior and hygiene. The PFM exercises that the athletes would be required to perform at home included 30 sustained contractions and four quick contractions after each sustained contraction, in different positions and daily for three months.

Weekly visits were made at the club during the study period to ensure motivation and adherence to PFMRP in EG both at home and after the training sessions.

Normality of variables was assessed in the statistical analysis with the nonparametric test of Shapiro-Wilk, and the Student t-test was applied for independent and paired samples. At the intersection of variables, the Chi-square test was used. Whenever the applicability conditions were not met, we used the Fisher's alternative exact test. All data were collected and analyzed using SPSS, version 20.0, with a significance level of 5%.

RESULTS

The characterization of the sample groups revealed no statistically significant differences in all parameters. The groups are homogeneous and can be compared (Table 1).

TABLE 1 Sample characterization of the experimental group (EG) and control group (CG)

	EG (n = 16)	CG (n = 16)	p+
	$\bar{x}$±SD (min-max)	$\bar{x}$±SD (min-max)	
Demographics			
Age (years)	19.4 ± 3.24 (16-25)	19.1 ± 2.11 (17-26)	0.749
BMI (kg/m^2)	22.8 ± 2.57 (19.2-24.9)	21.5 ± 1.81 (19.2-24.1)	0.135
Duration of UI (years)	2.4 ± 1.67 (1-4)	1.6 ± 0.72 (1-6)	0.064
Characteristics of the sport			
Sports practice (years)	6.9 ± 4.09 (2-12)	4.9 ± 2.51 (3-15)	0.106
Weekly training sessions (number)	3.6 ± 0.93 (3-6)	4.8 ± 0.61 (3-6)	0.745
Characterization of SUI			
Frequency of leakage	**n (%)**	**n (%)**	0.113#
Once or several times in a month	5 (31.3%)	8 (50%)	
Once or several times in a week	11 (68.8%)	8 (50%)	
Amount of urinary leakage			
Drops	7 (43.8%)	6 (37.5%)	0.685#
Small amount (weak stream of urine)	9 (56.3)	10 (62.5%)	
Severity of UI			
Low	1 (6.2%)	5 (31.2%)	0.109#
Moderate	10 (62.5%)	5 (31.2%)	
High	5 (31.2%)	6 (37.5%)	
Triggering activities			
Training	14 (87.5%)	13 (81.3%)	1.000*
Competition	2 (12.5%)	3 (18.8%)	
Activities of daily life			
Yes	3 (37.5%)	6 (37.5%)	0.433*
No	13 (62.5%)	10 (62.5%)	
Prevention strategies for urinary leakage sanitary pads (during sports)			
Yes	11 (68.8%)	11 (68.8%)	1.000#
No	5 (31.2%)	5 (31.2%)	
Bathroom (prior to sports)			
Yes	14 (87.5%)	16 (100%)	0.484*
No	2 (12.5%)	0 (0.00%)	
Reducing the amount of liquid intake (prior to sports)			
Yes	9 (56.3%)	8 (50.0%)	0.723#
No	7 (43.8%)	8 (50.0%)	

$\bar{x}$±SD= mean and standard deviation.
+T-Student test for two independent samples.
#Chi-squared test.
*Fisher's exact test.

The variation of the initial and final mean values showed a statistically significant decrease in the amount of urinary leakage in EG, while in CG no significant differences were seen at the end of the study. In EG, the mean value fell 45.5% while in CG, the decrease reached 4.9%, which represents a significant difference between the groups (Table 2).

TABLE 2 Intra- and inter-group comparison of the variation in amount of urinary leakage

	EG (n = 16)		CG (n = 16)	
	$\bar{x}$ ±SD (min-max)	P	$\bar{x}$ ±SD (min-max)	P
Pad-test variation (Final-initial)	(-) 2 ±1.28 (1-4.5)	<0.001*	(-) 0.2 ± 0.41 (0.3-1.2)	0.324 <0.001+

$\bar{x}$ ±SD= mean and standard deviation.
*p<0.05 intra-group.
+p<0.05 inter-group.

The variation between the initial and final mean value for frequency of UI episodes was statistically significant in EG (Table 3).

In terms of variation of mean values, there was significant reduction in the frequency of UI episodes in 14.3% of the subjects in EG, and in 0.05% of the women in CG. This decrease in variation in UI episodes was significant between the groups (Table 3).

TABLE 3 Intra- and inter-group comparison of the variation in the frequency of incontinence episodes

	EG (n=16)		CG (n=16)	
	$\bar{x}$ ±SD (min-max)	P	$\bar{x}$ ±SD (min-max)	P
Variation of FIE (Final-initial)	(-) 0.3 ± 0.50 (0-2)	<0.001*	(-) 0.1 ± 0.44 (0-3)	0.414 <0.001+

$\bar{X}$±SD=mean and standard deviation; FIE=frequency of incontinence episodes.
*p<0.05 intra-group.
+p<0.05 inter-group.

Discussion

The importance of sports for women's general health, the increasing need for knowledge about the effects of high impact sports activities on lower urinary tract and the evidence of treatment of UI in nulliparous athletes have recently fueled scientific research in this area.[2,16]

In the present study, the characterization of the total sample revealed a mean age of 19 years. According to a study by BØ & Borgen,[8] the prevalence of urinary leakage in female athletes occurs between 15 and 39 years old.

In the analysis of BMI, the athletes' total mean was 22 Kg/m^2, considered by the National Health Nutrition Examination Survey as normal weight. In the study by BØ & Borgen,[8] the mean BMI of the athletes was also one of normal body weight, which is consistent with the results obtained in the present study. Waldrop[17] reported that metabolic and hormonal changes in athletes can result in UI. Hormonal deficits (hypoestrogenism) reduce blood flow in arteriovenous plexus, mucosal coaptation, and urethral pressure, promoting IU.[17,18]

In this study, the parameters of frequency and amount of urinary leakage were used to determine the degree of UI, showing a greater percentage of athletes with moderate severity. Roza et al.[20] found mild and moderate UI in sports such as track and field, basketball, volleyball and handball. The severity of UI increases with the type and the continuity of high-impact sports (running, jumping), with equally progressive consequences both for sports performance and the quality of life of female athletes. In the present study, none of the athletes resorted to a doctor for early intervention and to prevent worsening of the condition. Thyssen et al.,[16] in a sample of young dance athletes, showed that only 3.3% told a doctor about the symptoms of urinary incontinence.

In this study, the highest percentage of urinary leakage was triggered during training, 87.5% in EG and 81.3% in CG. These results are in agreement with the study by Thyssen et al.,[16] who demonstrated that athletes who practice sports such as gymnastics, basketball, volleyball and handball had 95.2% of urinary leakage during training against 51.2% during competitions. This aspect can be explained by the high level of catecholamines in stress situations, such as in competitions.[16]

The present study demonstrated that athletes of both groups resorted to strategies or measures to prevent urinary leakage. In decreasing order, the measure most commonly used to conceal urinary leakage was the use of a sanitary pad, followed by bladder emptying and the reduction of fluid intake before training. Eliasson et al.[20] found the same strategies in a sample of 18 gymnastics athletes.

In this study's baseline assessment, the groups showed no significant differences regarding the amount of urinary leakage (pad-test). After three months of PFMRP, EG reduced significantly the occurrence of urinary leakage, down 45.5% compared with 4.9% in CG, statistically significant differences being found between the groups.

The baseline mean value found for amount of urinary leakage in this study was 4.4 g. In a study published by Eliasson et al.,[20] which included a sample of 18 gymnastics athletes, the average amount of urinary leakage was 28 g (9-56 g). This difference can be explained by the type of sport, since gymnastics presents more impact than volleyball.[2,16]

Regarding the frequency of urinary leakage, baseline assessment showed an average frequency of 2.1 episodes in seven days, falling to 1.8 (14.3%) episodes in EG and 1.9 (0.05%) in CG by the end of the study period. By the end of the study, GE significantly decreased the frequency of urinary leakage compared to CG (p < 0,001).

A single study was published, including a small sample of volleyball players, with a combined treatment program (biofeedback, electrical stimulation, PFM strengthening exercises and vaginal cones). And after 4 months of intervention, the results showed that the program was effective in reducing the use of sanitary pads and symptoms of urinary leakage during volleyball training and activities of daily life.[21]

Conclusion

This study leads to the conclusion that the program of rehabilitation of pelvic floor muscles in this sample was effective for the reduction of stress urinary incontinence in volleyball athletes. The program of rehabilitation of the pelvic floor muscles allowed a significant improvement of clinical symptoms in the amount and frequency of urinary leakage.

Resumo

Reeducação dos músculos do pavimento pélvico em atletas de voleibol.

Objetivo: verificar a eficácia do programa de reeducação dos músculos do pavimento pélvico (PRMPP) em atletas femininas de voleibol, analisando a quantidade e a frequência das perdas urinárias.
Métodos: estudo experimental. A amostra foi constituída por 32 atletas do sexo feminino do Atlético Voleibol Clube de Famalicão (Portugal). As atletas foram selecionadas por conveniência e distribuídas aleatoriamente em dois grupos: o grupo experimental (GE = 16 atletas) e o grupo-controle (GC = 16 atletas). O GE foi submetido ao PRMPP durante 3 meses; o programa consistiu na conscientização e identificação dos músculos do pavimento pélvico (MPP), na pré-contração dos MPP ao aumento da pressão intra-abdominal, e em 30 contrações diárias dos MPP no domicílio. O GC teve acesso unicamente ao panfleto. Os instrumentos de avaliação englobaram os questionários, o *pad-test* (quantidade de perda urinária) e o registro da frequência das perdas urinárias (diário de 7 dias), antes e após o PRMPP.
Resultados: a quantidade de perda urinária diminuiu 45,5% no GE, com intervenção do PRMPP, e 4,9% nas atletas do GC, verificando-se diferenças estatisticamente significativas entre os grupos (p<0,001). Na frequência das perdas urinárias, a redução foi de 14,3% no GE e de 0,05% no GC, verificando-se diferenças estatisticamente significativas entre os grupos (p<0,001).
Conclusão: o PRMPP, nessa amostra, foi eficaz na incontinência urinária de esforço em atletas do sexo feminino de voleibol, pois permitiu melhorar significativamente os sintomas de quantidade e frequência das perdas urinárias.

Palavras-chave: atletas desportivas, incontinência urinária de esforço, fisioterapia.

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