

Effects of pelvic floor muscle training in pregnant women

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Abstract

Objective: The aim is to verify the effectiveness of the pelvic floor muscle training (PFMT) program in pregnant women, by analyzing the amount of urine leakage.

Design: Experimental study.

Location: Care units in the Vila Real district, Portugal.

Participants: Forty-three pregnant women divided into an experimental group (EG) (n=22) and a control group (CG) (n=21).

Interventions: Both groups were evaluated in a pre-delivery stage (initial) and 6 months after delivery (final). The EG was given a PFMT exercise protocol with a duration of 6 weeks, applicable in classes and at home, another PFMT protocol for 9 weeks.

Main measurements: The strength of the pelvic floor muscle was measured by the *Oxford Grading Scale* and the amount of urine was assessed with a Pad test. Quality of life was measured by the King's Health Questionnaire and self-efficacy by the Broome Pelvic Muscle Self-Efficacy Scale.

Results: The loss of urine, significantly reduced from 0.86 ± 0.83 to 0.50 ± 0.67 in the EG ($P = .021$), whereas in the CG no significant change was observed. The degree of muscle contraction increased by 4.82 ± 0.39 in EG and 3.95 ± 0.67 in CG. The quality of life observed significant improvements in both groups ($P < .05$). As for self-efficacy, for the EG it improved significantly – initial ($P = .001$), final ($P = .031$), and for the CG the values remained the same.

Conclusions: This PFMT protocol reduced urinary incontinence in pregnant women. The program allowed significant improvement in the quantity of urinary leakage and an increase in the strength of the pelvic floor muscle.

Keywords: exercise, pelvic floor muscle training, physiotherapy, pregnancy

Introduction

The International Continence Society has defined urinary incontinence (UI) as the complaint of any involuntary loss of urine¹ and stress urinary incontinence (SUI) as a complaint of involuntary loss of urine caused by effort or physical exertion or sneezing or coughing.¹ It is the most common type of UI in women, affecting 37% to 42%^{2,3} of women, being the most common type in pregnant women.⁴ Another study describes how 31% of UI were documented in the third trimester, with 70% of pregnant women experiencing SUI, 21.5% with mixed types, and 3.4% experiencing urge UI.⁵ UI is a problem with psychological

repercussions in various aspects of life,^{6,7} which may negatively impact quality of life (QoL).⁸ There are several risk factors contributing toward UI, with pregnancy being one of them. This is due to the physiological and anatomical changes which occur during pregnancy.⁵ For the pelvic floor muscle (PFM), delivery is probably the most stressful period in a woman's lifetime³; therefore, they are at the greatest risk for stretch-related injuries.

The mechanism of UI during pregnancy is unclear, as no change is observed in the anatomy of the bladder wall or the urethra and their position within the pelvic cavity. Changes do occur in the connective tissue during pregnancy with an 8- to 10-fold increase in the collagenous fibers. The effect of hormones, especially relaxin, combined with structural changes in the pelvic support function and pressure of the pregnant uterus may contribute toward incontinence during pregnancy.⁵ The conservative management is the first-line treatment because of its effectiveness and lack of adverse effects.⁹ Several studies have concluded that pelvic floor muscle training (PFMT) is an effective therapy for SUI.¹⁰⁻¹³ PFMT can modify muscle morphology by increasing the sectional area. It also alters the neuromuscular function by increasing the ability to recruit additional motor units, as well as the frequency of arousal. In addition, it improves muscle tone and the viscoelastic properties of the connective tissue. PFMT is a progressive training program involving specificity, intensity, rest time, frequency, volume, and duration.¹⁴

The aim of this study was to verify the effectiveness of the PFMT program in pregnant women by analyzing the amount of urine leakage and observing whether incontinence symptoms improved.

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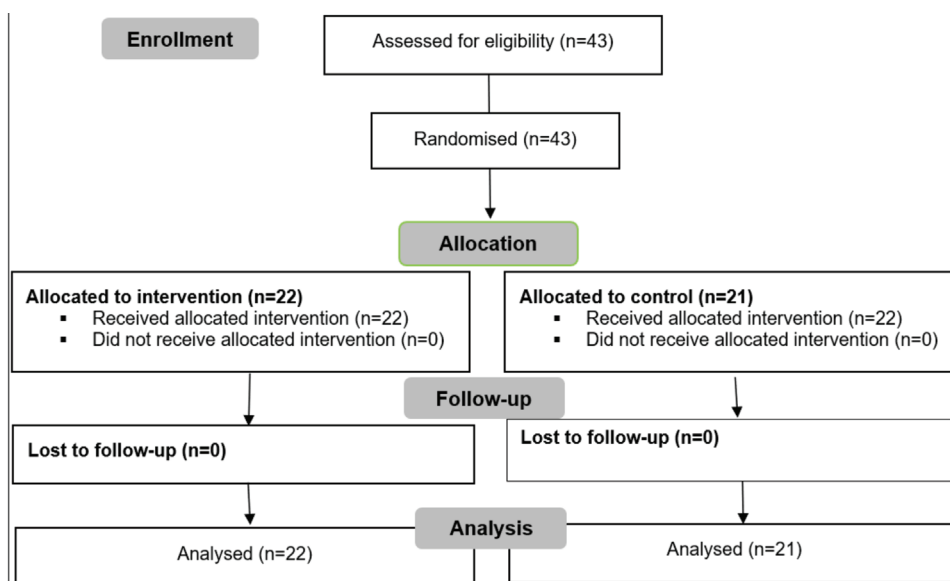


Figure 1. Flow diagram.

Materials and methods

The study is experimental in nature, with the initial sample consisting of 43 pregnant women attending 2 community care units (CCU) in the Vila Real district, Portugal (CCU Mateus and CCU Vila Real 1) (Fig. 1). The final sample included 43 pregnant women with symptoms of SUI (but not in all pregnant women), randomly divided in 2 groups: an experimental group (EG) and a control group (CG), with 22 and 21 pregnant women, respectively (Fig. 1).

Table 1

Demographic and clinical characteristics of the sample (n=43)

Variables	Total sample (N=43)	EG (n=22)	CG (N=21)	P
Age (yr)				
M±SD	32.9±5.0	32.6±5.5	33.1±4.7	.884*
Professional situation (%)				
Working in service	32 (74.4)	18 (81.8)	14 (66.7)	.310 [†]
Unemployed	11 (25.6)	4 (18.2)	7 (33.3)	
Previous births (%)				
Yes	13 (30.2)	10 (45.5)	3 (14.3)	.045 [†]
Type of delivery [‡] (%)				
Cesarean	3 (23.1)	3 (30.0)	0 (0.0)	.420 [†]
Normal delivery	10 (76.9)	7 (70.0)	3 (100.0)	
History of episiotomy [‡] (%)				
yes	5 (38.5)	4 (40.0)	1 (33.3)	.685 [†]
History of forceps [‡]				
Yes	0	0	0	–
Termination of pregnancy (%)				
Yes	4 (9.3)	3 (13.6)	1 (4.8)	.607 [†]
Medication				
Yes	0	0	0	–
Menarche				
M±SD	12.5±1.6	12.1±1.3	12.9±1.8	.099*
Stop test (%)				
Yes	39 (90.7)	18 (81.8)	21 (100.0%)	.108 [†]

CG=control group, EG=experimental group.

* Statistical significance by the Mann-Whitney test.

[†] Fisher exact test significance value.

[‡] Percentages compared to 13 (10 in experimental group and 3 in the control group) who had previous birth.

A lottery design was used for randomization of the sample, that is, 2-folded pieces of paper were placed in a common box, so that one was assigned the number 1 (CG) and the remaining was marked as number 2 (EG). It was previously agreed that the first paper that came out of the box would correspond to CCU Mateus and what remained in the box would be CCU Vila Real 1. Thus, the first draw was number 2 (EG), without knowledge of the meaning of this number, which ensured the blindness of the participants. The inclusion criteria were pregnant women, the first or second child, 28 weeks of gestation, aged 18 to 45 years. The exclusion criteria included a diagnosis of UI (urge UI and mixed UI), SUI triggered by factors external to the lower urinary tract (cognitive deficits and neurological pathologies) and pelvic organ prolapse.

Ethical approval was obtained from the North Regional Health Administration and the National Data Protection Committee. Written consent was obtained from each participant. The study was reported according to CONSORT guidelines.¹⁵

The participants' characteristics were assessed at baseline. Demographic and clinical characteristics of the sample were collected using a questionnaire, which included age, professional situation, previous births, type of delivery, history of episiotomy, history of forceps, termination of pregnancy, medication, menarche, and stop test (Table 1).

Intervention

All participants started their childbirth preparation classes at 28 weeks of gestation, and both groups attended the classes regularly, having their respective topics addressed by their family nurse. The only exception was that only the EG performed the PFMT protocol both at the end of class, supervised by a physiotherapist, and at home, unsupervised. All pregnant women received training with explanations regarding the general concepts of the PFM. In both groups, the primary outcomes (*PFM assessment*), were explained in detail, whereas the secondary outcomes (*assessment of urogynecological symptoms and PFMT programs*), were only explained to the EG.

Primary outcomes

Pelvic floor muscle assessment. A PFM contractility evaluation was performed by the physiotherapist at baseline and 6 months postpartum. First, a digital palpation was conducted, where the index and middle fingers were introduced 2 to 3 cm into the vaginal introitus. After a maximum contraction of the muscles, against the fingers, the muscle contractility was graded according to the *Oxford Grading Scale* (using the 5 point, 0 – no contraction, 5 – strong).^{16–18} This scale was applied by the same researcher, provide intraobserver reliability.

A Pad test (modified 20 minutes) was performed in the initial and final evaluations quantifying urine loss. It is not invasive and provides an easy, inexpensive, and objective assessment of urine loss.¹⁹

Secondary outcomes

Assessment of urogynecological symptoms. Patients of both groups completed 2 assessment questionnaires, in the initial and final phases. The Broome Pelvic Muscle Exercise Self-efficacy Scale was developed and validated by Broome²⁰ and it was later validated for the Portuguese population by Branquinho et al. It allows for analyzing the perception of the individual of the (self) efficacy of PFM contractions.²¹ It is a self-administered instrument, composed of 23 items divided into 2 parts. In part A (items 1–14), participants indicate the level of confidence they feel when performing that activity without loss of urine. In part B (items 1–9), participants indicate the level of confidence they feel when performing that activity in terms of urine loss prevention.²¹ The scores of part A, part B, and the total scale are obtained by averaging the items involved, ranging from 0 to 100. Higher values of the scores correspond to high levels of confidence.²¹

The King's Health Questionnaire (KHQ) was originally developed by Kelleher et al²² and designed to assess the impact of UI on the QoL of women, also evaluating urinary symptoms and subjective measures of severity. It was recently validated for the Portuguese population having obtained a good reliability.⁷ It demonstrated appropriate psychometric proprieties and validity. The KHQ is composed of 21 items analyzing 3 domains and it evaluates the agreement of the subjects on a 4- and 5-option Likert scale: personal limitations and daily life, emotions, and social relations and urinary symptoms. The KHQ scored from a minimum of 0 (best QoL) to a maximum of 100 (worst QoL), scored by every domain and by their global score. Scores of an independent subscale (Symptom Severity Scale) were calculated in the same way.⁷

Pelvic floor muscle training programs

Exercise protocol for pelvic floor muscle in preparation classes for childbirth. This PFM protocol^{8,23} was applied in preparatory delivery classes, for 6 weeks (2 times/wk), consisting of 2 phases, 6 exercises each: Phase I, known as awareness/stabilization, with a duration of 3 weeks, aimed to acquire awareness and perception of the PFM, its location and ability to contract them properly, as well as create a postural and respiratory dynamics. At this stage, the progression of the exercises/positions occurred in relation to increased gravity, that is, the exercises began in the lying position and gradually evolved into a standing position; the contraction time equals the relaxation time (a 10-second interval between efforts; 10 times). The gradual progression and repetition of the contraction/

relaxation movements allowed the pregnant participants to become more aware and learn to better control the action requested for each stage. Phase II, known as strength training, with a duration of 3 weeks, aimed to promote strengthening by progressively increasing muscle strength, recruiting more motor units and hypertrophy of PFM. At this stage, the contraction is greater than the relaxation time, progressively increasing the level of difficulty over time (3 exercises with 6 seconds of contraction and 3 of rest; 1 exercise with 5 seconds of contraction and 2 seconds of rest and 2 exercises with 10 seconds of contraction and 2 seconds of rest, respectively; 5 times).

Exercise protocol for pelvic floor muscle, at home. This protocol carried out at home,²⁴ with a duration of 9 weeks, consists of 3 distinct phases, each phase lasting 3 weeks. Phase I – mixed phase, in the first and second weeks the pregnant woman must perform 10 rapid contractions (1 second) and 10 sustained contractions (5 seconds), both 3 times/day (10 seconds of relaxation); in the third week, it changes to 2 × 10 rapid contractions (1 second) and 10 sustained contractions (6 seconds), both 3 times/day (10 seconds of relaxation). Phase II – active phase, in the first and second weeks the pregnant woman must perform 2 × 10 rapid contractions (1 second) and 2 × 10 sustained contractions (7 seconds), both 3 times/day (7 seconds of relaxation); in the third week, 2 × 10 rapid contractions (1 second) and 2 × 10 sustained contractions (8 seconds), both 3 times/day (8 seconds of relaxation). Phase III – resisted phase, in the first week the pregnant woman must perform, 2 × 10 rapid contractions (2 seconds) and 3 × 10 sustained contractions (9 seconds), both 3 times/day (5 seconds of relaxation); in the second week, 2 × 10 rapid contractions (2 seconds) and 3 × 10 sustained contractions (10 seconds), both 3 times/day (5 seconds of relaxation); in the third week, 2 × 10 rapid contractions (2 seconds) and 3 × 10 sustained contractions (12 seconds), both 3 times/day (5 seconds of relaxation). Each participant will have to record their adherence to the proposed home exercise protocol on a daily basis.

Data analysis

Data were analyzed using SPSS v22.0. The variables studied were characterized by mean and standard deviation, the normal distribution of the data was tested with the Shapiro-Wilk test. This test checks the null hypothesis of a variable, following a normal distribution, and is suitable for small samples. The test results led to the conclusion that most of the variables do not have a distribution close to normal, which is a necessary condition for using parametric tests, particularly in a small sample, as is the case of this study. For the study comparing the EG and CG regarding the characteristics of participants (qualitative variables) the Fisher exact test was used. The Mann-Whitney test was used to study the significance of the difference of ages between the EG and CG. The Wilcoxon test for paired samples was used to study the significance of the differences between the initial and final phases in the EG and CG, which was done separately. The correlation between continuous variables was studied with the use of Spearman correlation coefficient.

Results

The study was carried out with 43 healthy pregnant women, aged 21 to 44 years (Fig. 1). The participants were screened and allocated to the EG (n=22) or CG (n=21). The participants had

Table 2

Correlational analysis between age, pad test, Oxford Grading Scale and pad test, Oxford Grading Scale, King's Health Questionnaire, and Broome Pelvic Muscle Self-efficacy Scale

Scale/subscale	Age		Pad test		Oxford grading scale	
	Initial evaluation	Final evaluation	Initial evaluation	Final evaluation	Initial evaluation	Final evaluation
Pad test (g)	0.275	0.167	–	–	–0.162	–0.281
Oxford Grading Scale	0.159	0.082	–0.162	–0.281	–	–
KHQ general health	0.152	–0.020	0.179	0.301*	–0.412**	–0.440**
KHQ incontinence impact	0.089	–0.099	0.198	0.503**	–0.457**	–0.281
KHQ personal limitations and daily life	–0.034	–0.025	0.046	0.354*	–0.195	–0.494**
KHQ emotions and social relations	0.001	0.089	0.259	0.208	–0.415**	–0.337*
KHQ urinary symptoms	0.038	–0.108	0.089	0.305*	–0.518**	–0.325*
KHQ global	0.019	–0.059	0.079	0.393**	–0.472**	–0.443**
Severity of symptoms	0.021	0.015	–0.005	0.259	–0.185	–0.551**
Broome PMES – part A	0.193	0.095	–0.128	–0.279	0.628**	0.237
Broome PMES – part B	–0.030	0.155	–0.303*	–0.511**	0.746**	0.481**
Broome PMES – total	0.106	0.134	–0.227	–0.354*	0.703**	0.288

Spearman correlation coefficient.

KHQ= King's health questionnaire, PMES = Pelvic Muscle Self- Efficacy Scale.

* $P < .05$.

** $P < .01$.

a mean age of 32.9 ± 5.0 years. No significant differences between the 2 groups were found in terms of baseline characteristics ($P = .884$) (Table 1). The participants completed the intervention and final assessments and then were included in the analysis. At the end of 9 weeks, each participant returned the protocol of adherence to the recommended exercises to be performed at home. There was 100% compliance, with no reported dropouts.

The correlation between the Pad test and the Oxford Grading Scale is not significant, both at the initial and final stages. All KHQ domains, including the KHQ global score, correlated negatively with the Oxford Scale (Table 2). The loss of urine quantified by the Pad test significantly reduced from 0.86 ± 0.83 at the initial stage to 0.50 ± 0.67 at the final stage in the EG ($P = .021$) but remained stable in the CG ($P = .854$). There were significant differences between the groups concerning the variation initial-final Pad test ($P = .032$) (Table 3). Therefore, there were improvements within the EG though there were no significant differences between the CG and EG. The degree of

muscle contraction, measured by the Oxford scale, increased significantly in the EG ($P < .001$) from 3.59 ± 0.85 to 4.82 ± 0.39 and did not change significantly in the CG ($P = .609$) – the comparison of the differences initial-final between groups was significant ($P < .001$) (Table 3). The perception of general health (KHQ – general health) did not suffer any statistically significant changes between the initial and final stages in the EG ($P = .096$) or in the CG ($P = .414$). The impact of incontinence (KHQ – impact incontinence) dropped significantly from the initial to the final stage, both in the EG ($P = .003$) and in the CG ($P = .013$). For the KHQ dimensions in KHQ – personal limitations and daily life there was a significant improvement in the QoL in the EG ($P = .002$), but not in the CG ($P = .232$), with significant differences between groups regarding the variation initial-final ($P = .042$); in KHQ – emotions and social relations there were no significant changes either in the EG ($P = .750$) or in the CG ($P = .289$); in KHQ – urinary symptoms in size the total KHQ and severity of symptoms observed significant improvements in both

Table 3

Comparison between initial evaluation and final evaluation in the experimental group and in the control group

Variables	EG (n=22)			CG (n=21)			Difference P^\dagger
	Initial evaluation	Final evaluation	P^*	Initial evaluation	Final evaluation	P^*	
Pad test (g)	0.86 ± 0.83	0.50 ± 0.67	.021	0.43 ± 0.60	0.43 ± 0.81	.854	.032
Oxford Grading Scale	3.59 ± 0.85	4.82 ± 0.39	<.001	3.81 ± 0.93	3.95 ± 0.67	.609	<.001
KHQ general health	19.32 ± 15.30	13.64 ± 16.77	.096	21.43 ± 14.33	19.05 ± 13.47	.414	.127
KHQ incontinence impact	31.82 ± 29.95	7.58 ± 20.40	.003	23.81 ± 30.08	4.76 ± 15.94	.013	.505
KHQ personal limitations and daily life	12.95 ± 10.18	4.66 ± 9.45	.002	12.02 ± 10.46	8.17 ± 10.27	.232	.042
KHQ emotions and social relations	3.03 ± 6.58	2.46 ± 8.20	.750	3.77 ± 7.78	6.35 ± 10.17	.289	.340
KHQ urinary symptoms	39.39 ± 34.07	19.19 ± 26.16	.018	34.39 ± 28.95	10.58 ± 11.37	.004	.499
KHQ global	18.46 ± 14.66	8.77 ± 12.93	.004	16.73 ± 12.58	8.37 ± 6.92	.019	.874
Severity of symptoms	16.21 ± 10.66	5.30 ± 7.74	<.001	24.13 ± 14.29	11.75 ± 8.73	.006	.277
Broome PMES – part A	76.62 ± 16.38	81.49 ± 17.65	.138	85.78 ± 15.61	86.22 ± 11.01	.778	.158
Broome PMES – part B	71.62 ± 17.79	82.02 ± 15.87	.001	81.85 ± 15.54	81.11 ± 14.01	.825	.025
Broome PMES – total	74.66 ± 16.00	81.70 ± 14.93	.031	84.24 ± 13.45	84.22 ± 11.94	.984	.012

Data are presented as mean \pm SD.

CG=control group, EG=experimental group, KHQ = King's Health Questionnaire, PMES = Pelvic Muscle Self-efficacy Scale.

* Wilcoxon signed rank test.

† Mann-Whitney test for the comparisons between groups regarding the differences final-initial evaluation.

groups ($P < .05$) (Table 3). As for the scale of Broome, in part A there were no significant changes either in the EG ($P = .138$) or in the CG ($P = .778$). In part B and the Broome-Total scale, the women in the EG improved significantly ($P = .001$ and $P = .031$, respectively), whereas in the CG there was no significant change ($P > .05$) – the variation initial-final differed significantly between groups in both scales ($P = .025$ and $P = .012$, respectively) (Table 3).

Discussion

This study demonstrated that a 6-week training protocol using progressive PFMT, in combination with a 9-week home program, resulted in significant improvements in pregnant women in the EG.

UI has been considered as an injury caused by pregnancy and delivery. Several authors have studied the prevalence of UI in pregnant women and the values are identical in all studies, approximately 40%.^{1,2,4,25} SUI was the most common type of UI during pregnancy, with 41.7% of nulliparous women, 38% of primipara women and 20.3% of multipara women experiencing UI.²⁵ The prevalence of SUI increased from 7% at 3 months postpartum to 30 and 42% at 5 and 12 years postpartum, respectively.²⁶ PFMT is recommended by the International Continence Society as a means of preventing and treating pelvic floor dysfunctions,²⁷ for being minimally invasive and without complications. PFMT is the most commonly recommended conservative therapy for pregnant women with SUI.⁴ The most important prognostic factor for PFMT efficacy is the adherence to the training protocol,^{8,28} so the EG have better results than the CG. The strength of this study includes the high adherence and implementation of an exercise program. Continue PFMT during pregnancy prevents UI during pregnancy and after delivery. PFM strength improved significantly after intensive PFMT,²⁹ indicating that this physical condition can be improved with the practice of physical exercise. Guidelines on physical activity or exercise and pregnancy encourage pregnant women to continue or adopt an active lifestyle during and after pregnancy.^{30,31}

The participants of the EG adhered to the program, completing it at a satisfactory level. This indicates that strength training of the PFM has to be continue to be effective, in agreement with the results of studies on women with SUI.³²⁻³⁴ Soave et al³⁵ concluded in its review that the PFMT program following general strength-training principles can be recommended both during pregnancy and in the postnatal period. PFMT, combined with the physiotherapist's intervention, is increasingly becoming the first line of treatment for SUI. Physiotherapists, who use guidelines like PFMT, need to understand the nature of the SUI, the available scientific evidence, the influence of prognostic factors, and the principles of behavioral therapy. Therefore, physiotherapists may contribute to movement behavior modification and to changes in cognition about incontinence.³

Our results demonstrated that loss of urine (quantified by *Pad test*) significantly reduced in the EG ($P = .021$) and remained stable in the CG ($P = .854$). There were significant differences between the groups. This prevention and treatment (PFMT) was effective in reducing urine. Tosun et al³⁶ obtained similar results in his study, the urine reduction in the PFMT group ($n = 65$) went from 3.1 to 0.2, after 12 weeks. The *Pad test* has some limitations but it is an easy, inexpensive, and objective assessment of urine loss.¹⁹ This study suggests that PFMT can reduce the incidence of SUI at gestational stages of 35 weeks and at 6 weeks and 6 months postpartum by significantly increasing PFM strength, compared with women who did not perform PFMT.⁴

In addition to having had consequences on the decrease of UI, this training protocol also shows an increase in the muscle strength of PFM. The degree of muscle contraction (measured by the Oxford Grading Scale) increased significantly in the EG ($P < .001$), from 3.59 ± 0.85 to 4.82 ± 0.39 and did not change significantly in the CG ($P = .609$). The comparison of the differences initial-final between groups was significant. The results for muscle strength assessed by the Oxford Grading Scale for Da Roza et al¹⁶ converge with those obtained in this study (the Oxford Scale is a reliable method to assess the PFM contraction capacity). Again, it highlights the importance of PFMT,^{37,38} rated grade A, with no reported side effects³⁹ and an improvement of symptoms.³⁸ Several studies have evaluated the muscle strength of the perineum after PFMT protocol and all had great effects in terms of increasing the strength of the PFM, either through Oxford Grading Scale or perineometry.^{36,40,41}

The incontinence impact of the KHQ dropped significantly from the initial to final stages, both in the EG and in the CG. For the domains, KHQ (Personal limitations and daily life) there was a significant improvement in the QoL in the EG but not in the CG, with significant differences between groups regarding the variation initial-final; for KHQ (Urinary symptoms) in size, the total KHQ and severity of symptoms, significant improvements were observed in both groups ($P < .05$). This result shows an improvement in the UI, which improves QoL.^{8,14,42} Arguably, there is little value in an intervention that increases the strength of PFM if it does not also increase QoL.^{43,44} Other studies, which used KHQ, associated with a PFMT protocol, also demonstrated that there was an improvement in urinary symptoms and, in turn, an improvement in QoL.^{45,46}

In the Broome Pelvic Muscle Exercise Self-efficacy Scale of PFM, there were no significant changes in part A between the EG ($P = .138$) and the CG ($P = .778$). In part B and in the total scale, the EG improved significantly ($P = .001$ and $P = .031$, respectively), whereas in the CG there was no significant change ($P > .05$). It was found once again that the protocol applied for 6 weeks with supervision of a physiotherapist, plus the home exercise protocol for 9 weeks, has important effects on increasing muscle strength of the PFM. Increasing PFMT increases the muscle strength.^{17,47} These results are similar to those of Sousa et al⁴⁸ who demonstrated that self-efficacy in contracting PFM showed that the PFMT has been effective, increasing levels of self-efficacy in contraction of PFM.

The results of this research are similar to those of Dumoulin et al⁴⁵ that concluded in its review that the PFMT is better than no treatment, placebo, or inactive control treatments for women with SUI. We can be confident that PFMT can cure or improve symptoms and may reduce the number of leakage episodes in women with SUI. Sousa et al⁴⁸ also had findings that corroborate the results of this study. The PFMT protocol seems to be effective in UI treatment in young nulliparous athletes demonstrated a significant improvement in *Pad-test*, Self-efficacy of Broome, Oxford grading scale, and perineometry values, after 8 weeks protocol.

Limitations of the design

Some limitations of this study should be considered. The sample was small, the pregnant women lacked knowledge concerning SUI, not all participants were nulliparous, several participants were pregnant with their second child, and not all participants have SUI. The muscle strength of the PFM should be measured using a manometer, because it is a more reliable, accurate, and

effective method. An evaluation at the end of the PFMT application was important and not just 6 months postpartum, but unfortunately it was not possible to perform it. The exercise protocol to be developed at home should also be supervised by a physiotherapist or another method should be added that proves adherence to the protocol.

This study leads to the conclusion that the PFM training program in this sample could be an effective mechanism for the prevention and reduction of urine leakage in pregnant women. The PFM training program allowed for a significant improvement of clinical symptoms in the amount of urine leakage and increased PFM strength.

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None.

Author contributions

TFP: Project development, data collection, data analysis, manuscript writing; PMP: Project development, data analysis; RC: Project development, manuscript editing; RV: Project development, data collection, data analysis, manuscript editing

Conflict of interest

The authors declare no conflicts of interest.

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