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Effect of home-based core exercises on postpartum stress urinary incontinence during COVID-19 pandemic in Jeddah city: a randomised control trial

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Abstract

Introduction. Postpartum stress urinary incontinence affects many women worldwide; it may exist during pregnancy or postpartum with a risk of permanence increasing five years later. This study aimed to determine the effect of home-based core exercises on postpartum stress urinary incontinence during the COVID-19 pandemic, in Jeddah city.

Methods. Randomised control trial was conducted on 26 postpartum women aged 25–40 years with mild or moderate grade stress urinary incontinence and a body mass index (BMI) less than 30 kg/m2. Participants were randomly divided into two equal groups (A & B). Group A performed home-based core exercises and pelvic floor muscle training for twenty-four sessions three times weekly for eight weeks; each session lasted 30 minutes. Group B performed home-based PFMT only. The assessment of pelvic floor muscles (PFMs) was measured with the Modified Oxford Grading Scale, while the 1-hour pad test and International Consolation on Incontinence questionnaire-short form (ICIQ UI- SF) total score served to assess incontinence severity before and after treatment.

Results. The results showed a significant improvement in PFMs strength and endurance in both groups and there was a highly significant difference between groups, favouring the study group (A). There was a highly significant difference between the groups in the 1-hour pad test and ICIQ-SF total score, favouring the study group (A).

Conclusions. Home-based core exercises for postpartum SUI women were an effective method to improve PFMs strength and endurance and minimise SUI symptoms.

Key words: home-based core exercise, postpartum stress urinary incontinence, COVID-19 pandemic

Introduction

Stress urinary incontinence (SUI) is involuntary urine leakage during stressful events and physical exertion, such as coughing and sneezing, which considerably affects the quality of life (QOL) [1]. It is a stressful and uncomfortable state with hygiene and psychosocial consequences [2]. Saudi females have shown moderate urinary incontinence (UI) that increased with ageing, menopause, diabetes, depression, and obstetrics events, negatively influencing QOL [3]. SUI is the most widespread form of UI, which frequently occurs with obstetrics events, postpartum (≥ 2 years of childbirth), and multiparous [4].

Postpartum SUI is an essential social and health issue affecting many women worldwide; it may exist during pregnancy or puerperium with no diminution three months after delivery, and the risk of permanence increase five years later [5]. Vaginal delivery was associated with double the incidence of long-term SUI twice compared to a caesarean section, affecting younger women. In contrast, the caesarean section offered considerable protection versus pelvic floor trauma but cannot indicate the caesarean section's preferability. Furthermore, the risk of trauma increases if assisted vaginal delivery is used, such as a vacuum or forceps [6].

There are many approaches to treating postpartum SUI, either by conservative or surgical interventions. The conservative physiotherapy interventions are essential in handling all UI types; they have a reliable and efficient method to treat SUI, consider a first-line treatment, and are highly recommended to improve women's health and QOL. Core exercises are helpful, as core muscles showed an essential role in controlling and activating the pelvic floor muscles (PFMs). Pelvic floor muscle training (PFMT) is a highly recommended intervention that manages all UI types [5], which can prevent and treat UI during pregnancy and postpartum, and performing eight weeks of supervised PFMT following the strength training protocols are highly recommended [7].

The coronavirus disease (COVID-19) pandemic has prompted the world's governments to implement strict instructions and enforce social distancing, which manipulates institutions and businesses, including the health field, as physiotherapy clinical visits have been restricted to compensate for these challenges. Consequently, clinics and hospitals implemented such alternatives as home-based exercises, web-based rehabilitation applications, telerehabilitation, video-call rehabilitation, and others [8, 9].

Home-based exercises are available as an option for physiotherapists in different fields, and the outcome of home-based exercises should be evaluated as many patients face daily obstructions that limit their regularity and consistency of clinic and hospital visits, especially in the women's health field, such as the coronavirus pandemic, motherhood, and personal issues [10]. Few studies were found in a search considering the home-based exercises for treating the SUI using PFMT [11, 12], and a new study combined PFMT and stabilisation exercise for postpartum SUI with low back pain [10]. Therefore, we aimed to examine the effect of a home-based program on improving postpartum SUI symptoms via core

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muscle exercises; to our knowledge, no previous studies have considered this suggestion.

Subjects and methods

Design

A single-blinded randomised controlled trial (RCT) was conducted in the East Jeddah Hospital and the Outpatient Physiotherapy Clinic at the Faculty of Medical Rehabilitation Sciences at King Abdelaziz University in Jeddah city between July 2021 and May 2022.

Participants

The study was carried out on twenty-six postpartum women with mild- or moderate-grade SUI. Participants' selection adhered to the following criteria: twenty-six postpartum normal vaginal delivery women suffering from mild or moderate SUI, where grade I (mild) – urine leakage with severe stressors such as coughing or sneezing, grade II (moderate) – urine leakage with moderate stress during rapid movement, age ranged from 25 to 40 years old, body mass index (BMI) less than 30 kg/m^2, and living in Jeddah city. Women with the following criteria were excluded; post-caesarean section, diabetes mellitus, obesity, hypertension, musculoskeletal disorders such as disc prolapse, neurological disorders, gynaecological disorders, genital prolapse and pregnant women.

Randomisation

The participants were assigned randomly to two groups equal in numbers: study group A (n = 13) and control group B (n = 13). Group allocation was concealed by drawing lots using opaque folded paper with the names of the groups written them, which were opened after the baseline examination, in the presence of the participant who blindly enrolled in the group (Figure 1).

Interventions

In both groups, the home-based program involved a total of twenty-four sessions, three sessions per week for eight weeks. Study group (A) performed home-based core exercises and PFMT; each session lasted 30 minutes. Control group (B) performed home-based PFMT only.

Outcomes measures

Participants in both groups were examined similarly at two points of examination sessions: before and after the home-based program with precautions following the COVID-19 health protocols released by the Ministry of Health of Saudi Arabia. The following demographic and anthropometric data were collected: age, height, weight, BMI, mode of delivery, parity, and the period since the last childbirth, which were documented in a physiotherapy assessment sheet for women's health. The outcomes measures used were as follows:

1. International Consolation on Incontinence questionnaire-short form (ICIQ UI- SF): All the participants were asked to fill out the questionnaire before starting the sessions and after the last session. We used the Arabic form, which has been proven a stable and accurate questionnaire used for SUI assessment in clinical practice and research among Saudi women [13]. It aims to evaluate the severity, frequency, and impact on QOL. It contains four essential items: UI frequency, the quantity of leakage, the general effect of the UI, and self-diagnostic items that score from 0 to 21; greater scores suggest a worse severity.

2. Modified Oxford grading scale (MOS): For UI women, digital vaginal palpation by MOS is widely used to evaluate PFM strength [14]. MOS is a 6-point scale graded from 0 to 5; it can be performed manually via vaginal palpation in clinical assessment to measure the pelvic floor muscle strength and function [15]. During the assessment, the participant assumed a crook lying position to assess the PFMs' strength and endurance, one finger was inserted into the vagina, and the par-

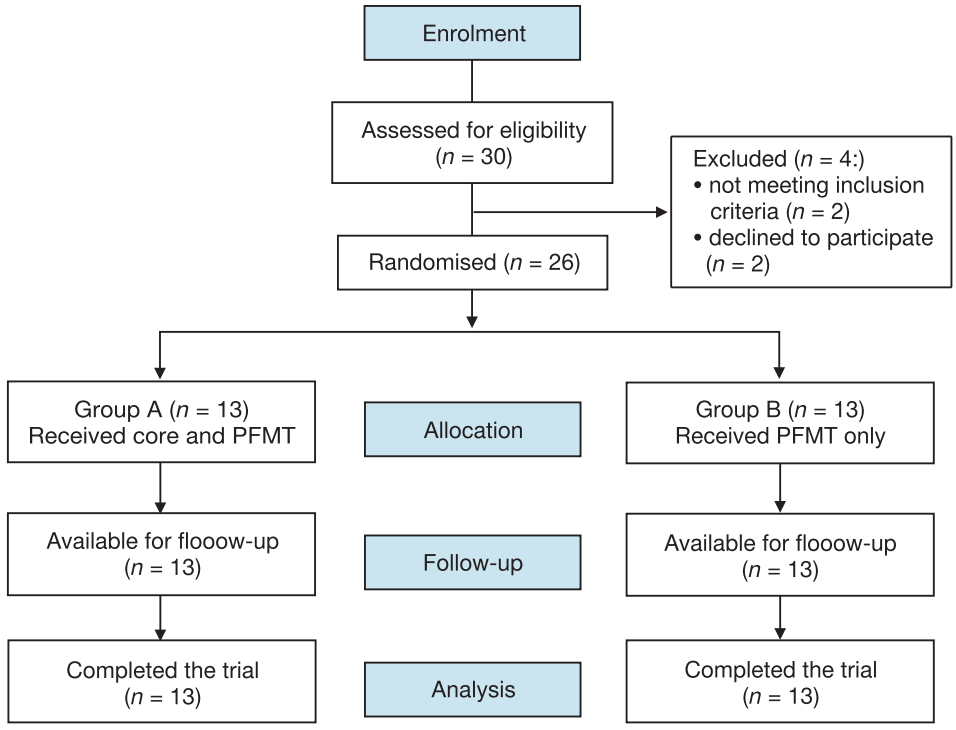

Figure 1. Flowchart of the participants during the trial

ticipant was asked to contract their PFMs as much as possible, then determine the grade of contraction using the MOS.

3. Endurance assessment: while maintaining the previous position, the participant was asked to contract the PFMs and hold them as much as possible to examine the muscles' endurance in maintaining sustained contraction (muscle fibre type I) and then repeat ten contractions as quickly as possible several times in 10s to examine the muscles' endurance by quick flickers (muscle fibre type II), which were recorded using digital vaginal palpation to assess endurance [15, 16].

4. 1-hour pad test: A method of testing the quantity of urine leakage in different positions. The 1-hour pad test is the most used pad test in RCT studies for treating SUI. The needed tools are pads, a weight scale, and 500 ml of water [17]. A 1-hour pad test was applied as the last examination procedure during the examination sessions. The procedures start by measuring the pad weight, and then the participant is asked to drink 500 ml of sodium-free liquid (water). After 15 minutes of rest, the participant performs exercises including 30 minutes of walking that involves stairs climbing, then standing from a sitting position (10 times), picking objects up off the floor (5 times), coughing while sitting (10 times), running on the spot (1 minute) and lastly, 1 minute of hand washing in running water. Then the pad was re-weighed, and the results were documented; the weight was recorded in grams of urine lost. More than 1 gram was considered positive SUI on this test, indicating a mild stage [17].

Procedures

After examination, participants were re-educated about the core muscles, PFM, and urinary tract system muscles using a diagram model and how to perform contractions correctly during the PFM examination; then the exercise procedures and how to do the home exercises were described in detail.

Study group (A): the home-based session started by performing four core exercises while assuming a crook lying position with the feet flat on the surface and knees separated. The participant was asked to do the following in each core exercise [18]:

1. Basic bridging: contact her abdominal muscles and raise the buttocks and pelvis from the surface.

2. Static core exercise: take a deep breath through her nose, expire through the mouth, contract her abdominal muscles, and then press the lumbar region down toward the surface.

3. Toe tap: contract her abdominal muscles, raise her legs, then hold one leg up and lower the other leg while keeping it under control and maintaining the back flat on the surface; repeat for each side.

4. Crunch abdominals: contract her abdominal muscles, try to raise her shoulder off the surface, repeat ten times, then relax, and focus on keeping her breathing steady for three sets.

For basic bridging and static core exercises, the participant holds the action for 10 seconds, repeats it ten times, and then relaxes for a few seconds. At the same time, the toe tap and abdominal crunch exercises were repeated ten times and followed by relaxation for a few seconds. Moreover, the participants were taught to breathe regularly during the core exercises. All the core exercises were performed for three sets a day, three times per week for eight weeks.

This was followed by the three steps of PFMT while assuming the same crook lying position; the participant was asked to perform the following [15]:

1. First step (Pubovaginalis muscle contraction): contract as if she were controlling her urethral orifice.

2. Second step (Puborectalis muscle contraction): contract as if she is controlling her bowel action.

3. Third step (Pubococcygeus muscle contraction): contract as if she is controlling her urethral orifice and bowel action and drawing the vagina up.

In each step, they were instructed to avoid thigh and abdominal muscle contraction; the contraction was held for 10 seconds, interrupted by 3 seconds of relaxation, and repeated ten times for three sets, three times per week for eight weeks. The exercise session lasted for 30 minutes.

The control group (B) only received exactly the same instructions for the three steps of PFMT.

The participants were also provided with a hard copy and soft copy brochure describing all the details of the home exercises in their first language, either Arabic or English, including the exercise guidelines and protocol, images, number of repetitions and sets, and holding time, so the participants were able to adhere to the exercise program more efficiently. A well-designed home exercise schedule was provided, which the participants were asked to fill out to record and check their weekly home exercises, as well as a weekly follow-up session on WhatsApp, which included voice messages and calls to review how to perform the exercises correctly and what they should avoid, to track their adherence and compliance with the home exercises, and to motive them to continue the home-based program. Finally, they were allowed to communicate easily with the principal researcher during the weekdays.

Data analysis

The data were collected and analysed statically using IBM SPSS statistics for windows, version 21. Descriptive statistics included the mean and standard deviation, the *t*-test assessed each group before and after the interventions and compared the results, while a p-value > 0.05 was considered non-significant and < 0.05 was considered a significantly different result. Further, a p-value < 0.01 was considered a highly significant result.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Research and Studies Department in Jeddah at the Ministry of Health of Saudi Arabia, and the ethical approval number KACST, KSA: H-02-J-002 was issued. Also, it was approved by the Ethics and Research Committee in Faculty of Medical Rehabilitation Sciences in King Abdulaziz University and the ethical approval number FMRS-EC2022-020 was issued.

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

Table 1 represents the general characteristics of the participants in both groups (A&B) at the beginning of the study. The independent *t*-test revealed that there was no significant difference (p < 0.001) in mean values of age, BMI, parity, and the postpartum period.

Table 1. General characteristics of women in both groups

Variables	Study group (A) mean ± *SD*	Control group (B) mean ± *SD*	Comparison	
			t	*p*
Age (years)	35.00 ± 6.570	36.38 ± 5.140	0.081	0.598
BMI (kg/m^2)	24.370 ± 3.2976	25.044 ± 3.2469	0.903	0.525
Parity	3.08 ± 1.553	2.46 ± 1.330	0.468	1.085
Postpartum period	1.738 ± 0.9700	2.115 ± 0.7221	0.079	1.124

p – probability < 0.01

Pelvic floor muscle strength and endurance evaluation

1. Modified oxford scale MOS: The mean ± *SD* values of PFMs strength before and after treatment for both groups are presented in Table 2. The paired *t*-test showed a statistically highly significant difference ($p < 0.001$) with an improvement rate of 20% in the study group A and a statistically non-significant difference ($p = 0.169$) with an improvement rate of 3% in the control group B. The independent *t*-test of after treatment between groups revealed a statistically highly significant difference ($p = 0.008$) favouring the study group A.

2. Endurance assessment: the mean ± *SD* values of sustained contraction and quick flickers in 10 seconds before and after treatment for both groups are presented in Table 3. The paired *t*-test for both endurance variables in the study group A showed a statistically highly significant difference ($p < 0.001$) with an improvement rate of 90% in sustained contraction and 45% in quick flickers. Moreover, the control group B showed a statistically significant difference ($p = 0.003$) with an improvement rate of 8% in sustained contraction and 10.7% in quick flickers. The independent *t*-test to compare between groups after treatment revealed a statistically highly significant difference ($p < 0.001$) in sustained contraction and quick flickers in 10 seconds favouring the study group A.

SUI symptoms assessment

1-hour pad test: the mean ± *SD* values of the 1-hour pad test before and after treatment for both groups are presented in Table 4. The paired *t*-test in both groups showed a statistically highly significant difference ($p < 0.001$) with an improvement rate of –58% and –14%, respectively. The independent *t*-test comparison between groups revealed a statistically highly significant difference ($p < 0.001$) after treatment favouring the study group A.

Table 2. Comparison of PFM strength for both groups

MOS	Before mean ± *SD*	After mean ± *SD*	Comparison		
			t	*p*	rate*
Study group A	3.46 ± 0.660	4.15 ± 0.689	–5.196	< 0.001	20%
Control group B	3.46 ± 0.519	3.54 ± 0.519	–1.000	0.169	3%
Mean difference	0.000	0.615			
t	0.000	2.57			
p	0.500	0.008			

p – probability < 0.01, * improvement rate

Table 3. Comparison of PFMs endurance for both groups

Variables	Study group (A)					Control group (B)				
	before mean ± *SD*	after mean ± *SD*	*t*	*p*	rate*	before mean ± *SD*	after mean ± *SD*	*t*	*p*	rate*
Paired *t*-test										
Sustained contraction	7.08 ± 0.86	13.46 ± 3.6	–7.019	< 0.001	90%	7.31 ± 0.75	7.9 ± 0.76	–3.411	0.003	8%
Quick flickers	6.46 ± 0.66	9.38 ± 1.2	–8.875	< 0.001	45%	6.46 ± 0.52	7.15 ± 0.69	–3.323	0.003	10.7%

	Sustained contraction			Quick flickers		
	mean difference	*t*	*p*	mean difference	*t*	*p*
Independent *t*-test						
Before	0.231	–0.728	0.237	0.000	0.000	0.500
After	5.538	5.432	< 0.001	2.231	5.839	< 0.001

p – probability < 0.01, * improvement rate

Table 4. Comparison of 1-hour pad test for both groups

1-hour Pad test	Before mean ± *SD*	After mean ± *SD*	Comparison		Rate*
			t	*p*	
Study group (A)	1.500 ± 0.17	0.608 ± 0.44	6.580	< 0.001	–58.312%
Control group (B)	1.631 ± 0.42	1.408 ± 0.38	9.667	< 0.001	–14%
Mean difference	–0.1308	–0.8000			
t-value	–1.023	–4.888			
p-value	0.158	< 0.001			

p – probability < 0.01, * improvement rate

Table 5 Comparison of ICIQ-SF for both groups

	Study group (A)					Control group (B)				
	before mean ± *SD*	after mean ± *SD*	*t*	*p*	rate*	before mean ± *SD*	after mean ± *SD*	*t*	*p*	rate*
Paired samples *t*-test										
Frequency	2.23 ± 1.2	1.31 ± 0.94	4.382	< 0.001	–41.3%	2.54 ± 0.77	2.38 ± 0.76	1.477	0.083	–12.2%
Leakage amount	2.00 ± 0.00	1.69 ± 0.75	1.477	0.083	–15%	2.46 ± 0.87	2.31 ± 0.75	1.000	0.169	–12.5%
Severity	6.31 ± 0.85	3.00 ± 1.6	7.985	< 0.001	–52.4%	6.62 ± 1.3	5.77 ± 0.92	3.395	0.003	–14%
Total score	10.54 ± 1.9	6.00 ± 3.0	7.019	< 0.001	–42.6%	11.62 ± 2.3	10.46 ± 1.8	4.215	< 0.001	–10%

	Before			After		
	mean difference	*t*	*p*	mean difference	*t*	*p*
Independent *t*-test						
Frequency	–0.308	–0.760	0.227	–1.077	–3.184	0.002
Leakage amount	–0.462	–1.897	0.041	–0.615	–2.089	0.024
Severity	–0.308	–0.728	0.237	–2.769	–5.318	< 0.001
Total score	–1.077	–1.305	0.102	–4.462	–4.562	< 0.001

p – probability < 0.01, * improvement rate

2-ICIQ-SF: the mean ± *SD* values of the ICIQ-SF before and after treatment for both groups are presented in Table 5. The paired *t*-test in the study group (A) showed a statistically highly significant difference ($p < 0.001$) in frequency, severity, and ICIQ-SF total score with an improvement rate of –41.3%, –52.4%, and –42.6%, respectively, while there was a non-significant difference in leakage amount ($p = 0.083$). The paired *t*-test in the control group (B) showed a statistically significant difference ($p = 0.003$) in severity and a statistically highly significant difference ($p < 0.001$) in ICIQ-SF total score with an improvement rate of –13.897% and –9.897%, respectively, while there was a non-significant difference in leakage amount and frequency. The independent *t*-test to compare between groups showed significant differences after treatment in frequency ($p = 0.002$), leakage amount ($p = 0.024$), severity ($p < 0.001$), and ICIQ-SF ($p < 0.001$), which revealed a statistically highly significant difference in leakage frequency, severity, and ICIQ-SF total score favouring the study group A, while there was a non-significant difference in leakage amount.

Discussion

The incidence of postpartum SUI correlates to PFMs dysfunction [19], as it normally functions to regulate bladder fullness by supporting continence control, which supports the bladder neck and urethra [20]. The excessive antenatal elongation of abdominal and PFMs reduces the muscles' ability to produce a controlled and robust contraction during regular activity, which has been recognised in UI women, consequently disrupting the standard coordination patterns between continence and weak PFMs and core musculature [15]. A reduction in Transverse Abdominal (TA) thickness is noticed in postpartum women with UI during the abdominal drawing-in maneuver contraction. Including the TA's synergistic contraction in a training program was suggested for postpartum women with UI [21]. This concept is considered an essential piece of background knowledge for describing our exercise program for treating SUI symptoms.

In the current study, the PFM strength via MOS increased significantly only in the study group A with a 20% improvement rate, while the control group B showed a non-significant improvement. The endurance assessment mean changes before and after treatment of the sustained contraction in the study group A were 7.08–13.46, and in the control group B, they were 7.31–7.9, while the quick flickers of 10 seconds in the study group A were 6.46–9.38 and in the control group B, they were 6.46–7.15, with both variables showing a highly significant difference in the study group A and a significant difference in the control group B. Moreover, the comparison between groups showed a highly significant difference be-

tween the groups favouring improvement in study group A.

The current study's results agree with Luginbuehl et al. [22], who proved the effectiveness of physical therapy management in improving PFM strength and reducing urinary leakage in SUI women. Also, Ahlund et al. [23] noticed an improvement in PFM strength via MOS and endurance from a baseline of 9.6 and 12.0 to 26.7 and 23.4 after home-based PFMT for primiparous SUI. It also aligns with Dijvejeen et al. [24], who found PFM via MOS improved after four weeks of core muscle exercises, and they attributed the reason to the involvement of the back, abdominal, and diaphragm muscles. Likewise, Cavkaytar et al. [25] investigated the effect of home-based PFMT on QOL over SUI and MUI women for eight weeks; and found that both groups improved in PFMs strength via MOS after PFMT. Fitz et al. [26] also that noticed an improvement in PFM strength via MOS after treatment either in an outpatient group or a home-based group. This also agrees with Sigurdardottir et al. [27], who observed a UI reduction and PFM strength and endurance improvement among early postpartum women after PFMT.

In this study, the SUI assessment via 1-hour pad test in both groups showed a statistically highly significant difference after treatment, which indicates minimisation in urine leakage. The improvement rate shows a higher reduction in the study group A of 58% compared to the control group B at 14%. Furthermore, in SUI assessment via ICIQ-SF, the comparisons between both groups showed a significant difference in leakage frequency, severity, and a highly significant difference in ICIQ-SF total score with an improvement rate of –42.6% favouring the study group A. That indicates SUI symptom reductions after home-based core exercise, while there was a non-significant difference in leakage amount.

Some previous studies found that the core exercises can improve UI symptoms, such as Hung et al. [28], who studied the effectiveness of an intervention program consisting of deep abdominal, diaphragmatic, and PF exercises for four months and observed that it could improve women's SUI and MUI symptoms and QOL and suggested it as an alternative approach to treat UI. Moreover, Tajiri et al. [29] found an 88.9% SUI reduction and hypertrophy of TA and PFM muscles via ultrasounds after TA muscle exercise and PFM co-contraction and recommend it for treating women with SUI.

Moreover, Kamel et al. [30] noticed that twelve weeks of abdominal muscle strength exercise was more effective in treating obese patients with SUI than PFMT. Another study, by Khan et al. [31], found that women aged 30 to 45 with SUI improved significantly in SUI and QOL after performing the core muscles and PFMT for six weeks with five sessions per week.

The study's findings also align with Rajan [32], who assessed the UI severity before and after PFMT using ICIQ-SF and found a significant reduction in the total score from the baseline mean of 12.23 ± 2.03 to 9.89 ± 1.8. This also aligns with Al Belushi et al. [12], where home-based PFMT effectively reduced women's SUI symptoms on the Arabic ICIQ-SF, and QOL improved in the supervised group compared to the other group who received the lecture only. Furthermore, Felicíssimo et al. [11] noticed no differences between supervised and unsupervised PFMT on SUI women regarding PFM strength via MOS and SUI via the ICIQ-SF and 1-hour pad test.

Paiva et al. [33] found that both PFMT in a group or individually effectively treat UI with no significant difference, although PFMT at home is less effective, and suggested a home-based program for the extended management of UI. Moreover, they concluded that PFMT could be considered a short-term and lower-cost intervention, which makes it a viable option for public health systems. This finding differs from ours, where the home-based program was less effective, possibly due to the comparison criteria and target group.

In contrast to our findings, Kim et al. [34] studied the difference between supervised and unsupervised PFMT utilising trunk stabilisation for postpartum UI of all types and found that handling postpartum UI under a physiotherapist's supervision is more effective than unsupervised. Moreover, Bø and Herbert [35] reported that previous RCTs did not provide evidence that supports adding abdominal exercise to PFMT for SUI cases.

Limitations

The present study's main limitation encountered in that there is no previous study concerning the number of cases in Jeddah city, which is considered an obstacle in calculating the sample size and the generalisability of the trials' findings. There was also difficulty in collecting the study samples due to the restrictions of COVID-19 and lack of a larger sample size related to the loss of patient flow in clinics during the study period.

Conclusions

It was shown that there is a significant improvement in PFM strength and endurance in both groups, and there was a highly significant difference between groups favouring the study group (A). There was a highly significant difference between groups in the 1-hour pad test and the ICIQ-SF total score favouring the study group A. Therefore, it was concluded that home-based core exercises for postpartum SUI women effectively improved PFM strength and endurance and minimised SUI symptoms.

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Disclosure statement

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Conflict of interest

The authors state no conflict of interest.

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