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Original Article

Use of a Mobile Application for Pelvic Floor Muscle Training in Women with Urinary Incontinence: A Randomized Controlled Trial

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ABSTRACT

Background: *Urinary incontinence (UI) is a prevalent condition among women, significantly impacting their quality of life. Pelvic floor muscle training (PFMT) is a first-line treatment for UI, but adherence to traditional PFMT regimens is often challenging. Mobile health applications offer a promising solution to improve adherence and outcomes in PFMT.*

Objective: *This study aimed to evaluate the effectiveness of a mobile application for PFMT in women with urinary incontinence compared to traditional PFMT instructions.*

Methods: *A randomized controlled trial was conducted with 32 women aged 30-60 years diagnosed with stress, urge, or mixed urinary incontinence. Participants were randomly assigned to either the intervention group, which used a mobile application for PFMT, or the control group, which received standard PFMT instructions. The intervention lasted for 12 weeks. Baseline and post-intervention assessments included the frequency of incontinence episodes, pelvic floor muscle strength (measured with a perineometer), and quality of life (measured using the Urogenital Distress Inventory and the Incontinence Impact Questionnaire). Adherence to the intervention was monitored through app usage tracking and weekly follow-up phone calls for the control group. Data were analyzed using SPSS version 25, with repeated-measures ANOVA used to assess within-group and between-group differences over time.*

Conclusion: *The use of a mobile application for pelvic floor muscle training significantly improved urinary incontinence symptoms, pelvic floor muscle strength, and quality of life in women compared to traditional PFMT instructions. These findings support the integration of digital health tools into the management of urinary incontinence.*

Keywords: *Urinary incontinence, pelvic floor muscle training, mobile health applications, digital health, women's health, randomized controlled trial, adherence, quality of life, stress urinary incontinence, urge urinary incontinence, mixed urinary incontinence, Health*

INTRODUCTION

Urinary incontinence (UI) is a prevalent and distressing condition affecting women worldwide, significantly impacting their quality of life. Despite being common, UI remains underreported due to the associated stigma and misconceptions about its treatability (1).The prevalence of UI varies widely, with estimates suggesting that up to 50% of women experience some form of incontinence during their lifetime (2).The most common types of UI are stress urinary incontinence (SUI), characterized by leakage during physical exertion, and urge urinary incontinence (UUI), characterized by a sudden, intense urge to urinate. Mixed urinary incontinence (MUI), which involves symptoms of both SUI and UUI, is also frequently encountered (3).

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The underlying causes of UI in women are multifactorial, including childbirth, menopause, aging, obesity, and certain medical conditions. Pelvic floor muscle training (PFMT) is widely recognized as a first-line conservative treatment for UI, particularly SUI. PFMT involves exercises designed to strengthen the pelvic floor muscles, which support the bladder and urethra, thereby improving urinary control (4,5).The effectiveness of PFMT is well-documented, with numerous studies demonstrating significant improvements in UI symptoms and quality of life (6).

However, adherence to PFMT regimens remains a significant challenge. Traditional PFMT requires sustained motivation and correct technique, which many women find difficult to maintain without supervision. This challenge has led to the exploration of innovative solutions to enhance adherence and effectiveness, including the use of digital health technologies. Mobile health applications (apps) offer a promising avenue for delivering PFMT interventions (7, 8). These apps can provide interactive guidance, reminders, and feedback, potentially improving adherence and outcomes (9).

Several mobile apps have been developed to assist women in performing PFMT. These apps vary in their features, from simple reminder systems to comprehensive programs offering real-time feedback and progress tracking. Despite their potential, the clinical efficacy of these apps remains underexplored, necessitating rigorous randomized controlled trials (RCTs) to evaluate their effectiveness compared to traditional methods (10).

This study aims to address this gap by conducting a randomized controlled trial to assess the effectiveness of a mobile application for PFMT in women with urinary incontinence (11, 12).The primary objective is to compare the improvement in incontinence episodes between women using the mobile app and those following traditional PFMT instructions. Secondary objectives include evaluating changes in pelvic floor muscle strength and quality of life. By leveraging digital health technology, this study seeks to provide evidence on whether a mobile app can enhance the effectiveness of PFMT, thereby offering a scalable and accessible solution for managing urinary incontinence in women (13).

Urinary incontinence significantly impacts women's lives, and while PFMT is an effective treatment, adherence remains a challenge. Mobile health applications represent a novel approach to improving adherence and outcomes in PFMT. This study's findings will contribute to the growing body of evidence on digital health interventions, potentially informing clinical practice and guiding future developments in the management of urinary incontinence (14).

MATERIAL AND METHODS

The study was designed as a randomized controlled trial to evaluate the effectiveness of a mobile application for pelvic floor muscle training (PFMT) in women with urinary incontinence. The trial was conducted in accordance with the ethical principles of the Declaration of Helsinki and was approved by the relevant

institutional review board. Informed consent was obtained from all participants prior to their inclusion in the study.

Participants were recruited from outpatient clinics specializing in women's health and urology. Eligible participants included women aged 30-60 years who had been diagnosed with stress, urge, or mixed urinary incontinence. Exclusion criteria included pregnancy, recent pelvic surgery, neurological disorders affecting bladder function, and any other condition that could interfere with the ability to perform PFMT. Participants were randomly assigned to either the intervention group, which used the mobile application, or the control group, which received standard PFMT instructions. Randomization was performed using a computer-generated randomization sequence to ensure allocation concealment (13).

The intervention group was provided with a mobile application specifically designed for PFMT. This application included features such as instructional videos, daily exercise reminders, progress tracking, and real-time feedback on technique. Participants in the control group received written and verbal instructions on PFMT from a qualified physiotherapist, along with a printed exercise regimen to follow at home. Both groups were instructed to perform the exercises daily for 12 weeks. Baseline data collection included demographic information, medical history, and baseline measures of urinary incontinence, pelvic floor muscle strength, and quality of life. Urinary incontinence was assessed using a validated bladder diary and the Incontinence Severity Index. Pelvic floor muscle strength was measured using a perineometer, while quality of life was evaluated using the Urogenital Distress Inventory and the Incontinence Impact Questionnaire. These assessments were repeated at the end of the 12-week intervention period to evaluate changes over time (14).

The primary outcome measure was the change in the frequency of incontinence episodes, as recorded in the bladder diary. Secondary outcome measures included changes in pelvic floor muscle strength and quality of life scores. Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize baseline characteristics and outcome measures. Independent t-tests and chi-square tests were employed to compare baseline characteristics between groups. For the primary and secondary outcome measures, repeated-measures ANOVA was used to assess within-group and between-group differences over time. A significance level of $p < 0.05$ was considered statistically significant (14).

Throughout the study, adherence to the intervention was monitored using the mobile application's built-in tracking features and through weekly follow-up phone calls for the control group. Adherence rates and any adverse events were documented and analyzed. The study aimed to ensure rigorous data collection and analysis to provide reliable and valid results on the effectiveness of the mobile application for PFMT in women with urinary incontinence. In conclusion, this randomized controlled trial employed a robust methodology to evaluate the efficacy of a mobile application for PFMT. The inclusion of comprehensive baseline and follow-up assessments, along with rigorous data analysis, aimed to provide high-quality evidence on the potential benefits of incorporating digital health technologies into the management of urinary incontinence in women.

RESULTS

The study included a total of 32 women, with 16 participants in the control group and 16 in the intervention group. The baseline characteristics of the participants were similar across both groups, with no significant differences in age, socioeconomic status, education level, marital status, employment status, or previous treatments ($p > 0.05$).

Table 1 Baseline Characteristics

Characteristic	Control Group (n=16)	Mobile App, Group (n=16)	P-Value
Age (mean ± SD)	42.9 ± 7.4	42.5 ± 8.0	0.88
Socioeconomic Status (n, %)			
Low	7 (43.8%)	4 (25.0%)	0.29
Medium	5 (31.2%)	7 (43.8%)	0.48
High	4 (25.0%)	5 (31.2%)	0.70
Education Level (n, %)			
High School	6 (37.5%)	5 (31.2%)	0.72
Bachelor	2 (12.5%)	6 (37.5%)	0.22
Master	3 (18.8%)	2 (12.5%)	0.63
PhD	5 (31.2%)	3 (18.8%)	0.69
Marital Status (n, %)			
Single	4 (25.0%)	5 (31.2%)	0.70
Married	8 (50.0%)	7 (43.8%)	0.72
Divorced	2 (12.5%)	3 (18.8%)	0.62
Widowed	2 (12.5%)	1 (6.2%)	0.55
Employment Status (n, %)			
Employed	10 (62.5%)	11 (68.8%)	0.73
Unemployed	4 (25.0%)	3 (18.8%)	0.67
Retired	2 (12.5%)	2 (12.5%)	1.00
Previous Treatments (n, %)	9 (56.2%)	7 (43.8%)	0.48

The baseline measures for incontinence episodes, pelvic floor strength, and quality of life showed no significant differences between the control and intervention groups ($p > 0.05$).

Table 2 Baseline Measures

Measure	Control Group (n=16)	Mobile App, Group (n=16)	p-value
Incontinence Episodes	10.2 ± 2.6	10.4 ± 2.8	0.80
Pelvic Floor Strength (score)	3.1 ± 0.5	3.0 ± 0.6	0.60
Quality of Life (score)	67.5 ± 6.3	68.0 ± 7.0	0.75

The pre-treatment outcome measures similarly showed no significant differences between groups, confirming comparable baseline conditions.

Table 3 Pre-treatment Outcome Measures

Measure	Control Group (n=16)	Mobile App, Group (n=16)	p-value
Incontinence Episodes	10.2 ± 2.6	10.4 ± 2.8	0.80
Pelvic Floor Strength (score)	3.1 ± 0.5	3.0 ± 0.6	0.60
Quality of Life (score)	67.5 ± 6.3	68.0 ± 7.0	0.75

After 12 weeks of intervention, the results indicated significant improvements in the intervention group compared to the control group across all primary and secondary outcome measures.

Table 4 Post-treatment Outcome Measures

Measure	Control Group (n=16)	Mobile App, Group (n=16)	p-value
Incontinence Episodes	9.8 ± 2.5	5.6 ± 2.2	<0.001
Pelvic Floor Strength (score)	3.2 ± 0.5	4.5 ± 0.7	<0.001
Quality of Life (score)	70.2 ± 6.8	80.0 ± 7.5	<0.001

The frequency of incontinence episodes decreased significantly more in the intervention group (Mobile App) than in the control group. The intervention group reported a mean reduction of 4.8 episodes compared to a mean reduction of 0.4 episodes in the control group ($p < 0.001$). Pelvic floor muscle strength increased significantly in the intervention group, with a mean score improvement of 1.5 compared to 0.1 in the control group ($p < 0.001$). Additionally, quality of life scores improved significantly in the intervention group, with a mean increase of 12.0 points compared to 2.7 points in the control group ($p < 0.001$).

These results indicate that the use of a mobile application for pelvic floor muscle training significantly improves urinary incontinence symptoms, pelvic floor muscle strength, and quality of life in women, compared to traditional PFMT instructions. The findings support the potential of mobile health applications as effective tools in managing urinary incontinence (1-3).

DISCUSSION

The findings of this study demonstrated that the use of a mobile application for pelvic floor muscle training (PFMT) significantly improved urinary incontinence symptoms, pelvic floor muscle strength, and quality of life in women, compared to traditional PFMT instructions. These results align with previous research indicating the efficacy of digital health interventions in enhancing adherence and outcomes in PFMT (15).

The intervention group, which utilized the mobile application, exhibited a marked reduction in the frequency of incontinence episodes. This finding is consistent with studies that have shown digital tools can provide effective reminders and real-time feedback, which are critical in maintaining motivation and correct technique in PFMT (16). Moreover, the significant improvement in pelvic floor muscle strength observed in the intervention group underscores the importance of continuous and accurate exercise performance, facilitated by the mobile app's interactive features (17).

Quality of life, as measured by validated questionnaires, also improved significantly in the intervention group. This improvement is crucial, given that urinary incontinence substantially impacts daily activities, emotional well-being, and social interactions. The mobile application not only provided structured and accessible PFMT but also likely contributed to a greater sense of control and empowerment among the participants, thereby enhancing their overall quality of life (18).

Despite these promising results, several limitations must be acknowledged. The sample size was relatively small, and the study duration was limited to 12 weeks. A larger sample size and longer follow-up period would provide more robust data and allow for the assessment of long-term adherence and effectiveness. Additionally, the study relied on self-reported adherence to PFMT, which may be subject to reporting bias. Future studies should incorporate objective measures of adherence, such as app usage logs, to corroborate self-reported data (19).

Another limitation was the homogeneity of the study population, primarily consisting of women from similar socioeconomic backgrounds. This limits the generalizability of the findings to a broader population. Future research should aim to include a more diverse cohort to evaluate the effectiveness of mobile applications across different demographic groups (20) Furthermore, while the mobile application provided real-time feedback and progress tracking, it did not include personalized modifications to the PFMT regimen based on individual progress. Incorporating adaptive algorithms that tailor exercises to the user's performance could enhance the app's effectiveness (21). The strengths of this study include its randomized controlled design, which minimizes bias and allows for causal inferences. The use of validated outcome measures adds to the reliability of the findings. Additionally, the study contributes to the growing body of evidence supporting the integration of digital health technologies in managing chronic conditions like urinary incontinence.

CONCLUSION

In conclusion, the use of a mobile application for pelvic floor muscle training significantly improved outcomes for women with urinary incontinence. These findings suggest that digital health tools can enhance adherence to PFMT and provide effective management of urinary incontinence. Future research should focus on larger, more diverse populations and explore the long-term benefits and potential for personalized interventions using mobile applications. The integration of digital health technologies into routine clinical practice holds promise for improving the quality of care and outcomes for women with urinary incontinence (7).

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