

Correspondence

✉ Izza Ayub, drizzaayub@gmail.com

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Declarations

No funding was received for this study. The authors declare no conflict of interest. The study received ethical approval. All participants provided informed consent.

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Comparative Effects of Kegel and Squat Exercises on Urinary Incontinence Severity and Quality of Life

Izza Ayub¹, Zainab Basharat¹, Ayesha Sajid¹, Asma Asif¹

¹ Department of Rehabilitation Sciences, The University of Faisalabad, Pakistan

ABSTRACT

Background: Urinary incontinence (UI) is a common condition among women, associated with impaired quality of life, social stigma, and increased healthcare burden. Conservative management strategies such as pelvic floor muscle training are widely recommended as first-line interventions. While Kegel exercises are the most established approach, squat-based training has been proposed as an alternative for enhancing pelvic and core muscle strength. **Objective:** To compare the effects of Kegel and squat exercises on urinary incontinence severity and health-related quality of life among women with UI. **Methods:** A randomized clinical trial (NCT07156266) was conducted at two hospitals in Faisalabad, Pakistan, enrolling 26 women aged 30–60 years with clinically confirmed UI. Participants were randomly allocated into two groups: Kegel exercise group (n=14) and squat exercise group (n=12). Both groups received baseline transcutaneous electrical nerve stimulation followed by 12 weeks of daily exercises. Outcomes were assessed using the Incontinence Quality of Life questionnaire (I-QOL) and the International Consultation on Incontinence Questionnaire-Female Lower Urinary Tract Symptoms Long Form (ICIQ-FLUTS-LF). **Conclusion:** Kegel exercises were more effective than squats in improving quality of life and reducing symptom severity in women with UI, supporting their role as the preferred conservative treatment.

Keywords

urinary incontinence, pelvic floor muscle training, Kegel exercises, squats, women's health, quality of life

INTRODUCTION

Urinary incontinence (UI) is defined by the International Continence Society as the involuntary leakage of urine, and it represents a significant global health problem with a prevalence that disproportionately affects women due to factors such as childbirth, menopause, and aging (1). Despite not being life-threatening, UI has profound consequences for quality of life, including limitations on daily activities, social participation, and psychological well-being (2). The economic burden associated with UI management, including healthcare costs and reduced productivity, further underscores the importance of effective treatment strategies (3). Current estimates suggest that between 25–45% of women experience some degree of UI, with stress urinary incontinence (SUI) being the most common subtype, followed by urge urinary incontinence (UUI) and mixed urinary incontinence (MUI) (4).

The underlying mechanisms of UI involve either dysfunction in bladder storage or failure of the urethral sphincter and supporting tissues, often exacerbated by hormonal changes, pelvic floor trauma during childbirth, and comorbidities such as obesity and diabetes (5). These pathophysiological alterations lead to weakened pelvic floor muscles, impaired continence control, and increased urinary leakage under physical stress. While surgical interventions are available, conservative measures remain the preferred first-line approach, particularly pelvic floor muscle training (PFMT) and lifestyle modifications (6). Among these, Kegel exercises are the most widely prescribed, involving repeated voluntary contractions of the pelvic floor muscles to enhance sphincter strength and bladder control (7). Squat-based exercises, on the other hand, offer indirect pelvic floor activation while also engaging in the hip and core musculature, which may contribute to improved continence mechanisms and functional stability (8).

Previous studies have demonstrated the effectiveness of Kegel exercises in reducing UI severity and improving quality of life, with multiple randomized trials supporting their use as a non-invasive and cost-effective intervention (9). Squat exercises, though less studied, have been proposed as an alternative or adjunct therapy, as they recruit pelvic stabilizers and may enhance functional muscle endurance relevant to continence (10). However, the comparative effectiveness of these two interventions remains unclear. While some interventional studies suggest that squats can activate pelvic floor muscles to a degree comparable to Kegels, others report superior outcomes with targeted PFMT (11). Importantly, there is a lack of high-quality randomized studies directly comparing the two approaches. Given this gap, the present study was designed to compare the effects of Kegel exercises and squats on urinary incontinence severity and health-related quality of life among women with UI. The findings aim to provide evidence-based guidance for clinicians and physiotherapists on selecting the most effective conservative therapy for managing UI, particularly in resource-limited settings.

MATERIAL AND METHODS

This study was designed as a randomized clinical trial (NCT07156266) to evaluate the comparative effects of Kegel and squat exercises on urinary incontinence severity and health-related quality of life among women. The trial was conducted at two hospitals in Faisalabad, Pakistan—Madinah Teaching Hospital and Flah-E-Millat Hospital—over a period of four months following ethical approval from the Ethical Institutional Review Board. Participants were assured of confidentiality and anonymity. No participant was exposed to harm, and the interventions posed minimal risk. All procedures adhered to the Declaration of Helsinki.

Participants were women aged 30–60 years with a diagnosis of urinary incontinence confirmed by a qualified healthcare provider having clinical evidence of weak pelvic floor muscle strength and those who consented to be a part of this study. Exclusion criteria comprised pregnancy or plans

to conceive during the study period, recent pelvic or abdominal surgery within six months, neurological conditions, recurrent urinary tract infections, pelvic organ prolapse and any musculoskeletal or medical disorder that contraindicated exercise participation. A total of $n=39$ participants were assessed for eligibility. Among them $n=6$ did not meet inclusion criteria and $n=3$ declined to participate hence $n=30$ participants were randomly allocated into two group A ($n=15$) and B ($n=15$). After follow-up, group A had loss of $n=3$ participants due to missed session and participants moving to another city and group B had a loss of $n=1$ participant due to missed session. Finally, $n=26$ participants were analyzed after 12 weeks as in Figure 1.

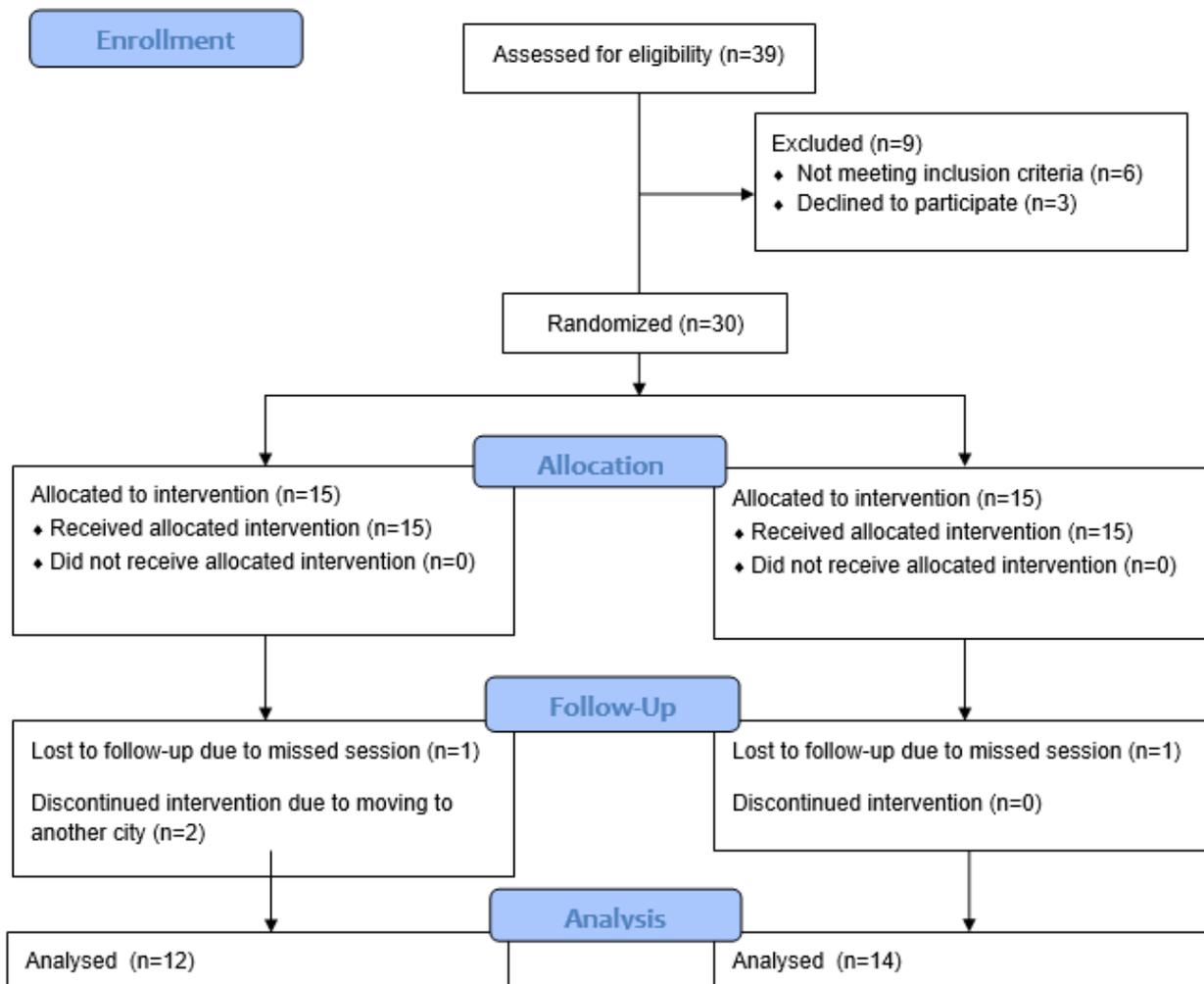


Figure 1 CONSORT Flow Diagram

All participants received baseline treatment with transcutaneous electrical nerve stimulation (TENS) applied at a moderate intensity (20–50 mA, 10–15 Hz frequency, and pulse duration of 100–200 us) for 20 minutes to standardize initial pelvic floor activation prior to exercise intervention (12). Group A performed squat exercises comprising sumo squats and narrow squats, with three sets of 10–12 repetitions daily for twelve weeks. Group B performed Kegel exercises comprising two forms: the “dead bug” and “bridging” positions, with three sets of ten repetitions daily for twelve weeks (13).

The primary outcome measure was the International Consultation on Incontinence Questionnaire-Female Lower Urinary Tract Symptoms Long Form (ICIQ-FLUTS-LF), a validated tool to assess urinary symptoms and their impact on daily life (14). The secondary outcome was the Incontinence Quality of Life questionnaire (I-QOL), which evaluates the effect of urinary incontinence on physical, social, and psychological well-being (15). Both questionnaires were administered at baseline and after the 12-week intervention.

Sample size estimation was based on previous studies using a standard deviation range of 8.0–27.7, with α set at 0.05 and power at 80%, yielding a required sample of 30 participants.

Data were analyzed using SPSS version 25. Assumptions of parametric test were assumed. Paired-sample t-tests were used for within-group pre- and post-intervention comparisons, while independent-sample t-tests were conducted for between-group differences. P-values <0.05 were considered statistically significant. Effect sizes and 95% confidence intervals were calculated to quantify the magnitude of changes.

RESULTS

A total of 26 women with urinary incontinence completed the study, with a mean age of 44.6 years (SD = 9.5). Most participants were married (81.5%), and nearly two-thirds had experienced a normal vaginal delivery (66.7%). Postmenopausal women accounted for the majority of the sample (74.1%). This demographic profile indicates that the cohort represented a middle-aged, largely postmenopausal, and clinically burdened population at elevated risk of urinary dysfunction.

The demographic features of study participants showed that 81% of the women were married. Regarding the mode of delivery, 66% of women had a history of normal delivery, while 29% of women had a C-section. Additionally, 74% of women reported postmenopausal status and 22 % reported premenopausal status.

Furthermore, concerning the type of urinary incontinence, 63% of women reported stress incontinence, 18% of urge type, and 14% of mixed incontinence type. Results also revealed that physical activity levels were significantly low, as 63 % of women reported low levels, 25 % with moderate and lastly, 7 % reported high levels of activity. In terms of comorbid conditions, 63% of women came with diabetes, 18 % with obesity, 11% with constipation, and 1% with urinary tract infections.

Within-group analyses revealed significant improvements across both interventions. The squat training group improved from 36.1 ± 18.5 to 73.0 ± 12.5 , with a mean gain of 37.0 points. In contrast, Kegel group, mean I-QOL scores improved markedly from 28.9 ± 24.8 at baseline to 86.6 ± 9.3 post-intervention, reflecting a mean gain of 57.7 point. This difference indicates that although both interventions were clinically beneficial, Kegel training produced a larger and more consistent impact on quality of life. The squat group showed a smaller reduction from 0.4 ± 0.1 to 0.3 ± 0.1 , yielding a mean difference of 0.1 while In Kegel exercise group ICIQ scores decreased from 0.5 ± 0.2 to 0.1 ± 0.1 , representing a mean reduction of 0.4. These findings highlight that Kegels were not only more effective in reducing leakage episodes but also achieved greater symptom relief relative to squats as in table 1.

Table 1: Within Group Analysis for Incontinence Quality of Life Questionnaire and International Consultation on Incontinence Questionnaire

Variables	Groups	Types	n	Mean \pm SD	p-value
Incontinence Quality of Life Questionnaire	Group A (Squats Exercises)	Pre	12	36.1 \pm 18.5	0.00
		Post		73.0 \pm 12.5	
	Group B (Kegel Exercise)	Pre	14	28.9 \pm 24.8	0.00
		Post		86.6 \pm 9.3	
International Consultation on Incontinence Questionnaire	Group A (Squats Exercises)	Pre	12	0.4 \pm 0.1	0.001
		Post		0.3 \pm 0.1	
	Group B (Kegel Exercise)	Pre	14	0.5 \pm 0.2	0.00
		Post		0.1 \pm 0.1	

Direct group comparisons after 12 weeks confirmed the superiority of Kegel exercises. Post-intervention I-QOL scores were significantly higher in the Kegel group (86.6 ± 9.3) than in the squat group (73.1 ± 12.5), with a mean difference of 13.5 points. Correspondingly, ICIQ scores were significantly lower in the Kegel group (0.1 ± 0.1) compared to the squat group (0.3 ± 0.1), with a mean difference of -0.2 . Together, these results demonstrate that while both forms of exercise were effective, Kegel training yielded greater gains in quality of life and greater reductions in incontinence severity as in table 2.

Table 2: Between Group Analysis for Incontinence Quality of Life Questionnaire and International Consultation on Incontinence Questionnaire

Variables	Groups	Types	N	Mean \pm SD	p-value
Incontinence Quality of Life Questionnaire	Group A (Squats Exercises)	Pre	12	36.1 \pm 18.5	0.419
	Group B (Kegel Exercise)	Post	14	28.9 \pm 24.8	
	Group A (Squats Exercises)	Pre	12	73.1 \pm 12.5	0.004
	Group B (Kegel Exercise)	Post	14	86.6 \pm 9.3	
International Consultation on Incontinence Questionnaire	Group A (Squats Exercises)	Pre	12	0.4 \pm 0.1	0.124
	Group B (Kegel Exercise)	Post	14	0.5 \pm 0.2	
	Group A (Squats Exercises)	Pre	12	0.3 \pm 0.1	0.004
	Group B (Kegel Exercise)	Post	14	0.1 \pm 0.1	

DISCUSSION

The present randomized trial evaluated the comparative effects of Kegel exercises and squat training on urinary incontinence severity and quality of life in women. Both interventions resulted in significant improvements, but the Kegel group demonstrated superior outcomes across all measures, including a greater increase in quality of life scores and a sharper reduction in urinary incontinence severity. These findings highlight the importance of targeted pelvic floor muscle training as a primary conservative treatment option for urinary incontinence (16).

Diabetes and obesity were common comorbidities; conditions known to exacerbate bladder dysfunction and contribute to pelvic floor weakening (17). These baseline risk factors underscore the clinical need for accessible, low-cost, and effective non-pharmacological interventions.

Our findings from between group analysis demonstrated a marked improvement in Kegel group highlighting greater reduction in urinary incontinence symptoms severity as compared to the squat treatment group. Kegel exercises helped focusing on the isolation and contraction of the pelvic floor muscles, particularly the pubococcygeus muscle, enhancing its ability to support the bladder and urethra effectively. This targeted strengthening improves sphincter control, reducing involuntary urine leakage. This aligns with previous trials showing that Kegel exercises directly strengthen the pelvic floor musculature, leading to enhanced urethral closure and improved continence (18).

Within group, squat training also provided promising results by primarily engaging hip and core musculature, offering indirect pelvic floor stimulation, squats engage not only the pelvic floor muscles but also the glutes, thighs, and core muscles, providing a more holistic approach to reinforcing the structural support around the pelvic region (19). Squats promote functional strength and stability, which can indirectly alleviate pressure on the bladder and improve continence (10). While studies such as Stupp et al. have suggested comparable activation of pelvic floor

muscles during squats, the present results confirm that isolated, repetitive contractions provided by Kegel exercises are more effective for symptom resolution (20).

Reductions in symptom severity, measured by ICIQ scores, were also significantly greater in the Kegel group compared to the squat group. This difference is clinically meaningful, as even modest reductions in ICIQ scores translate into substantial improvements in daily functioning and self-confidence. These results corroborate previous interventional studies demonstrating the efficacy of Kegel training for both stress and mixed incontinence subtypes (21). Furthermore, our findings resonate with systematic reviews recommending Kegel exercises as the first-line conservative therapy across diverse populations (22).

Kegel exercises and squats have both been shown to significantly improve urinary incontinence by targeting and strengthening the pelvic floor muscles, which play a central role in maintaining bladder control. Both exercises work through the mechanism of neuromuscular re-education, increasing the endurance and coordination of pelvic muscles, which are often weakened in individuals with urinary incontinence (23). By enhancing muscle tone and support, these exercises contribute to a better quality of life for individuals suffering from this condition. The clinical implications of this study are particularly relevant in the South Asian context, where urinary incontinence remains underdiagnosed and undertreated due to cultural stigma, embarrassment, and limited awareness (24).

By demonstrating that a home-based, low-cost intervention such as Kegel training yields substantial benefits, this study supports the incorporation of PFMT protocols into community health programs and physiotherapy practice in Pakistan. Squat exercises may still serve as a complementary intervention to enhance general lower body strength, but their role in continence management should be considered secondary to targeted PFMT. Several strengths of this study strengthen the validity of the findings. The use of a randomized design validated outcome measures (ICIQ-FLUTS-LF and I-QOL), and blinded outcome assessment reduce the likelihood of bias. Both groups demonstrated significant improvements, confirming that exercise-based interventions are a safe and effective strategy for managing UI. In addition, the absence of a non-exercise control group restricts the ability to separate the effects of natural recovery from intervention benefits.

Future research should aim to include larger, multicenter trials with longer follow-up periods to evaluate sustainability of improvements. Studies comparing Kegel exercises with emerging physiotherapy techniques such as biofeedback-assisted PFMT, electro stimulation, or combined squat–PFMT programs may provide a more nuanced understanding of optimal treatment strategies. Moreover, culturally tailored awareness programs and integration of PFMT into primary care could enhance treatment-seeking behavior and improve outcomes in populations where urinary incontinence is frequently overlooked. In summary, the present trial demonstrates that while both squat and Kegel exercises improve urinary incontinence symptoms and quality of life, Kegel training is significantly more effective. These findings reinforce existing clinical guidelines recommending Kegel exercises as the cornerstone of conservative UI management and highlight the need for broader implementation of PFMT protocols in routine practice.

CONCLUSION

Both Kegel and squat exercises significantly improve urinary incontinence severity and health-related quality of life among women. However, Kegel exercises produced superior outcomes, with greater reductions in symptom severity and larger gains in quality of life as compared to squats.

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