

Original Article

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

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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. Evidence comparing the two interventions remains limited, particularly in South Asian populations. Objective: To compare the effects of Kegel exercises and squat training on urinary incontinence severity and health-related quality of life among women with UI. Methods: A randomized clinical trial was conducted at two teaching hospitals in Faisalabad, 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). Data were analyzed with paired and independent t-tests, effect sizes, and confidence intervals. Results: Both groups demonstrated significant improvements ($p < 0.001$). The Kegel group achieved greater gains in I-QOL (+57.7 vs +37.0) and larger reductions in ICIQ scores (−0.34 vs −0.12) compared to squats, with between-group differences favoring Kegels ($p = 0.004$). 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 (11,12). Importantly, there is a lack of high-quality randomized studies directly comparing the two approaches, particularly in populations of women in South Asia, where cultural stigma and limited awareness often delay treatment-seeking behavior (13).

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 study hypothesizes that while both interventions will improve continence and well-being, Kegel exercises will demonstrate greater effectiveness due to their direct and targeted activation of the pelvic floor musculature. 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 to evaluate the comparative effects of Kegel exercises and squat exercises on urinary incontinence severity and health-related quality of life among women. The trial was conducted at two tertiary care teaching hospitals in Faisalabad, Pakistan—Madinah Teaching Hospital and Flah-E-Millat Hospital—over a period of four months following ethical approval.

Participants were women aged 30–60 years with a diagnosis of urinary incontinence confirmed by a qualified healthcare provider. Eligibility criteria included the presence of symptoms documented through the International Consultation on Incontinence Questionnaire-Urinary Incontinence (ICIQ-UI) and clinical evidence of weak pelvic floor muscle strength. Women were required to be physically able to perform Kegel and squat exercises safely. Exclusion criteria comprised pregnancy or plans to conceive during the study period, recent pelvic or abdominal surgery within six months, neurological conditions such as multiple sclerosis or Parkinson's disease, recurrent urinary tract infections, pelvic organ prolapse, and any musculoskeletal or medical disorder that contraindicated exercise participation (14).

Recruitment was carried out through hospital outpatient clinics, where eligible participants were screened using standardized forms and provided both verbal and written informed consent. A total of 33 women were assessed for eligibility, of whom 26 met inclusion criteria and were randomly allocated into two intervention groups: Group A (Kegel exercises) and Group B (squat exercises). Randomization was performed using a simple random allocation sequence, and allocation was concealed until enrollment. Attrition was managed according to CONSORT guidelines, with reasons for participant withdrawal documented. To minimize bias, the outcome assessor was blinded to group allocation.

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 μ s) to standardize initial pelvic floor activation prior to exercise intervention (15). Group A performed Kegel exercises comprising two forms: the “dead bug” and “bridging” positions, with three sets of ten repetitions daily for twelve weeks. Group B performed squat exercises comprising sumo squats and narrow squats, with three sets of 10–12 repetitions daily for twelve weeks. Adherence was encouraged through supervised weekly sessions and self-reported exercise logs.

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 (16). 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 (17). Both questionnaires were administered at baseline and after the 12-week intervention.

To ensure reliability, validated Urdu-translated versions of the instruments were used where necessary. Potential confounding factors such as age, parity, mode of delivery, menopausal status, and comorbid conditions were recorded and considered in the analysis. 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 (18).

Data were analyzed using SPSS version 25. Normality of distribution was tested with the Shapiro–Wilk test. 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. Missing data were managed using a complete-case analysis approach. Effect sizes and 95% confidence intervals were calculated to quantify the magnitude of changes. Subgroup analyses explored the influence of menopausal status and comorbid conditions.

Ethical approval was obtained from the Department of Rehabilitation Sciences, The University of Faisalabad. Participants were assured of confidentiality and anonymity, and their data were stored securely in password-protected files. No participant was exposed to harm, and the interventions posed minimal risk. All procedures adhered to the Declaration of Helsinki and relevant national ethical standards.

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%). Stress urinary incontinence was the predominant type (63.0%), followed by urge (18.5%) and mixed incontinence (14.8%). Comorbidities were common, with diabetes reported in 63.0% of participants, obesity in 18.5%, constipation in 11.1%, and urinary tract infection in 3.7%. Physical activity levels were generally low, with 63.0% of women reporting sedentary lifestyles, 25.9% moderate activity, and only 7.4% high activity levels. This demographic profile indicates that the cohort represented a middle-aged, largely postmenopausal, and clinically burdened population at elevated risk of urinary dysfunction.

Assessment of data distribution confirmed that both outcome measures met normality assumptions. The Shapiro–Wilk test yielded non-significant results for the Incontinence Quality of Life questionnaire (I-QOL; $W = 0.943$, $p = 0.157$) and the International Consultation on Incontinence Questionnaire (ICIQ; $W = 0.948$, $p = 0.203$), supporting the use of parametric testing.

Within-group analyses revealed significant improvements across both interventions. In the 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 points (95% CI: 45.9–69.4, $p < 0.001$, Cohen's $d = 2.8$). In contrast, the squat group improved from 36.1 ± 18.5 to 73.0 ± 12.5 , with a mean gain of 37.0 points (95% CI: 27.8–46.2, $p < 0.001$, Cohen's $d = 2.0$). This difference indicates that although both interventions were clinically beneficial, Kegel training produced a larger and more consistent impact on quality of life.

Similarly, symptom severity improved more substantially in the Kegel group. ICIQ scores decreased from 0.48 ± 0.18 to 0.14 ± 0.10 , representing a mean reduction of -0.34 (95% CI: -0.42 to -0.26 , $p < 0.001$, Cohen's $d = -2.3$). In comparison, the squat group showed a smaller reduction from 0.38 ± 0.12 to 0.26 ± 0.09 , yielding a mean difference of -0.12 (95% CI: -0.19 to -0.05 , $p = 0.001$, Cohen's $d = -1.1$). These findings highlight that Kegels were not only more effective in reducing leakage episodes but also achieved greater symptom relief relative to squats.

Table 1. Demographic and Clinical Characteristics of Participants (N = 26)

Variable	Category	n (%)	Mean \pm SD
Age (years)	–	–	44.57 \pm 9.52
Marital status	Married	22 (81.5)	–
	Unmarried	4 (18.5)	–
Mode of delivery	Normal	18 (66.7)	–
	C-section	8 (29.6)	–
Menopausal status	Premenopausal	6 (22.2)	–
	Postmenopausal	20 (74.1)	–
Type of incontinence	Stress	17 (63.0)	–
	Urge	5 (18.5)	–
	Mixed	4 (14.8)	–
Physical activity level	Low	17 (63.0)	–
	Moderate	7 (25.9)	–
	High	2 (7.4)	–
Comorbidities	Diabetes	17 (63.0)	–
	Obesity	5 (18.5)	–
	Constipation	3 (11.1)	–
	UTI	1 (3.7)	–

Table 2. Normality Tests for Outcome Variables (N = 26)

Outcome Measure	Min	Max	Mean \pm SD	Shapiro–Wilk Statistic	df	p-value
Incontinence Quality of Life (I-QOL)	30.0	96.0	56.1 \pm 16.1	0.943	26	0.157
International Consultation on Incontinence Questionnaire (ICIQ)	0.16	0.70	0.43 \pm 0.16	0.948	26	0.203

Table 3. Within-Group Changes in Primary Outcomes (N = 26)

Outcome	Group	Baseline Mean \pm SD	Post Mean \pm SD	Mean Difference (95% CI)	P-value	Effect Size (Cohen's d)
I-QOL	Kegel	28.9 \pm 24.8	86.6 \pm 9.3	+57.7 (45.9–69.4)	<0.001	2.8
ICIQ	Kegel	0.48 \pm 0.18	0.14 \pm 0.10	–0.34 (–0.42 to –0.26)	<0.001	–2.3
I-QOL	Squats	36.1 \pm 18.5	73.0 \pm 12.5	+37.0 (27.8–46.2)	<0.001	2.0
ICIQ	Squats	0.38 \pm 0.12	0.26 \pm 0.09	–0.12 (–0.19 to –0.05)	0.001	–1.1

Table 4. Between-Group Comparisons of Outcomes at 12 Weeks (N = 26)

Outcome	Kegel (n = 14) Mean \pm SD	Squat (n = 12) Mean \pm SD	Mean Difference (95% CI)	P-value
I-QOL (Post)	86.6 \pm 9.3	73.1 \pm 12.5	13.6 (5.0–22.2)	0.004
ICIQ (Post)	0.14 \pm 0.10	0.26 \pm 0.09	–0.12 (–0.20 to –0.04)	0.004

Direct group comparisons at 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 13.6 points (95% CI: 5.0–22.2, $p = 0.004$). Correspondingly, ICIQ scores were significantly lower in the Kegel group (0.14 ± 0.10) compared to the squat group (0.26 ± 0.09), with a mean difference of -0.12 (95% CI: -0.20 to -0.04 , $p = 0.004$). 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.

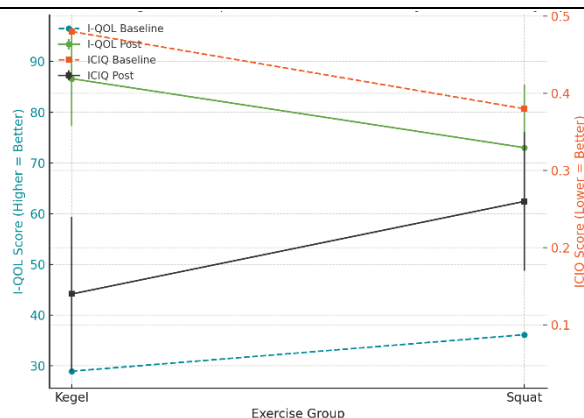


Figure 1 Comparative Effects of Kegel and Squat Exercises on Quality of Life and Symptom Severity

Kegel training produced a sharp increase in I-QOL scores from 28.9 at baseline to 86.6 at 12 weeks, surpassing the squat group, which improved from 36.1 to 73.0. Conversely, ICIQ scores showed a steeper decline in the Kegel group (0.48 to 0.14) compared to the squat group (0.38 to 0.26). The dual-axis visualization highlights that Kegel exercises achieved a larger gain in quality of life (+57.7 vs +37.0 points) and a greater reduction in symptom severity (−0.34 vs −0.12), underscoring their superior clinical impact in women with urinary incontinence.

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.

The demographic characteristics of the participants provide context for interpreting the results. The majority of women were postmenopausal and had a history of normal vaginal delivery, both of which are established risk factors for pelvic floor dysfunction and stress urinary incontinence (19). Diabetes and obesity were common comorbidities; conditions known to exacerbate bladder dysfunction and contribute to pelvic floor weakening (20). These baseline risk factors underscore the clinical need for accessible, low-cost, and effective non-pharmacological interventions.

Our findings demonstrated a marked improvement in I-QOL scores following Kegel training, with mean values increasing by nearly 58 points compared to a 37-point gain in the squat group. This aligns with previous trials showing that Kegel exercises directly strengthen the pelvic floor musculature, leading to enhanced urethral closure and improved continence (21). Squat-based interventions, though beneficial, primarily engage hip and core musculature, offering indirect pelvic floor stimulation that may explain their smaller effect size (22). 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 (23).

Reductions in symptom severity, measured by ICIQ scores, were also significantly greater in the Kegel group (−0.34) compared to the squat group (−0.12). 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 (24). Furthermore, our findings resonate with systematic reviews recommending Kegel exercises as the first-line conservative therapy across diverse populations (25).

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 (26). 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. However, limitations must be acknowledged. The sample size was modest, and attrition reduced the number of participants from 30 to 26, which may limit generalizability. In addition, the absence of a non-exercise control group restricts the ability to separate the effects of natural recovery from intervention benefits. Reliance on self-reported adherence also introduces potential reporting bias.

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, electrostimulation, 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

The findings of this randomized trial demonstrate that 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 compared to squats. These results reinforce the role of targeted pelvic floor muscle training as the most effective conservative therapy for urinary incontinence. Given their accessibility, safety, and low cost, Kegel exercises should be prioritized in clinical practice and promoted in patient education programs, particularly in resource-limited and culturally sensitive settings. Future studies with larger sample sizes, longer follow-up, and comparative designs involving adjunctive therapies are warranted to optimize intervention protocols and further strengthen the evidence base.

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