UGC Approved Indexed Peer Reviewed Journal

ISSN: 2320-6586 (Online)

IILM UNIVERSITY

Technologies for Sustainable Development Goals 2025 (TECH4SDG-2025)

School of Computer Science & Engineering

IILM University Greater Noida

Presents

1st National Conference

on

Technologies for Sustainable Development Goals 2025 (TECH4SDG-2025)

3rd March 2025

Technically Co-Sponsored by IEEE UP SECTION (INDIA)

Venue:

IILM University, Greater Noida

Plot No.18,16, Knowledge Park II, Greater Noida, Uttar Pradesh 201306

Procedings Published at

International Journal of Research in Modern Engineering and Emerging Technology

Vol. 13, Sp. Issue 1, April 2025

Doi: https://doi.org/10.63345/ijrmeet.org.v13.si1.1301

Editor-in-Chief

Dr. Mylavarapu Seetharama Prasad

www.ijrmeet.org

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International Journal of Research in Modern Engineering and Emerging Technology (IJRMEET)

Vol. 13, Sp. Issue: 01, April: 2025
(IJRMEET) ISSN (o): 2320-6586

Effect of Pelvic Floor Exercises on Women's Health and Functional Recovery

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Abstract : Pelvic floor dysfunction can impair urinary continence, physical activity, social participation, and women's quality of life. This study framework examines the effect of a structured pelvic floor muscle training programme on urinary symptoms and functional recovery in women with stress urinary incontinence. A parallel-group design was developed for 120 women aged 25–60 years, equally allocated to supervised training or an education-only comparator. The 12-week intervention included progressive exercises, six physiotherapy consultations, home practice, and anticipatory contraction during activities associated with leakage. Outcomes included the International Consultation on Incontinence Questionnaire–Urinary Incontinence Short Form (ICIQ-UI SF), daily leakage frequency, pelvic floor symptom distress, interference with daily activities, and vaginal squeeze pressure. In the simulated analysis, mean ICIQ-UI SF scores decreased from 12.6 to 6.8 in the intervention group and from 12.4 to 10.3 in the comparator group, producing a between-group difference in change of −3.7 points (95% confidence interval: −4.73 to −2.67). Daily leakage decreased by 2.8 versus 0.7 episodes, while a reduction of at least 50% occurred in 65.0% versus 33.3% of participants. Symptom distress, activity interference, and squeeze pressure also improved more in the intervention group. These simulated findings describe an internally consistent pattern compatible with published evidence supporting pelvic floor muscle training for stress urinary incontinence. Confirmation of treatment effectiveness requires prospectively collected clinical data and longer-term follow-up.

Keywords: Pelvic floor muscle training; women's health; stress urinary incontinence; functional recovery; rehabilitation; quality of life.

Introduction

Pelvic floor health contributes to women's ability to maintain continence and participate comfortably in everyday activities. Dysfunction may become apparent during coughing, lifting, exercise, or other situations that increase abdominal pressure. For affected women, the consequences extend beyond leakage itself: concern about accidents may restrict work, recreation, travel, and social interaction.

Pelvic floor muscle training (PFMT) involves repeated voluntary contraction and relaxation of the muscles supporting the pelvic organs. Its therapeutic purpose includes improving muscular strength, endurance,

coordination, and timely activation. Training therefore requires more than repeatedly squeezing as strongly as possible. Women must identify the appropriate muscles, avoid bearing down, and achieve adequate relaxation between contractions.

Published evidence supports PFMT for female urinary incontinence, particularly stress urinary incontinence. However, effectiveness in one population cannot automatically be transferred to all women with pelvic symptoms. Pregnancy, recent childbirth, prolapse, pain, and impaired relaxation introduce different rehabilitation needs [1,4,5]. PubMed

Functional recovery also requires careful definition. Improved muscle pressure alone does not establish that a woman has resumed desired activities. Conversely, reduced symptom interference can be meaningful even when complete continence is not achieved. A useful investigation should therefore combine symptom severity, leakage frequency, muscular performance, and patient-reported activity impact.

The present paper focuses on women with stress urinary incontinence. This narrower population provides a clinically coherent basis for examining the broader relationship between pelvic floor exercises, women's health, and recovery of everyday function.

Literature Review

Evidence for Urinary Continence

Dumoulin, Cacciari, and Hay-Smith's Cochrane review found that PFMT improved outcomes compared with inactive

control conditions in women with urinary incontinence [1]. Its findings support exercise-based conservative management, while also showing that outcomes and evidence certainty vary across diagnostic groups. PubMed

An earlier randomized trial by Bø, Talseth, and Holme compared pelvic floor exercises, electrical stimulation, vaginal cones, and no treatment [2]. Pelvic floor exercises performed better than the other active approaches for genuine stress incontinence. The study helped establish targeted muscle training as an intervention with measurable clinical benefit. pubmed.ncbi.nlm.nih.gov

NICE recommends supervised PFMT lasting at least three months as first-line treatment for women with stress or mixed urinary incontinence. Its guidance specifies programmes containing at least eight contractions performed three times daily [3]. These recommendations support a structured training period rather than brief advice without follow-up. NICE



Figure 1. Pelvic floor muscle training: support, coordination, and potential functional benefits.
Conceptual illustration; individual outcomes vary.

Pregnancy and Postpartum Recovery

Woodley and colleagues reviewed PFMT for preventing and treating urinary and faecal incontinence during pregnancy and after childbirth [4]. Their findings distinguish preventive antenatal training from treatment of established postpartum symptoms. Evidence for one application should not be presented as proof of effectiveness for every postpartum condition. PubMed

Hilde and colleagues' postpartum randomized trial did not demonstrate a significant reduction in urinary incontinence from its training programme [5]. This result is relevant because natural recovery, childbirth-related injury, baseline symptoms, and comparator care can influence apparent treatment effects. Postpartum rehabilitation consequently requires its own research design rather than extrapolation from non-postpartum populations. PubMed

Pelvic Organ Prolapse

The POPPY trial investigated individualized PFMT in women with symptomatic pelvic organ prolapse [6]. It demonstrated improvement in prolapse symptoms, supporting conservative rehabilitation for selected women. Nevertheless, symptom relief should be distinguished from complete anatomical restoration or prevention of future surgery. pubmed.ncbi.nlm.nih.gov

Supervision and Delivery Format

The OPAL trial compared PFMT with and without electromyographic biofeedback in women with stress or mixed urinary incontinence [7]. Routine addition of biofeedback did not improve the principal long-term outcome. This suggests that equipment should not be assumed to provide additional benefit when appropriate training is already available. The BMJ

Dumoulin and colleagues demonstrated that group-based PFMT was noninferior to individual treatment in older women with urinary incontinence [8]. Group delivery may therefore increase service capacity, although private assessment remains relevant for confirming technique and addressing individual concerns. PMC

The updated Cochrane review by Hay-Smith and colleagues compared different PFMT approaches [9]. Many comparisons remained limited by low-certainty evidence. Consequently, a particular exercise format should not be described as universally superior merely because it is more intensive or technologically complex. Cochrane

Outcome Measurement and Durability

Avery and colleagues developed the ICIQ as a brief measure of urinary incontinence symptoms and impact [10]. Barber, Walters, and Bump developed the PFDI-20 and PFIQ-7 to assess pelvic floor distress and its effects on daily life [11]. Together, these instruments allow rehabilitation research to address both symptom burden and functional consequences. PubMed

Bø and Hilde's long-term systematic review emphasized the importance of sustained outcomes and the limitations of available follow-up evidence [12]. NICE additionally recommends tailoring programmes to contraction and relaxation ability, discomfort, and individual goals [13]. These findings support individualized assessment and maintenance planning. pubmed.ncbi.nlm.nih.gov

Research Objectives

The primary objective is to evaluate change in urinary incontinence severity after a structured 12-week PFMT programme.

Secondary objectives are to assess leakage frequency, pelvic floor symptom distress, interference with daily activities, vaginal squeeze pressure, and the proportion achieving a predefined reduction in leakage.

The research hypothesis is that supervised PFMT produces greater improvement than education alone. Functional

recovery is operationalized as reduced symptom-related activity interference; it does not imply recovery from surgery or reversal of childbirth injury.

Materials and Methods

Study Design and Population

The research framework uses a two-arm randomized design with baseline and 12-week assessments. The simulated cohort contains 120 women aged 25–60 years, with 60 assigned to each group.

Eligibility requires stress urinary incontinence for at least three months, an average of at least one leakage episode daily on a three-day bladder diary, and the ability to perform a voluntary pelvic floor contraction after instruction.

Exclusions include pregnancy, childbirth within the preceding six months, urgency-predominant incontinence, active urinary infection, substantial pelvic pain, marked difficulty relaxing the pelvic floor, recent pelvic surgery, neurological conditions affecting continence, and advanced symptomatic prolapse. These exclusions improve population consistency but restrict generalizability.

For an actual trial, concealed computer-generated allocation and assessor masking would reduce selection and measurement bias. Participant and therapist masking would be impractical.

Sample Size

A planning calculation assumes a three-point between-group difference in ICIQ-UI SF change, a change-score standard deviation of five points, 80% power, and a two-sided significance level of 0.05. Approximately 44 participants per group would be needed under a normal approximation. Allowing 15% attrition increases the requirement to approximately 52 per group; 60 per group provides an additional margin.

These assumptions inform recruitment planning and do not guarantee the expected effect.

Intervention

The PFMT arm receives six individual physiotherapy consultations over 12 weeks and performs home exercises three times daily. Training progresses according to the woman's demonstrated ability.

Table 1. Structured PFMT programme

Component	Programme specification
Initial assessment	Confirm contraction, inward lift, and complete relaxation
Sustained contractions	Eight repetitions per session, progressing toward eight-second holds
Recovery intervals	At least equal to contraction duration; longer if required
Rapid contractions	Five brief contractions after the sustained sequence
Daily practice	Three sessions daily
Position progression	Supported lying, sitting, then standing
Functional practice	Anticipatory contraction before coughing or lifting
Supervision	Consultations at weeks 0, 2, 4, 6, 8, and 10
Adherence support	Exercise diary, reminders, and technique review

The clinician adjusts the workload when fatigue, discomfort, breath holding, or substitution occurs. The programme includes relaxation throughout and does not use interruption of urination as a routine exercise.



Figure 2. Stages of a supervised pelvic floor muscle training programme.

Comparator

The comparator receives standardized education about continence, constipation management, appropriate fluid intake, and help-seeking. It does not receive a prescribed progressive PFMT programme during the comparison period.

This design estimates the effect of a supervised treatment package. It cannot separate the physiological effects of exercise from additional clinician contact, encouragement, and adherence support. An actual trial should document independent exercise undertaken by comparator participants.

Outcome Measures

The primary outcome is ICIQ-UI SF change from baseline to week 12. Scores range from 0 to 21; lower values indicate less severe urinary incontinence.

Secondary outcomes comprise:

- Average daily leakage episodes from a three-day diary.
- PFDI-20 total score, ranging from 0 to 300.
- PFIQ-7 total score, ranging from 0 to 300.
- Vaginal squeeze pressure above resting pressure, measured in cmH_2O.
- At least 50% reduction in daily leakage frequency.

Lower questionnaire scores represent improvement. Higher squeeze pressure represents increased measured muscular performance. Pressure measurements require standardized positioning, equipment, and confirmation that abdominal straining does not produce the recorded increase.

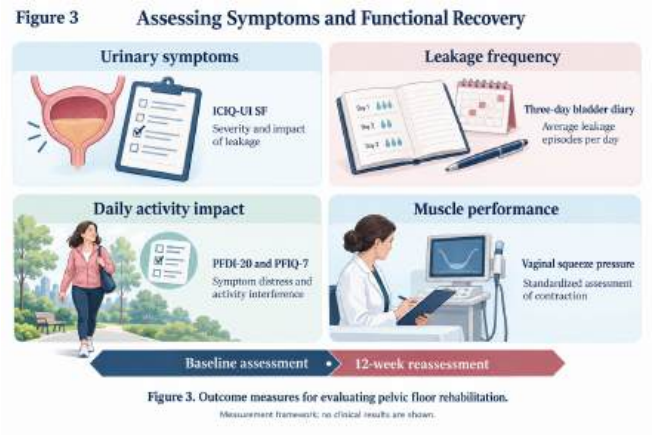

Figure 3. Outcome measures for evaluating pelvic floor rehabilitation.

Measurement framework; no clinical results are shown.

Statistical Analysis

Continuous results are expressed as means and standard deviations. Between-group differences in change are calculated as intervention change minus comparator change. Welch's independent-samples t-test and corresponding 95% confidence intervals are used for the supplied summary statistics.

Responder proportions are compared using Pearson's chi-square test. Secondary analyses are exploratory, without multiplicity adjustment. Diary counts and ordinal questionnaire distributions would require inspection in a real dataset; alternative models may be appropriate.

The simulated scenario assumes complete assessments for all 120 participants. It contains no participant-level dataset, missing-data analysis, or baseline-adjusted regression.

Ethical Considerations

No human participants were enrolled for this manuscript. A clinical implementation would require institutional ethics approval, prospective registration, informed consent, confidential records, consent for intimate assessment, and procedures for adverse-event monitoring and referral.

Results

Baseline Characteristics

The two simulated groups have similar demographic characteristics and baseline symptom severity.

Table 2. Simulated baseline characteristics

Characteristic	PFMT, n = 60	Comparator, n = 60
Age, years	42.8 ± 8.6	43.3 ± 8.2
Body mass index, kg/m²	26.4 ± 3.8	26.7 ± 3.6
Parity	2.1 ± 0.9	2.2 ± 1.0
Symptom duration, months	24.6 ± 13.2	25.1 ± 12.8
Postmenopausal, n (%)	18 (30.0%)	19 (31.7%)
Previous vaginal delivery, n (%)	48 (80.0%)	49 (81.7%)

Values are mean ± standard deviation unless otherwise specified. Baseline similarity does not establish successful randomization in an actual study; allocation procedures would require independent documentation.

Urinary Symptoms and Functional Outcomes

ICIQ-UI SF scores declined by 5.8 points in the PFMT arm and 2.1 points in the comparator. Daily leakage decreased from 4.2 to 1.4 episodes with PFMT, compared with 4.1 to 3.4 episodes in the comparator.

Table 3. Simulated outcomes at baseline and week 12

Outcome	PFMT baseline	PFMT week 12	Comparator baseline	Comparator week 12
ICIQ-UI SF	12.6 ± 3.2	6.8 ± 3.6	12.4 ± 3.1	10.3 ± 3.7
Leakage episodes/day	4.2 ± 1.8	1.4 ± 1.2	4.1 ± 1.7	3.4 ± 1.6
PFDI-20	86 ± 28	53 ± 25	84 ± 27	71 ± 26
PFIQ-7	72 ± 26	36 ± 23	70 ± 25	58 ± 24
Squeeze pressure, cmH_2O	22 ± 8	30 ± 9	23 ± 8	26 ± 9

PFDI-20 decreased by 33 points with PFMT and 13 points with education. PFIQ-7 decreased by 36 and 12 points, respectively. Thus, the simulated pattern combines lower symptom burden with reduced interference in everyday life.

Between-Group Differences

Table 4. Simulated change-score comparisons

Outcome	PFMT change ± SD	Comparator change ± SD	Difference in change (95% CI)	p-value
ICIQ-UI SF	−5.8 ± 2.8	−2.1 ± 2.9	−3.70 (−4.73, −2.67)	<0.001
Leakage episodes/day	−2.8 ± 1.6	−0.7 ± 1.7	−2.10 (−2.70, −1.50)	<0.001
PFDI-20	−33 ± 18	−13 ± 19	−20.00 (−26.69, −13.31)	<0.001
PFIQ-7	−36 ± 21	−12 ± 22	−24.00 (−31.78, −16.22)	<0.001
Squeeze pressure, cmH_2O	+8 ± 6.0	+3 ± 6.5	+5.00 (2.74, 7.26)	<0.001

Change-score standard deviations differ from baseline and follow-up standard deviations because repeated measurements within individuals are correlated. All reported confidence intervals are calculated from the specified change-score statistics.

Response to Treatment

A reduction of at least 50% in leakage frequency is assigned to 39 of 60 PFMT participants and 20 of 60 comparator participants.

Table 5. Simulated leakage response

Response	PFMT	Comparator
At least 50% reduction	39 (65.0%)	20 (33.3%)
Less than 50% reduction	21 (35.0%)	40 (66.7%)
Total	60 (100%)	60 (100%)

The absolute difference is 31.7 percentage points, with an approximate 95% confidence interval of 14.7–48.6 percentage points. Pearson's χ^2 is 12.04, giving $p = 0.00052$. This response threshold indicates substantial improvement, rather than complete continence.

Discussion

The simulated outcomes describe a consistent relationship between supervised PFMT, reduced urinary symptoms, increased muscular performance, and lower activity interference. The primary difference of 3.7 ICIQ-UI SF points favours PFMT, while the leakage diary provides a complementary measure of improvement.

The direction agrees with established evidence supporting PFMT for stress urinary incontinence [1,2]. However, the magnitude is an assumption of this numerical scenario, not an estimate validated by the cited studies. Similarity to published evidence does not authenticate newly supplied results.



Figure 4. Supervision, home practice, reminders, and review support exercise adherence.
Conceptual support framework; benefits depend on individual assessment and participation.

Several mechanisms could explain improvement in an actual trial. Increased contraction strength may support continence during exertion. Improved endurance may sustain muscular function, while anticipatory activation may reduce leakage during coughing or lifting. Correct technique and relaxation are central because additional repetitions cannot compensate for bearing down or inappropriate muscle recruitment.

The activity findings are also relevant. Lower PFIQ-7 scores suggest less interference from pelvic symptoms in daily life. Nevertheless, this questionnaire does not directly measure walking endurance, occupational productivity, return to sport, or postoperative recovery. Claims about these outcomes would require dedicated measurements.

Residual symptoms remain visible: mean leakage is 1.4 episodes daily after PFMT, and 35% do not meet the response threshold. This prevents interpreting improvement as universal cure. In practice, persistent symptoms would warrant reassessment of diagnosis, technique, adherence, and alternative management.

Supervision may contribute through feedback and encouragement. The comparator's improvement could reflect education, altered behaviour, symptom fluctuation, or measurement effects. Because therapist contact differs, the between-group contrast represents the full rehabilitation package.

The programme does not require routine biofeedback equipment, consistent with OPAL's findings [7]. Group delivery could support wider access following individual assessment, as suggested by the GROUP trial [8]. Neither study establishes that every delivery format is equally suitable for every woman.

Limitations

The principal limitation is the absence of observed clinical data. Statistical significance here reflects specified summary values and cannot establish therapeutic efficacy.

The scenario assumes complete follow-up and does not examine adherence, adverse events, contamination, or participant-level variability. Its education-only comparator cannot isolate exercise effects from professional attention. Twelve weeks also provides no evidence about sustained benefit or recurrence.

Excluding recent postpartum women, advanced prolapse, pelvic pain, and neurological conditions limits applicability. Sexual function and bowel outcomes were not measured. Accordingly, the findings cannot support claims of improvement across all dimensions of women's health.

Conclusion

Published evidence supports supervised pelvic floor muscle training as conservative treatment for women with stress urinary incontinence. The supplied numerical framework shows internally consistent improvements in symptoms, leakage frequency, muscular pressure, and activity interference over 12 weeks.

These values must be replaced with verified observations before the manuscript is presented as completed clinical research. A definitive study should document allocation, adherence, harms, missing data, and longer-term functional outcomes.

Funding and Conflicts of Interest

No external funding supported preparation of this manuscript. Author-specific funding and conflict declarations must be confirmed before submission.

Data Availability

The numerical tables contain simulated summary statistics. No clinical participant dataset was collected or analysed.

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