

Efficacy of Pelvic Floor Muscle Exercises in Improving Severe Urinary Incontinence Symptoms in Women of Sulaimani City



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ABSTRACT

Urinary incontinence (UI) is a highly prevalent disorder that significantly impacts women's daily activities and social life. While pelvic floor muscle exercise (PFME) is recommended as the first-line management approach, there is increasing recognition that combining exercise-based interventions with educational support may enhance clinical outcomes. A quasi-experimental study was conducted involving 100 women, who were divided equally into two groups ($n = 50$). At baseline, both groups were comparable regarding age, medical history, gynecological history, and occupation ($P > 0.05$). Outcomes were measured and compared pre- and post-intervention. Post-intervention, the experimental group demonstrated significant improvements in body mass index and waist-to-hip ratio ($P < 0.001$), whereas the control group showed no significant changes. Furthermore, UI symptoms, particularly leakage triggered by coughing, sneezing, or physical activity, were almost entirely resolved in the intervention group ($P < 0.001$), yielding very large effect sizes. The intervention group also experienced significant reductions in anxiety, avoidance behaviors, and leakage triggers. Neither medication (42%, 34%), rectocele repair (22%, 28%), nor cystocele repair (24%, 32%) in the control and intervention groups, respectively, led to satisfactory or complete improvement. The combination of PFME and educational support effectively improves physical metrics and alleviates the symptoms and psychological burden of severe UI.

Index Terms: Urinary Incontinence, Muscle of the Pelvic Floor, Exercise, Severity, Body Mass Index, Waist-Hip Ratio

1. INTRODUCTION

Urinary incontinence (UI) is a global health concern affecting millions of women, carrying profound physical, psychological, and social implications [1]. Defined as the involuntary loss of urine [2], its prevalence is notably higher in women due to physiological and anatomical factors such as pregnancy, childbirth, and menopause [3]. Despite its impact, many women do not seek professional medical advice, often due

to social stigma, embarrassment, or the misconception that UI is an inevitable consequence of aging [4]. Epidemiological data suggest that approximately 25% to 45% of women are affected by UI [5], with susceptibility increasing significantly in older populations [6]. Regional studies, such as those conducted in northern Iraq, have reported a prevalence as high as 51.7% among Kurdish women [7]. The condition is generally categorized into three primary types [8]: Urge UI: Characterized by a sudden, involuntary compulsion to urinate [9]. Stress UI: Occurring when abdominal pressure increases during physical activities such as coughing, sneezing, laughing, or exercising [10]. Mixed UI: A combination of both urgency and stress-related symptoms [11], [12]. The detrimental impact of UI on quality of life is extensive, frequently leading to anxiety, diminished self-esteem, social withdrawal, and sexual dysfunction [13]. Risk factors are

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multifactorial, including advanced age, obesity, high parity, vaginal delivery, diabetes, menopause, and a history of pelvic surgery [14].

1.1. Management and the Role of Healthcare Providers

Current clinical guidelines advocate for pelvic floor muscle exercise (PFME) as the primary intervention for stress, urge, and mixed incontinence [15]. These exercises enhance muscular strength, endurance, and coordination, thereby improving bladder control and overall quality of life [16]–[18]. Furthermore, a recent meta-analysis indicated that women who perform PFMT are 92% more likely to report significant improvement compared to those who do not [19]. The success of these interventions depends heavily on proper instruction and execution; evidence suggests that supervised programs yield superior outcomes compared to unsupervised ones [20]. Consequently, nurses play a pivotal role in early detection, patient education, and ongoing support. However, there remains a critical need for enhanced formal training for nursing professionals to optimize care for women suffering from this condition [21]. The main objective of the current study is to assess the effect of PFME on symptom improvement in women with severe UI.

2. MATERIALS AND METHODS

2.1. Study Design

A quantitative design, quasi-experimental study, was implemented to assess the efficacy of PFME s in improving severe UI symptoms in women of Sulaimani City.

2.2. Setting of the Research

Participants in the study were recruited from the Urodynamic Unit of the Surgical Teaching Hospital in Sulaimani City, Kurdistan Region of Iraq. Although the intervention program was implemented in the Mersi Private Hospital, the physical therapy clinic. The data collection period started on January 25, 2025, to 29 April 2025, and the post-intervention assessment was performed after the completion of the interventional program.

2.3. Sample of the Research

A non-probability purposive sampling technique was applied to recruit participants who met the study's inclusion and exclusion criteria. The sample consisted of 100 female patients who were diagnosed with UI by urologists at the Urodynamic Unit. Following recruitment, participants were assigned sequentially into the intervention and control groups using a non-random allocation approach. The intervention

group ($n = 50$) received the educational program, whereas the control group ($n = 50$) received routine care.

2.4. Inclusion and Exclusion Criteria

Only females of Adult females aged 18–65 years old, diagnosed with any type of UI (stress, urgency, mixed, or overflow), with or without prior surgical history, and with or without comorbidity, including diabetes mellitus (DM), irritable bowel syndrome (IBS), hypothyroidism, and hypertension. Pregnant women and those with stroke, and severe mental disorders were excluded.

2.5. Ethical Considerations

The College of Nursing, University of Raparin, approved the study protocol meeting number 13 on August 15, 2024. A formal invitation letter was sent to the Sulaimani Directorate of Health, Surgical Teaching Hospital. All patients were informed about their right to withdraw at any time and handed an oral informed consent. All informational data is kept confidential with anonymity guaranteed.

2.6. Tools of the Study

The study tool was constructed based on an extensive review of related literature and studies, which consists of three parts. The first part dealt with sociodemographic and clinical data, some gynecological history variables, past medical history, body mass index (BMI), and waist-to-hip ratio (WHR). The second part was about the specific clinical features, the severity of leakage during physical activity, and triggering factors. The last part, related to changes in avoidance and healthy behaviors related to UI in control and intervention groups.

2.7. Validity, Reliability, and Pilot Study

The educational program and questionnaire were prepared after reviewing related literature and previously validated tools concerning UI and its related behavioral and avoidance patterns. The questionnaire items were modified to suit the study objectives and the characteristics of the study population. To ensure content validity, the program and study instrument were evaluated by a panel of eight experts from the fields of urology, gynecology, medicine, and nursing. The experts examined the instrument regarding clarity, relevance, comprehensiveness, and suitability, and the required modifications were made according to their recommendations. Instrument reliability was assessed using Cronbach's alpha coefficient through test–retest analysis, which demonstrated good internal consistency with a value of 0.85. A pilot study was carried out between January 4 and January 18, 2025, on ten women with UI to determine the clarity and feasibility of the questionnaire and study

procedures. Those participants were excluded from the final sample. Data collection was conducted through face-to-face interviews, and each interview required approximately 20 min, including measurement of BMI and WHR. The questionnaire items were scored using a Likert-type scale ranging from 0 to 4, where higher scores reflected greater severity or more frequent behavioral and avoidance problems. Total and subscale scores were obtained by summing the responses to the questionnaire items.

2.8. Intervention Group

The intervention group was enrolled in 24 sessions over 3 months, introducing the nursing educational program to them. The researchers prepared the booklet for the educational program and translated it only into the Kurdish language because all participants were Kurdish, each session lasted about 150 min, and the sessions were organized twice a week. The participants were separated into two groups; each group consists of 25 women. The subjects were anatomy and physiology of the urinary tract system, predisposing factors, signs and symptoms of UI, fluid management, bladder training, sexual problems, and effectiveness of delivery. These sessions were done through lectures, images, movies, and role plays at Mersi Private Hospital in Sulaimani City. Those who could not answer the call were contacted by phone as well as through the Viber group communication. The control group did not receive an educational program and booklet; they received only routine information.

2.9. Statistical Analysis of the Study

The Statistical Package of Social Science Version 26 was used to analyze the data. Descriptive statistics involved frequency distributions, percentages, means, and standard deviations. The inferential statistical tests employed the Chi-square test, Fisher's exact test, the Wilcoxon signed-rank test, the McNemar–Bowker test, the Wilcoxon signed-rank test, and the Mann–Whitney test. Cramer's V Effect size and Cohen's d Effect size were used to report effect sizes. The statistical significance was established at $P < 0.05$.

3. RESULTS

Table 1 illustrates that both groups were well-matched at the start of the study, with no significant differences in age or occupation ($P > 0.05$). Most women were aged 40–59 years, and about two-thirds were homemakers in each group. This balance is important because it means any later differences between groups are likely due to the intervention, not pre-existing differences. The similarity supports the validity of the randomized design.

Table 2 shows that the control and intervention groups were similar in their gynecological history, with no significant differences in gravida, menstrual state, or type of delivery ($P > 0.05$ for all). Most women in both groups were either multigravida or grand multigravida, and over 60% were post-menopausal. Regarding delivery, normal vaginal delivery and combined cesarean/vaginal delivery were the most common types in both groups. This balance ensures that differences in later outcomes are not due to pre-existing gynecological factors.

Table 3 demonstrates that the control and intervention groups had very similar medical histories, with no significant differences in diabetes, hypertension, IBS, hypothyroidism, or pelvic floor conditions ($P > 0.05$ for all). Importantly, all women who received medication for any condition reported no improvement. This suggests that past health issues were evenly distributed, so they did not bias the results of the study.

TABLE 1: Distribution of women's sociodemographic characteristics of control and intervention groups

Variables	Groups		P-value
	Control (50) F (%)	Intervention (50) F (%)	
Age			
30–39	5 (10)	5 (10)	0.698 ^a
40–49	22 (44)	18 (36)	
50–59	23 (46)	27 (54)	
Occupation			
Employee	19 (38)	19 (38)	1 ^b
Non-employee	31 (62)	31 (62)	

^aChi-square test, ^bFisher's exact test

TABLE 2: Distribution of gynecological history in control and intervention groups

Variables	Groups		P-value
	Control (50) F (%)	Intervention (50) F (%)	
Gravida			
Primigravida	1 (2)	6 (12)	0.116 ^a
Multigravida	30 (60)	21 (42)	
Grand multigravida	19 (38)	23 (46)	
Menstrual State			
Menopause	30 (60)	33 (66)	0.54 ^b
Still having regular periods	20 (40)	17 (34)	
Type of delivery			
Both C/S and NVD	22 (44)	22 (44)	0.66 ^a
Cesarean section	5 (10)	8 (16)	
NVD	23 (46)	20 (40)	

^aChi-square test, ^bFisher's exact test. NVD: Normal vaginal delivery

Table 4 indicates that the intervention group showed significant improvements in both BMI and WHR categories ($P < 0.001$), while the control group had no change. For

example, normal weight increased from only 6% to 46% in the intervention group, and the high-risk WHR category dropped from 58% to 22%. The effect sizes (Cramer's $V = 0.387$ and 0.514) indicate moderate to strong practical benefits of the intervention.

TABLE 3: Distribution of medical and surgical history in the control and intervention groups

Variables	Groups		P-value*
	Control (50) F (%)	Intervention (50) F (%)	
Diabetic mellitus			
Yes	5 (10)	7 (14)	0.76
No	45 (90)	43 (86)	
Hypertension			
Yes	17 (34)	12 (24)	0.38
No	33 (66)	38 (76)	
Irritable bowel syndrome			
Yes	24 (48)	25 (50)	1
No	26 (52)	25 (50)	
Hypothyroidism			
Yes	7 (14)	9 (18)	0.79
No	43 (86)	41 (82)	
Received medication?			
No	29 (58)	33 (66)	0.537
Yes	21 (42)	17 (34)	
Treatment improved?			
No	21 (100)	17 (100)	---
Yes	0 (0)	0 (0)	
Hysterectomy			
Yes	1 (2)	6 (12)	0.11
No	49 (98)	44 (88)	
Rectocele surgery			
Yes	11 (22)	14 (28)	0.65
No	39 (78)	36 (72)	
Cystocele surgery			
Yes	12 (24)	16 (32)	0.504
No	38 (76)	34 (68)	
Hemorrhoid surgery			
Yes	10 (20)	9 (18)	1
No	40 (80)	41 (82)	

*Fisher's exact test

Table 5 demonstrates that the intervention group achieved dramatic reductions in all urinary symptoms, with nearly every problem completely resolved after treatment ($P < 0.001$ for most items). For instance, the inability to control urine fell from 98% to 0%, and urine leak during coughing dropped from 88% to 10%. The control group showed no meaningful changes. Effect sizes were very large (Cohen's g up to 0.98), confirming the intervention was highly effective across all clinical features.

In (Table 6) the control group, urine leakage severity during physical activities such as lifting and standing did not change significantly ($P > 0.05$). However, the intervention group improved dramatically in all four activities ($P < 0.001$), with mean scores rising from moderate-to-severe levels to near-perfect scores (4 out of 4). Effect sizes were moderate to large (Cohen's d up to 0.8), showing the intervention helped women control leakage during everyday physical demands.

Table 7 reports that all triggering factors for urine leakage, such as coughing, sneezing, and bending, remained unchanged in the control group ($P > 0.05$ for each). In the intervention group, every trigger showed a highly significant improvement ($P < 0.001$), with mean scores increasing from low to near-maximum. The largest improvements were seen for sneezing and cold weather, with very large effect sizes (Cohen's $d > 0.83$). This indicates the intervention reduced leakage across a wide range of daily triggers.

TABLE 4: Distribution of body mass index categories, waist-to-hip ratio, and effect size in control and intervention groups

Variables	Control (50) F (%)		P-value ^a	Intervention (50) F (%)		P-value ^a	Effect size ^b
	Pre	Post		Pre	Post		
BMI category							
Obese class III	3 (6)	3 (6)	0.372	6 (12)	0 (0.0)	<0.001	0.387
Obese class II	15 (30)	16 (32)		5 (10)	3 (6)		
Obese class I	15 (30)	17 (34)		21 (42)	10 (20)		
Overweight	13 (26)	11 (22)		15 (30)	14 (28)		
Normal weight	4 (8)	3 (6)		3 (6)	23 (46)		
WHR category							
0.85 and more	28 (56)	32 (64)	0.264	29 (58)	11 (22)	<0.001	0.514
0.81–0.84	17 (34)	13 (26)		13 (26)	14 (28)		
0.80 or lower	5 (10)	5 (10)		8 (16)	25 (50)		

^aMcNemar-Bowker Test, ^bCramer's V. BMI: Body mass index, WHR: Waist-to-hip ratio

TABLE 5: Distribution of specific clinical features and effect sizes in control and intervention groups

Specific clinical feature	Class	Control (50) F (%)		P-value ^a	Intervention (50) F (%)		P-value ^a	Effect size ^b
		Pre	Post		Pre	Post		
Inability to control urine	Yes	49 (98)	48 (96)	1	49 (98)	0 (0)	<0.001	0.98
	No	1 (2)	2 (4)		1 (2)	50 (100)		
Urine leak while sneezing	Yes	36 (72)	37 (74)	1	41 (82)	0 (0)	<0.001	0.82
	No	14 (28)	13 (26)		9 (18%)	50 (100)		
Urine leak while laughing	Yes	41 (82)	40 (80)	1	40 (80%)	0 (0)	<0.001	0.8
	No	9 (18)	10 (20)		10 (20)	50 (100)		
Urine leak while coughing	Yes	42 (84)	41 (82)	1	44 (88)	5 (10)	<0.001	0.78
	No	8 (16)	9 (18)		6 (12)	45 (90)		
Involuntary leakage after a sudden urge to urinate	Yes	42 (84)	43 (86)	1	44 (88)	2 (4)	<0.001	0.84
	No	8 (16)	7 (14)		6 (12)	48 (96)		
Continuous dribble after urinating	Yes	25 (50)	25 (50)	1	36 (72)	4 (8)	<0.001	0.72
	No	25 (50)	25 (50)		14 (28)	46 (92)		
Frequent urination	Yes	37 (74)	38 (76)	1	41 (82)	4 (8)	<0.001	0.82
	No	13 (26)	12 (24)		9 (18)	46 (92)		
Urine leak during sexual intercourse	Yes	11 (22)	8 (16)	0.375	24 (48)	2 (4)	<0.001	0.44
	No	39 (78)	42 (84)		26 (52)	48 (96)		

^aMcNemar's test, ^bCohen's g for McNemar**TABLE 6: Distribution of urinary leakage severity during physical activities in the control and intervention groups**

Items	Control (n=50)		P-value ^a	Intervention (n=50)		P-value ^a	Effect size ^b (95% CI)
	Pre	Post		Pre	Post		
	Mean±SD			Mean±SD			
Lifting: Light objective <5 kg	3.86±0.49	3.8±0.67	0.606	3.22±1.22	4±0.0	<0.001	0.53 (0.30, 0.71)
Lifting: Heavy objective >5 kg	3.3±0.91	3.52±0.76	0.08	2.68±1.41	3.94±0.24	<0.001	0.64 (0.44, 0.79)
Standing for 30 min	3.9±0.46	3.94±0.24	0.66	3.16±1.18	3.96±0.19	<0.001	0.55 (0.33, 0.73)
Standing for >30 min	3.18±0.96	2.98±1.06	0.07	2.2±1.16	3.9±0.36	<0.001	0.8 (0.64, 0.90)

^aWilcoxon signed-rank test, ^bMann-Whitney U Test, ^cCohen's d**TABLE 7: Distribution of factors associated with changes in urinary leakage severity in the control and intervention groups**

Items	Control (n=50)		P-value	Intervention (n=50)		P-value ^a	Effect size ^b (95% CI)
	Pre	Post		Pre	Post		
	Mean±SD			Mean±SD			
Cough	1.16±1.33	1.06±1.43	0.107	0.84±1.20	3.60±0.49	<0.001	0.86 (0.74, 0.93)
Sneezing	1.96±1.32	1.96±1.38	0.861	1.16±1.36	3.90±0.30	<0.001	0.83 (0.70, 0.91)
Sleep	3.68±0.59	3.70±0.51	0.914	2.68±1.42	3.98±0.14	<0.001	0.66 (0.46, 0.80)
Before reach bathroom	0.64±0.72	0.68±1.02	0.971	0.84±0.93	3.50±0.54	<0.001	0.88 (0.78, 0.94)
Feeling of urgency	1.28±1.14	1.24±1.27	0.922	1.04±1.12	3.72±0.50	<0.001	0.86 (0.74, 0.93)
Leakage with daily activity	3.02±1.02	2.98±1.02	0.457	2.18±1.48	3.94±0.24	<0.001	0.76 (0.60, 0.86)
Leaked urine without any particular reason	3.78±0.65	3.86±0.35	0.527	2.62±1.50	4.00±0.00	<0.001	0.67 (0.48, 0.81)
Bending	2.90±0.95	2.96±0.90	0.518	2.76±1.39	3.98±0.14	<0.001	0.63 (0.43, 0.78)
The feeling of running water	2.46±1.15	2.60±1.11	0.187	1.56±1.72	3.76±0.48	<0.001	0.75 (0.59, 0.85)
Sexual activity	3.56±0.91	3.60±0.81	0.75	2.10±1.54	3.86±0.35	<0.001	0.72 (0.55, 0.83)
Cold weather	1.36±1.19	1.46±1.27	0.461	0.56±0.95	3.54±0.65	<0.001	0.87 (0.76, 0.93)

^aWilcoxon signed-rank test, ^bCohen's d. SD: Standard deviation, CI: Confidence interval

Table 8 shows that the control group showed no change in incontinence-related worries or healthy behaviors such as

fluid intake control ($P > 0.05$). In contrast, the intervention group improved significantly in all six areas ($P < 0.001$), with

TABLE 8: Pre–post (control and intervention) changes in avoidance and healthy behaviors

Items	Control (n=50)		P-value ^a	Intervention (n=50)		P-value ^a	Effect size ^b (95% CI)
	Pre	Post		Pre	Post		
	Mean±SD			Mean±SD			
Worry about not reaching the bathroom on time	0.50±0.68	0.50±0.95	0.358	0.28±0.54	3.72±0.45	<0.001	0.89 (0.79, 0.94)
Worry about sneezing or coughing due to incontinence	0.80±1.18	0.84±1.36	0.958	0.70±1.16	3.64±0.48	<0.001	0.85 (0.73, 0.92)
Worry about bathroom location in new places	0.86±0.78	0.86±1.01	0.501	0.50±0.81	3.82±0.39	<0.001	0.88 (0.78, 0.94)
Worry about leaving home for a long time	0.90±0.93	0.86±0.99	0.566	0.58±0.81	3.60±0.49	<0.001	0.87 (0.76, 0.93)
Waking up at night due to urinary incontinence	1.98±0.98	1.96±0.92	0.378	1.20±0.97	3.70±0.46	<0.001	0.87 (0.76, 0.93)
Attention to fluid intake when not at home	1.78±1.36	1.86±1.37	0.726	1.34±1.29	3.88±0.33	<0.001	0.86 (0.74, 0.93)

^aWilcoxon signed-rank test, ^bCohen's d. SD: Standard deviation, CI: Confidence interval

mean scores rising from low to high levels of confidence and control. For example, worry about not reaching the bathroom on time increased from 0.28 to 3.72 out of 4. Effect sizes were very large (Cohen's d up to 0.89), demonstrating strong psychological and behavioral benefits. Overall, the current findings support the growing evidence that comprehensive nurse-led continence programs are more effective than standard care alone; however, differences in intervention intensity, adherence levels, follow-up duration, and patient characteristics across studies should be considered when interpreting and comparing outcomes.

4. DISCUSSION

4.1. Baseline Sociodemographic Characteristics

Although the present findings demonstrated significant improvements in UI symptoms following the nursing educational intervention and PFME program, the magnitude of improvement observed in this study appears greater than that reported in several previous studies. First, the basic sociodemographic characteristics of patients showed comparability between the control and intervention groups on most characteristics. The majority of respondents from both groups fell within the age category of 50–59 years, making up 46.0% of the control group and 54.0% of the intervention group. Individuals aged 40–49 years made up 44.0% of the control group, whereas 36.0% in the intervention group belonged to this age category. Respondents aged 30–39 years constituted 10.0% in each group. The described age categories agree with epidemiological data confirming the prevalence of UI in women aged 45–60 years [22]. According to the findings presented by Milsom and Gyhagen in their systematic review (2019) [23], the incidence of UI in women is progressive, and in individuals over 50 years, this indicator reaches 35–45%. Thus, the demographics of the selected sample agree with existing research findings. Finally, there was a similarity between the groups regarding occupation,

as the majority of participants in both groups worked as homemakers, or were employed. Similar trends in occupation distribution can be expected in a sample of middle-aged women who were more likely to experience UI and follow the proposed therapy. Indeed, in accordance with the findings of Nygaard and Shaw [24], the occupational pattern was positively correlated with UI severity, with some activities being associated with an increased risk of UI development.

4.2. Baseline Gynecological History

There was no difference in the gynecologic profiles of the two groups, including gravida, menstrual, and delivery type. Both study groups included mostly multiparous patients, which is in agreement with the scientific literature, demonstrating that an increased number of gravidas and vaginal deliveries predisposes women to UI [25]. An important clinical feature of the studied groups is the high percentage of menopausal patients, since the hormone change occurring during menopause predisposes women to UI [26]. An equal distribution of menopausal women among groups ensures that any hormonal effect on the results would be similar. The equal distribution of delivery type in both groups, in which almost one-half of the subjects underwent both cesarean and vaginal delivery, is also typical for multiparous women. This finding agrees with previous research, including the study by Al Mutairi and Al Farra (2018) [27], which also reported no significant link between mode of delivery and urinary incontinence. Similarly, Hersh *et al.* (2025)[28] reported that the prevalence of postpartum urinary incontinence remains comparable between vaginal delivery and caesarean section performed due to obstructed labor.

4.3. Baseline Medical History

Past medical conditions were similarly distributed between groups. A small proportion had diabetes or hypothyroidism, about one third had hypertension, and nearly half reported IBS. This similarity reduces the likelihood that comorbidities influenced the study results. This finding is consistent with

Agochukwu-Mmonu *et al.* [29]. Large-scale studies of UI indicate that women with diabetes have a considerably higher likelihood of developing overall incontinence, as well as a markedly increased risk of urge incontinence compared with women without diabetes. Likewise, Trapani *et al.* [30] assessed the associated risk factors and the prevalence of UI among women with hypertension. Among women with hypertension, UI is significantly associated with risk factors including age, diabetes mellitus, BMI, and urinary diseases. Furthermore, BMI is recognized as a key risk factor for hypertension.

The relatively high prevalence of IBS in both groups warrants attention, as bowel and bladder dysfunction commonly coexist and may share underlying pathophysiological mechanisms. A cross-sectional study by Ruța *et al.* [32] found that the majority of women with IBS also reported UI symptoms, compared to a minority of women without IBS. UI can persist in women who have cystocele or rectocele surgery since the strength of pelvic floor muscles may not be restored with surgical repair. Constant flimsiness of the pelvic floor can boost the chances of repeated prolapse and urinary side effects. The training of the pelvic floor muscles can enhance the work of the muscles and give the bladder and the pelvic organs more appropriate support. Past research has indicated that those women who carry out regular pelvic floor exercises have fewer prolapse symptoms and improved pelvic floor outcomes. Pelvic floor training can also enhance post-operative recovery and decrease the risk of recurrence. These results justify the effectiveness of using pelvic floor exercises as post-operative treatment [32], [33].

4.4. Anthropometric Changes

BMI and WHR in the intervention group improved significantly. The number of participants who met the normal BMI during the intervention increased. The percentage of women who attained a good shape WHR is also higher. These results show that there were improvements in body composition after the intervention. Subak *et al.* [34] observed that moderate weight reduction is capable of reducing UI in obese and overweight women. The current research involved weight reduction, pelvic floor muscle training, and dietary counseling. The effectiveness of non-surgical weight loss interventions in enhancing UI was also supported by a systematic review and meta-analysis [35]. The meta-analysis conducted by Shang *et al.* [36] revealed that the risk of UI was elevated by higher BMI. It was also suggested in the same study that weight loss enhances the results of continence. Moreover, Pomian *et al.* [37] have discovered that, despite the BMI, abdominal obesity is a factor that leads to pelvic floor dysfunction.

4.5. Improvement in Specific UI Symptoms

This suggests that multifactorial nurse-led interventions may provide superior outcomes compared with isolated exercise programs. In comparison with previous literature, the current study showed complete resolution of urine leakage during sneezing and laughing and marked reductions during coughing. While Dumoulin *et al.* [38] have identified that pelvic floor muscle interventions were superior to no treatment or placebo. Likewise, Garcia-Sanchez *et al.* [39] have found that symptom frequency was significantly decreased with supervised pelvic floor muscle training. Hay-Smith *et al.* [40] also agree with the findings, having confirmed that UI can be cured or, at the very least, improved by the exercise of pelvic floor muscles. The Seventh International Consultation on Incontinence recommends the use of PFME as a first-line conservative intervention with a Grade A recommendation [41]. Moreover, Serati *et al.* [42] discovered that the symptoms decreased, and sexual functioning improved with PFME.

4.6. Urinary Leakage during Physical Activities

Important changes in the urinary leakage were seen during physical tasks such as lifting light and heavy items, and standing up, with moderate-to-large effect sizes. Lifting puts more pressure on the abdomen, and it needs the contraction of the muscles of the pelvic floor to be quick, whereas standing needs the muscles to be active to counter the pressure due to gravity. The two activities may cause fatigue and lack of coordination in muscles, thereby affecting the urethral closure [43]. Hence, pelvic-floor muscle endurance and coordination exercises can be effective in decreasing urine leakage during such activities, but the lack of such exercises can enable symptoms to persist [44].

4.7. Reduction in Triggering Factors

The findings showed major reductions in urine leakage caused by physiological, environmental, and activity-related triggers in the intervention group. In contrast, the control group showed no noticeable improvement throughout the study, supporting previous evidence that symptoms often persist without pelvic floor muscle training exercises [45]. After the intervention, most participants in the treatment group reported little or no urine leakage during common daily situations. The improvement was considerable, with effect sizes ranging from moderate to large [46]. A marked reduction in leakage during sneezing and coughing was also observed, which may be related to the use of the Knack technique. This technique involves contracting the pelvic floor muscles before activities that increase intra-abdominal pressure. Studies [47], [48] have shown that regular use of the Knack technique can significantly reduce urine leakage

during coughing, sneezing, and similar activities. The intervention also led to important improvements in urgency-related leakage, particularly in situations where urine leakage occurred before reaching the bathroom [49].

Symptoms of urgency and overactive bladder can be exacerbated by cold weather since this can lead to higher sympathetic nerve activity and detrusor muscle contractions. It has been established before that cold exposure to the environment can adversely impact the urinary functions of women with UI adversely [50]. The decrease in the urine leakage noticed after the intervention indicates better bladder stability, neuromuscular control, and behavioral responses to urgency. The number of participants who transitioned to experiencing some level of leakage to complete bladder control was significant, suggesting that there was a significant clinical improvement beyond the expected results reported by supervised or digital health programs [51]. Less leakage during sexual intercourse was also an essential finding, with UI often having an impact on intimacy and sexual satisfaction. Research has also indicated that pelvic floor muscle training is capable of reducing leakage and also enhancing sexual performance by strengthening the pelvic muscles [52]. Women in the control group still reported avoidance behaviors, including keeping near toilets, fearing coughing or sneezing, and restricting day-to-day activities. Such results are in line with other earlier studies that reported that long-term behavioral limitations tend to arise as a result of UI [53]. Contrastingly, the level of anxiety and avoidance behaviors among women in the intervention group had reduced. Behavioral continence interventions, such as pelvic floor muscle training, education, bladder training, and lifestyle interventions, have been demonstrated to enhance quality of life and decrease symptom severity [54]. Another aspect of nursing education that is demonstrated by these findings is the importance of educational programs in enhancing the daily lives and health behaviors of women. The same results were demonstrated by Mohammed *et al.* (2024) [55], who established that the intervention group had a better nutritional status, had better chronic disease control, physical activity, and weight reduction compared to the control group.

5. CONCLUSION

Pelvic floor muscle training combined with nursing education significantly improved UI symptoms and related behaviors in women, while no improvement was observed in the control group. The findings support pelvic floor muscle training as an effective first-line conservative treatment for UI.

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