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Article

Effects of Stabilization Exercises and Pelvic Floor Muscle Training on Urinary Parameters in Individuals with Chronic Low Back Pain and Urinary Incontinence

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Abstract

Background/Objectives: This study aimed to investigate the effects of stabilization exercises and pelvic floor muscle training (PFMT) on urinary parameters in individuals with chronic low back pain and urinary incontinence. **Methods**: A total of 44 participants aged 18–65 years were included. Participants were randomized into three groups: a stabilization exercises combined with PFMT group, a standard PFMT group, and a control group. One group received PFMT combined with stabilization exercises, whereas the other group received standard PFMT alone. In both intervention groups, an 8-week program was implemented, consisting of one supervised session per week with a physiotherapist and two home-based sessions per week. No intervention was applied to the control group. Urinary parameters were evaluated using the Urogenital Distress Inventory (UDI) and the Incontinence Severity Index. Psychological symptoms were assessed using the Trait Anxiety Inventory. Quality of life was evaluated using the Incontinence Quality of Life Scale (I-QOL). **Results**: PFMT combined with stabilization exercises was significantly more effective than standard PFMT on the UDI parameter ($p < 0.05$). In the group receiving PFMT combined with stabilization exercises, all parameters showed significantly greater improvement compared with the control group ($p < 0.05$). Additionally, in this group, all parameters showed statistically significant improvement after treatment compared with before treatment ($p < 0.05$). **Conclusions**: PFMT combined with stabilization exercises may be an effective approach for improving urinary parameters. Further studies are warranted to better elucidate the efficacy of PFMT combined with stabilization exercises.

Keywords: urinary incontinence; low back pain; stabilization exercises; pelvic floor muscle training

1. Introduction

Pelvic floor muscle training (PFMT) is a widely used physiotherapy and rehabilitation approach for treating urinary incontinence and has the highest level of evidence among conservative interventions. In this approach, various exercises are taught and implemented in a regular regimen to improve the endurance, strength, and coordination of the pelvic floor muscles [1]. Combined exercise programs are also implemented for women with urinary incontinence. In these programs, exercises targeting the abdominal muscles are incorporated along with PFMT. Combined programs are reported to be more effective than standard PFMT. These combined programs, which train the pelvic floor and abdominal regions simultaneously, have been preferred in individuals presenting with both urinary incontinence and low back pain [6].

Although studies exist examining core stabilization training or pelvic floor exercises and their relationship with the urinary system, the number of high-level evidence studies investigating these

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interventions in combination is limited. These studies highlight the need for further research to clarify the relationship between low back pain and the urinary system [7].

Although most previous studies addressing urinary problems coexisting with low back pain focus on incontinence, other related conditions such as prolapse, overactive bladder syndrome, fecal incontinence, irritable bowel syndrome, sexual dysfunction, and leg pain may also be present and should not be overlooked in scientific research and clinical studies [8].

Various neurochemical, physiological, kinesiological, biomechanical, functional, and anatomical associations between the urinary system and low back pain have been proposed previously [9]. In particular, the core stabilizer muscles and the pelvic floor muscles are considered the primary structures mediating these connections and functions. However, previous research highlights the need for further research and stronger evidence [10]. Therefore, we anticipate that clinical practices and scientific studies addressing these relationships during the treatment process may benefit both systems, clarify unresolved issues in the literature, and guide future research.

The aim of this study was to compare the effects of PFMT combined with stabilization exercises versus PFMT alone on urinary parameters in individuals with chronic low back pain and urinary incontinence.

2. Materials and Methods

We included 44 female participants aged 18–65 years with urinary incontinence and chronic low back pain.

2.1. Inclusion Criteria

- Presence of urinary incontinence, defined by affirmative answers to the symptom-based questions: “Do you leak urine when you cough, sneeze, or laugh?” and “Do you leak urine with a sudden urge before you can reach the toilet?”
- Women aged 18–65 years
- Low back pain lasting for at least 3 months, with participants reporting low back pain at least once per week [6]
- A Numeric Rating Scale (NRS) score ≥ 4 (6)
- An Oswestry Disability Index score ≥ 20% [6]

2.2. Exclusion Criteria:

- Individuals with radiculopathy
- A history of lumbar or pelvic surgery within the past 6 months
- Individuals who had received PFMT within the past 3 months
- Patients with systemic, inflammatory, rheumatic, malignant, bony pathologies, or other conditions that could cause secondary low back pain
- Individuals with stage 3 or 4 pelvic organ prolapse diagnosed by a physician
- Pregnant women and those who had delivered within the previous 12 months
- Body mass index (BMI) ≥ 30 kg/m^2

2.3. Evaluation Methods

The Urogenital Distress Inventory (UDI) and the Incontinence Severity Index (ISI) were used to assess the severity of incontinence symptoms. The State-Trait Anxiety Inventory and the Incontinence Quality of Life Scale (I-QOL) were used to evaluate quality of life.

2.4. Intervention Protocol

Participants were randomized into three groups using the sealed-envelope method: a stabilization exercises combined with PFMT group, a standard PFMT group, and a control group. In the stabilization exercises combined with PFMT group, participants received combined pelvic floor

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muscle training and stabilization exercises for 8 weeks, consisting of one supervised session per week with a physiotherapist and two home-based sessions per week. During this protocol, participants were instructed to perform stabilization exercises in coordination with breathing while simultaneously engaging the pelvic floor muscles (Table 1). The standard PFMT group received conventional pelvic floor muscle training alone. In this protocol, separate contractions were taught for the slow-twitch (type I) and fast-twitch (type II) muscle fibers of the pelvic floor. To improve endurance, activation of the slow-twitch fibers was emphasized, and participants were instructed to visualize the pelvic floor as an elevator: lift up, hold at the top for a period, and then slowly lower. To increase strength, activation of the fast-twitch fibers was emphasized, and participants were instructed to imagine quickly turning a running tap off and on. Both intervention groups followed the same schedule of one supervised session and two home-based sessions per week for 8 weeks (Table 2). In both groups, the program began with exercises tolerated by each participant, with repetitions, sets, contraction hold times, exercise types, and positions progressed from basic to advanced at defined intervals. Warm-up exercises were performed at the beginning of each session, and cool-down exercises were performed at the end. Rest intervals of 10–30 s were allowed between exercises and 1–3 min between sets. Prior to the exercises, participants were provided with necessary information using visual presentations and anatomical models. No intervention was provided to the control group.

Table 1. Pelvic floor muscle training program combined with stabilization exercises.

PFMT combined with stabilization exercises	First and second week	Third and fourth week	Fifth and sixth week	Seventh and eighth week
	Week 1: 8–12 Reps × 2 Sets Week 2: 15–20 Reps × 2 Sets	Week 3: 8–12 Reps × 2 Sets Week 4: 15–20 Reps × 2 Sets	Week 5: 8–12 Reps × 3 Sets Week 6: 15–20 Reps × 3 Sets	Week 7: 8–12 Reps × 3 Sets Week 8: 15–20 Reps × 3 Sets
Bridge	Beginner level	Single leg lift (bilateral)	With ball squeeze	With elastic band resistance
Supine abdominal	Beginner level	With arms extended	With arms crossed	Hands behind head
Dead bug exercise	Legs only	Arms and legs	Arms and legs (leg resistance)	Arms and legs (arm and leg resistance)
Bird dog exercise	Arm and leg separate	Cross arm and leg	Cross arm and leg (leg resistance)	Cross arm and leg (arm and leg resistance)
Clamshell	-	Beginner level	With elastic band resistance	With hip lift
Squat	-	-	Mini squat	Deep squat
Plank	-	-	Wide stance	Narrow stance
Side plank	-	-	Knees bent	Knees extended

PFMT, pelvic floor muscle training; Reps, Repetitions.

Table 2. Standard pelvic floor muscle training program.

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Standard pelvic floor muscle training	First and second week	Third and fourth week	Fifth and sixth week	Seventh and eighth week
	Week 1: 8–12 Reps × 2 Sets Week 2: 15–20 Reps × 2 Sets	Week 3: 8–12 Reps × 2 Sets Week 4: 15–20 Reps × 2 Sets	Week 5: 8–12 Reps × 3 Sets Week 6: 15–20 Reps × 3 Sets	Week 7: 8–12 Reps × 3 Sets Week 8: 15–20 Reps × 3 Sets
Exercise positions	Supine	Side lying	Prone	Quadruped
	Side lying	Prone	Quadruped	Sitting
	Prone	Quadruped	Sitting	Standing

Reps, repetitions.

2.5. Statistical Analysis

Data were analyzed using the SPSS 22.0 statistical software package [7]. The Kolmogorov–Smirnov test was used to assess the normality of the data distribution. The Kruskal–Wallis test was used to compare the three groups. Pairwise comparisons between groups were performed using the Mann–Whitney *U* test, and within-group comparisons were performed using the Wilcoxon signed-rank test. A significance level of $p < 0.05$ was adopted for all statistical tests. Based on the NRS, the statistical power of the study was 83%, with an effect size of 0.93.

3. Results

No significant differences were observed between the groups in terms of age, BMI, or symptom duration, indicating that the groups were homogeneously distributed with respect to these variables (Table 3).

Table 3. Demographic and physical characteristics of the participants.

	Stabilization exercises combined with PFMT group N = 16	**Standard PFMT group N = 13**	**Control group N = 15**	χ^2	**P**
Age (years) (X ± SD) (Minimum–maximum)	45.06 ± 7.20 34–59	47.85 ± 6.93 41–65	44.13 ± 8.44 25–57	1.189	0.552
BMI (kg/m²) (X ± SD) (Minimum–maximum)	24.96 ± 2.34 20.6–28.6	25.96 ± 1.83 23.5–28.7	24.90 ± 2.87 19.2–29	1.632	0.442
Symptom duration (months) (X ± SD) (Minimum–maximum)	6.88 ± 3.79 3–14	7.15 ± 3.63 3–12	6.80 ± 3.10 3–13	0.005	0.998

PFMT, pelvic floor muscle training; BMI, body mass index; χ^2, Kruskal–Wallis test statistic;*$p < 0.05$.

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3.1. Analysis of Urinary Parameters and Quality of Life

All groups were similar with respect to pretreatment UDI, ISI, TAI, and I-QOL scores ($p > 0.05$). Post-treatment measurements showed significant differences between the groups for all these parameters ($p < 0.05$) (Table 4).

Table 4. Investigation of urinary parameters and quality-of-life measures.

Urinary symptoms		Stabilization exercises combined with PFMT group N = 16 (X ± SD)	Standard PFMT group N = 13 (X ± SD)	Control group N = 15 (X ± SD)	χ^2	P
UDI (0–18)	Pretreatment	8.44 ± 2.34	10.77 ± 2.35	10.07 ± 4.35	5.428	0.066
	Post-treatment	6.25 ± 3.28	9.15 ± 2.38	11.33 ± 2.80	15.599	0.001
ISI (1–12)	Pretreatment	6.56 ± 3.85	6.38 ± 3.04	5.27 ± 2.82	1.199	0.549
	Post-treatment	3.00 ± 1.75	4.46 ± 2.60	7.33 ± 2.58	16.987	0.001
TAI (20–80)	Pretreatment	49.87± 8.40	46.08 ± 6.58	47.53 ± 7.53	1.296	0.523
	Post-treatment	42.25 ± 3.61	45.54 ± 8.35	49.40 ± 7.12	8.102	0.017
I-QOL (22–110)	Pretreatment	59.06 ± 18.54	61.92 ± 13.23	66.33 ± 14.25	2.062	0.357
	Post-treatment	77.19 ± 13.15	74.15 ± 10.63	55.73 ± 14.43	14.718	0.001

PFMT, pelvic floor muscle training; UDI, Urogenital Distress Inventory; ISI, Incontinence Severity Index; TAI, Trait Anxiety Inventory; I-QOL, Incontinence Quality of Life Scale; χ^2, Kruskal–Wallis test statistic; $p < 0.05$.

When differences in UDI scores were examined between groups, all pairwise comparisons showed significant differences, indicating a reduction in urogenital distress levels ($p < 0.05$). In addition, comparison between the stabilization exercises combined with PFMT group and the standard PFMT group revealed a significant difference in pretreatment values ($p < 0.05$) (Table 5).

When differences in ISI scores were examined between groups, significant differences were observed between the stabilization exercises combined with PFMT group and the control group and between the standard PFMT group and the control group ($p < 0.05$), indicating a reduction in incontinence severity. The stabilization exercises combined with PFMT group and the standard PFMT group showed similar levels of incontinence severity ($p > 0.05$) (Table 5).

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When differences in TAI scores were examined between groups, a significant difference was observed between the stabilization exercises combined with PFMT group and the control group ($p < 0.05$), indicating a reduction in anxiety levels. The stabilization exercises combined with PFMT group and the standard PFMT group had similar anxiety levels ($p > 0.05$), as did the standard PFMT group and the control group ($p > 0.05$) (Table 5).

When differences in I-QOL scores were examined between groups, significant differences were observed between the stabilization exercises combined with PFMT group and the control group and between the standard PFMT group and the control group ($p < 0.05$), indicating an improvement in quality of life. The stabilization exercises combined with PFMT group and the standard PFMT group had similar quality-of-life scores ($p > 0.05$) (Table 5).

Table 5. Comparison of urinary parameters and quality of life between groups.

Urinary parameters		Stabilization exercises combined with PFMT vs. Standard PFMT		Stabilization exercises combined with PFMT vs. Control Comparison		Standard PFMT vs. Control Comparison	
		z	p	z	p	z	p
UDI	Pretreatment	−2.363	0.018	−1.392	0.164	−0.742	0.458
	Post-treatment	−2.448	0.014	−3.611	0.000	−1.995	0.046
ISI	Pretreatment	−0.089	0.929	−0.762	0.446	−1.119	0.263
	Post-treatment	−1.433	0.152	−4.040	0.000	−2.502	0.012
TAI	Pretreatment	−1.119	0.263	−0.713	0.476	−0.392	0.695
	Post-treatment	−0.968	0.333	−2.893	0.004	−1.547	0.122
I-QOL	Pretreatment	−0.790	0.429	−1.286	0.199	−0.899	0.369
	Post-treatment	−0.812	0.417	−3.500	0.000	−2.952	0.003

PFMT, pelvic floor muscle training; UDI, Urogenital Distress Inventory; ISI, Incontinence Severity Index; TAI, Trait Anxiety Inventory; I-QOL, Incontinence Quality of Life Scale; z, Mann–Whitney *U* Test, $p < 0.05$.

When pretreatment and post-treatment UDI scores were examined within the groups, the stabilization exercises combined with PFMT group showed a significant decrease in urogenital distress levels, whereas the control group showed a significant increase ($p < 0.05$) (Table 6).

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When pretreatment and post-treatment ISI scores were examined within the groups, participants in the stabilization exercises combined with PFMT group showed a significant decrease in incontinence severity, whereas the control group showed a significant increase ($p < 0.05$) (Table 6).

When pretreatment and post-treatment TAI scores were examined within the groups, participants in the stabilization exercises combined with PFMT group showed a significant decrease in anxiety levels ($p < 0.05$) (Table 6).

When pretreatment and post-treatment I-QOL scores were examined within the groups, participants in both the stabilization exercises combined with PFMT group and the standard PFMT group showed significant increases in I-QOL scores, whereas the control group showed a significant decrease in I-QOL scores ($p < 0.05$) (Table 6).

Table 6. Within-group comparisons of urinary parameters and quality of life.

Urinary parameter	Stabilization exercises combined with PFMT group N = 16				Standard PFMT group N = 13				Control group N = 15			
	Pre-T (X ± SD)	Post-T (X ± SD)	z	p	Pre-T (X ± SD)	Post-T (X ± SD)	z	p	Pre-T (X ± SD)	Post-T (X ± SD)	z	p
UDI	8.44 ± 2.34	6.25 ± 3.28	−2.481	0.013	10.77 ± 2.35	9.15 ± 2.38	−1.697	0.090	10.07 ± 4.35	11.33 ± 2.80	−1.220	0.222
ISI	6.56 ± 3.85	3.00 ± 1.75	−3.191	0.001	6.38 ± 3.04	4.46 ± 2.60	−1.929	0.054	5.27 ± 2.82	7.33 ± 2.58	−2.365	0.018
TAI	49.87 ± 8.40	42.25 ± 3.61	−3.033	0.002	46.08 ± 6.58	45.54 ± 8.35	−0.210	0.834	47.53 ± 7.53	49.40 ± 7.12	−0.818	0.414
I-QOL	59.06 ± 18.54	77.19 ± 13.15	−3.082	0.002	61.92 ± 13.23	74.15 ± 10.63	−3.112	0.002	66.33 ± 14.25	55.73 ± 14.43	−3.069	0.002

PFMT, pelvic floor muscle training; UDI, Urogenital Distress Inventory; ISI, Incontinence Severity Index; TAI, Trait Anxiety Inventory; I-QOL, Incontinence Quality of Life Scale; z, Mann–Whitney *U* Test, $p < 0.05$.

4. Discussion

In this study, we examined the effects of pelvic floor and stabilization exercises on urinary parameters in individuals with chronic low back pain and urinary incontinence and found that PFMT combined with stabilization exercises was more effective than standard pelvic floor training in reducing urogenital distress, as measured by the UDI. Compared with the control group, reductions were observed in urogenital distress, incontinence severity, and anxiety levels, along with an increase in quality of life. Compared with the control group, the standard PFMT group also showed reductions in urogenital distress and incontinence severity as well as an increase in quality of life. In post-treatment measurements, quality of life increased in the standard PFMT group compared with pretreatment values, whereas in the stabilization exercises combined with PFMT group, reductions were observed in urogenital distress, incontinence, and anxiety parameters, along with an increase in quality of life. Furthermore, in the control group, post-treatment measurements showed increases in urogenital distress and incontinence severity, along with a decrease in quality of life compared with pretreatment values.

In a 2022 study of women with stress-type urinary incontinence and low back pain, participants were randomized into two groups. The intervention group received a combination of PFMT and

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stabilization exercises, whereas the control group received PFMT alone. Outcomes included the pad test, ISI, I-QOL, and the King's Health Questionnaire. After 12 weeks of intervention, the intervention group showed significant improvements in I-QOL and ISI compared with the control group [8]. In the present study, conducted with similar participants and comparable outcome measures, a key difference is that we implemented an 8-week treatment program. We observed significant differences between the stabilization exercises combined with PFMT group and the control group as well as between the standard PFMT group and the control group. However, unlike the 2022 study, we found similar ISI and I-QOL results when comparing the stabilization exercises combined with PFMT group with the standard PFMT group. This discrepancy may be related to the shorter treatment duration in our study.

In a randomized controlled trial conducted by Hagovská et al. in 2020, the effects of PFMT and stabilization exercises were examined in women with stress-type urinary incontinence. The participants were divided into two groups: one received a high-intensity program and the other received a low-intensity program. The high-intensity group received treatment 5 days per week, whereas the low-intensity group received treatment 2 days per week. Both groups participated in a 12-week program. The treatment program included bridging, cross-limb movements in the quadruped position, and breathing-synchronized exercises, with participants also receiving instruction on how to perform the exercises [9]. The study found significant improvements in both groups, with the high-intensity program being more effective than the low-intensity program in reducing incontinence severity. Although the exercises and application methods used in our treatment program are consistent with those in that study, the program implemented in the present study can be classified as low intensity according to the intensity categories used by Hagovská et al. In addition, we implemented an 8-week program in our study, and Hagovská et al. used a 12-week program. Accordingly, although both the stabilization exercises combined with PFMT group and the standard PFMT group in our study showed significant improvements in incontinence severity compared with the control group and their own pretreatment values, the lack of difference between these two intervention groups may be related to treatment duration and intensity.

In a 2021 study, the effect of the maximum number of repetitions in a treatment program combining pelvic floor exercises with stabilization exercises was examined in women with stress urinary incontinence. Thirty women were randomized into three groups. One group performed each exercise 10 times daily, another 20 times, and the third 30 times. Exercises were completed in four sets, with each repetition held for 5 s. The results showed that the exercise program reduced incontinence severity in all groups; however, the group performing 30 repetitions demonstrated a more pronounced reduction. These findings indicate that pelvic floor strengthening exercises are beneficial and that higher repetition counts yield better outcomes [10]. This study supports our conclusion that the similar results observed between our stabilization exercises combined with PFMT group and the pelvic floor training–only group for some urinary parameters, such as incontinence severity and quality of life, may be related to treatment intensity.

In a multidisciplinary study published in 2022, the effects of pelvic floor exercises combined with psychologist-led therapy on pelvic floor dysfunction were examined in 88 participants aged 28–85 years. Participants were randomized into two groups: one performed PFMT alongside a psychologist-led program, whereas the other performed PFMT alone. Treatment was administered over 6 months, with better participation observed in the group that included the psychologist. The study reported that the combined program (psychologist + PFMT) produced greater improvements in European Quality of Life (E-QOL) and anxiety levels than PFMT alone, with both groups showing significant changes from baseline to final assessment [11]. In our study, TAI scores showed significant within-group and versus-control differences for both the stabilization exercises combined with PFMT group and the standard PFMT group, whereas comparisons between these two intervention groups yielded similar results. This may be related to the shorter treatment duration in our protocol and the potential need for a multidisciplinary approach.

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We suggest that including PFMT combined with stabilization exercises in treatment programs may be beneficial and could serve as an alternative therapeutic model. Furthermore, we propose that this combined approach has the potential to contribute to the literature and inform future research aimed at improving urinary parameters and quality of life.

5. Conclusions

We propose that, for individuals with both urinary incontinence and low back pain, combining stabilization exercises with PFMT, rather than applying these interventions separately, may more effectively support treatment outcomes in urinary parameters and quality of life. The combined protocol used in our study may be considered an alternative therapeutic option.

Abbreviations

The following abbreviations are used in this manuscript:

BMI	Body mass index
ISI	Incontinence Severity Index
KHQ	King's Health Questionnaire
NRS	Numeric Rating Scale
ODI	Oswestry Disability Index
PFMT	Pelvic floor muscle training
STAI	State-Trait Anxiety Inventory
TAI	Trait Anxiety Inventory
UDI	Urogenital Distress Inventory

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