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EFFECTIVENESS OF TRADITIONAL PELVIC FLOOR EXERCISES VS. PELVIC FLOOR EXERCISES WITH A GYM BALL IN POSTMENOPAUSAL WOMEN

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Abstract
Objective: This study aimed to compare the effectiveness of two Kegel exercise protocols on improving pelvic floor muscle strength in postmenopausal women: traditional pelvic floor exercises (Group A) and pelvic floor exercises performed with a gym ball (Group B).
Study Design: Participants were recruited from a physiotherapy and rehabilitation center and randomized into two groups. Group A performed traditional pelvic floor exercises, while Group B incorporated a gym ball into their exercise routine. Both groups received detailed instructions and were periodically supervised to ensure proper technique. The intervention lasted for ten weeks, with exercises performed four days per week. Pelvic floor muscle strength was assessed using digital palpation and the Modified Oxford Scale pre- and post-intervention.
Results: In Group A, the mean pretest score was 2.15±0.813, and the post-test score increased to 2.40±0.883, with a p-value of 0.02, indicating a significant improvement. In Group B, the mean pretest score was 2.20±0.768, and the post-test score significantly increased to 3.15±0.745, with a highly significant p-value of <0.001. The intergroup comparison showed no significant difference at baseline (p=0.88), but post-intervention, Group B had significantly higher scores than Group A (p=0.001). The findings suggest that incorporating a gym ball into pelvic floor exercises provides greater improvements in muscle strength.
Conclusion: This study highlighted the effectiveness of pelvic floor exercises in improving muscle strength in postmenopausal women. While both traditional exercises and those performed with a gym ball showed benefits, the latter was significantly more effective. Incorporating a gym ball into pelvic floor exercise routines could be a beneficial strategy for enhancing muscle strength and overall quality of life in postmenopausal women. Further research with larger sample sizes is recommended to confirm these results and explore additional benefits.
Keywords: Kegel exercise; Pelvic Floor Exercise, Postmenopausal Women

INTRODUCTION

Postmenopause is a significant phase in a woman's life, marked by the cessation of menstrual periods for 12 consecutive months and the end of reproductive capacity. During this period, a lack of estrogen causes atrophic changes in the vaginal and periurethral tissues, the urogenital tract, and stress-related involuntary urine loss. It has also been linked to increased frequency and urgency of urination (Samsioe, 2007). This phase often brings about various physiological changes, including a decline in the suppleness and strength of pelvic floor muscles due to hormonal changes (Bodner-Adler et al., 2020). Pelvic floor dysfunction, a common issue among postmenopausal women, can lead to complications such as urinary incontinence, pelvic organ prolapse, and decreased sexual function (Tinelli et al., 2010). Addressing pelvic floor dysfunction through effective interventions is crucial to improving the quality of life and preventing these complications.
Therapeutic targeted exercise, like pelvic floor training, is one of the approaches focused on non-invasive and non-pharmacological interventions. Pelvic floor exercises, also known as Kegel exercises, involve repetitive contraction and relaxation of the pelvic floor muscles. These exercises are essential for enhancing muscle strength, preventing and managing pelvic floor dysfunction (Samsonova et al., 2023). Previous studies have shown that pelvic floor exercises can significantly reduce symptoms of urinary incontinence and improve pelvic organ support (Price et al., 2010; Bo, 2012; Fricke et al., 2021; Soave et al., 2019). Additional active treatment methods include pelvic floor contraction exercises combined with coactivation of trunk stabilizing muscles or Kegel exercises, which concentrate on strengthening and optimizing the function of the pelvic floor muscle (Ojukwu et al., 2022). However, traditional pelvic floor exercises have their limitations, including the challenge of ensuring consistent and proper technique among participants, which can affect their effectiveness.

In recent years, incorporating a gym ball into pelvic floor exercise routines has gained popularity, particularly among physiotherapists working with postmenopausal women. The gym ball provides an unstable surface that engages additional muscle groups, increasing the intensity and effectiveness of the exercises (Martinho et al., 2016). This approach not only targets the pelvic floor muscles but also strengthens the core and lower back muscles, promoting overall stability and posture. Studies have indicated that using a gym ball during exercises can lead to greater improvements in muscle strength and function compared to traditional methods (Panchal et al., 2019; Ladi Seyedian et al., 2014; Patil et al., 2024). The potential benefits of this innovative approach make it an important area of study.

The aim of this study is to compare the effectiveness of traditional pelvic floor exercises and pelvic floor exercises performed with a gym ball in postmenopausal women. The study will evaluate changes in pelvic floor muscle strength and secondary benefits such as core strength, posture, and quality of life. Participants will be recruited from a physiotherapy and rehabilitation center and will be randomly assigned to either Group A (traditional pelvic floor exercises) or Group B (pelvic floor exercises with a gym ball). The intervention will last for ten weeks, with participants performing exercises four days per week. Pre- and post-intervention assessments will be conducted using digital palpation and the Modified Oxford Scale, along with participant questionnaires to evaluate improvements in symptoms and overall well-being.

MATERIALS AND METHODS

Study Design

This clinical, randomized, and controlled comparison study was conducted from Month to Month 2024 at Noel Physiotherapy and Rehabilitation Center, Perambur, Chennai 600011. Postmenopausal women undergoing pelvic floor exercises were invited to participate. All participants provided informed and written consent in accordance with the Standard Declaration.

Participants

The study included 40 postmenopausal women aged 45-60 years who were willing to participate. Only women experiencing physiological menopause were included. Participants were selected based on a comprehensive physiotherapy assessment, which included menstrual history, genitourinary history, incontinence history, gastrointestinal history, pain history, past history, personal history, drug history, family history, socio-economic history, medical and surgical history, and psychological history. Consultations were provided based on the general examination.

Exclusion Criteria

Women with urinary tract infections, urinary incontinence, pelvic organ prolapse, myopathy, neurological abnormalities, cognitive and physical disorders that would hinder participation in either evaluation or training programs were excluded.

Randomization and Group Allocation

The 40 participants were randomized by draw into two groups: Group A (n = 20) received traditional pelvic floor exercises, while Group B (n = 20) received pelvic floor exercises with a gym ball. Each participant underwent purposive sampling and was divided into the two groups. The outcomes were interpreted based on the comparison of pre- and post-experimental tests.

Evaluation and Data Collection

Basic evaluation and demographic data were collected prior to the intervention. The strength of the participants' pelvic floor muscles was measured using the Modified Oxford Scale through manual vaginal palpation after the general examination. This assessment was completed following group division. Patients were instructed on their assigned exercises and given precise instructions on the frequency and repetitions of exercises.

Exercise Protocol

Exercises were performed four days a week for ten weeks, starting on the first day and ending on the forty-first day, ensuring no bias between the groups. Both groups followed the same guidelines. Participants received direct explanations of their length adjustments each week. On Day 41, the same assessment of pelvic floor muscle strength was conducted after the activities were completed. Strength grades were recorded to determine the effectiveness of each group's workout. Group A's pelvic floor exercises (Kegels) included supine lying, side lying, prone lying, diamond pose, butterfly position, seated-wide legged, quadruped position, sumo squat position, side clamshell position, and knee fold position. Group B's pelvic floor exercises with a gym ball (Kegels with gym ball) included roll out position, straight sitting, wall squat position, bridging position, 90-90 positions, prone lying position, wall standing position, supine wide leg spread position, quadruped with gym ball wall support, and supine clamshell position.

Duration of Treatment

Each participant followed a 10-week program consisting of 10 exercises per group, with increasing frequency and repetition every three weeks: 1st to 3rd week had a hold time of 5-7 seconds, rest time of 5 seconds, and 5 sets of

repetitions; 4th to 7th week had a hold time of 10 seconds, rest time of 10 seconds, and 10 sets of repetitions; and 8th to 10th week had a hold time of 15 seconds, rest time of 15 seconds, and 15 sets of repetitions. The frequency was 4 days per week, and the same duration of treatment was given for both groups.

Outcome Measures

The Modified Oxford Scale (Manual Muscle Testing) using vaginal palpation, created by Laycock, was used to assess the strength of the pelvic floor muscles. It has a six-point rating system and can be used in conjunction with vaginal palpation in clinical evaluation. Physiotherapists frequently employ this technique as it is simple and doesn't require expensive equipment. Vaginal palpation demonstrated a high 95% confidence interval in terms of inter-rater reliability.

Statistical Analysis

Statistical analysis was performed using SPSS software to analyze the results of intergroup and intragroup comparisons of the groups by using paired t-tests for the different interventions of Group A and Group B based on the pretest and posttest results for each group. The independent t-test was used to find the statistical difference between Group A and Group B of the interventional groups.

RESULTS

Intragroup Comparison

The intragroup comparison of pelvic floor muscle strength for Group A, which performed traditional pelvic floor exercises, showed a statistically significant improvement. The mean pretest score was 2.15±0.813, which increased to 2.40±0.883 post-test, with a p-value of 0.02 (Table 1, Fig 1). Similarly, Group B, which performed pelvic floor exercises with a gym ball, had a mean pretest score of 2.20±0.768, which significantly increased to 3.15±0.745 post-test, with a highly significant p-value of <0.001 (Table 1, Fig 1).

Table 1: Intragroup comparison of pelvic floor muscle strength

INTERVENTION GROUPS	TEST SCORES	MEAN	STD.DEVIATION	P-VALUE
Pelvic floor ex's (Group-A)	Pre-test scores	2.15	0.813	0.02
	Post-test scores	2.40	0.883	
Pelvic floor ex's with gym ball (Group-B)	Pre-test scores	2.20	0.768	<0.001
	Post-test scores	3.15	0.745	

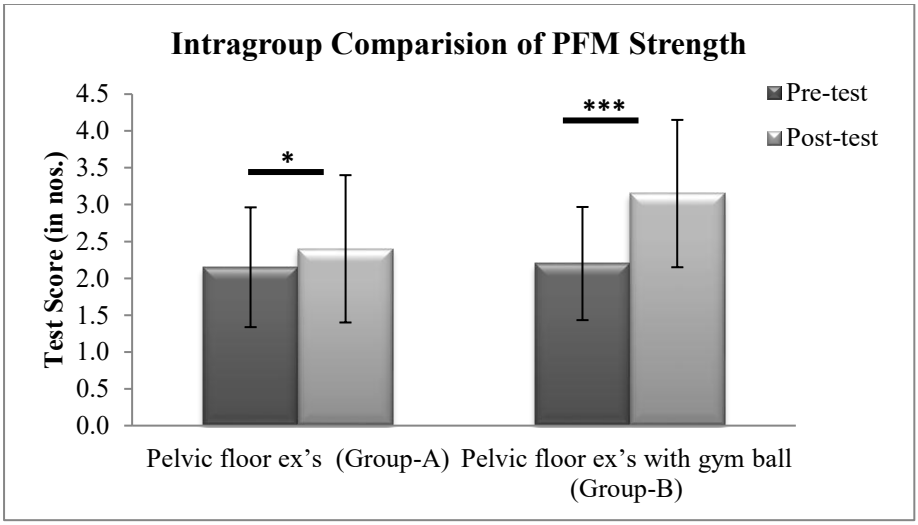

Figure 1: Intragroup Comparison of PFM Strength. Values are shown as means ± S.D. (n = 20). * p <0.5, *** p <0.001

Intergroup Comparison

The intergroup comparison of pelvic floor muscle strength between Group A and Group B showed no significant difference at baseline. Group A had a mean pretest score of 2.15±0.813, while Group B had a mean pretest score of 2.20±0.768, with a t-value of 0.200 and a p-value of 0.88. However, post-intervention, Group A had a mean post-test score of 2.40±0.883, while Group B had a higher mean post-test score of 3.15±0.745. The t-value was 2.900, and the p-value was 0.001, indicating a significant difference in post-intervention outcomes between the two groups (Table 2). The comparison of pelvic floor muscle strength between the two groups showed a pre-test

p-value of 0.78 and a post-test p-value of 0.01, signifying a significant improvement in Group B compared to Group A.

Table 2: Intergroup comparison of pelvic floor strength between group A & B

TEST SCORES	GROUPS	TOTAL SAMPLES (n)	MEAN	STD. DEVIATION	P-VALUE
Pre-test scores	Group A	20	2.15	0.813	0.88
	Group B	20	2.20	0.768	
Post-test scores	Group A	20	2.40	0.883	0.001
	Group B	20	3.15	0.745	

Statistical Analysis

The paired t-test for intragroup comparison of pelvic floor muscle strength revealed that for Group A, the calculated t-value of 0.200 was less than the t-table value of 2.145 at a significance level of 5% with 14 degrees of freedom. This indicates that performing pelvic floor exercises alone does not result in a significant increase in pelvic floor strength. Conversely, for Group B, the calculated t-value of 2.900 was higher than the t-table value of 2.145, indicating that utilizing a gym ball for pelvic floor exercises significantly improves pelvic floor strength. The p-value and statistical significance confirm that the difference between Group A and Group B is statistically significant by standard measures (Table 1, Table 2).

Chi-Square Analysis

The chi-square analysis compared the percentage of participants in each group who completed the pre-test on pelvic floor muscle strength. In Group A, the very weak contraction percentage was 55.6%, weak contraction was 46.7%, and moderate contraction was 50.0%. For Group B, the percentages were 44.4%, 53.3%, and 50.0% for very weak contraction, weak contraction, and moderate contraction, respectively (Table 3).

Table 3: Comparison of Pelvic floor muscle strength between two groups (Pre-test)

			Pre test scores			Total	
			Very weak PFM contraction	Weak PFM contraction	Moderate PFM Contraction		
Pre test	Pelvic floor ex's	n	5	7	8	20	0.78
		%	55.6%	46.7%	50.0%	50.0%	
	Pelvic Floor ex's with gym ball	n	4	8	8	20	
		%	44.4%	53.3%	50.0%	50.0%	
Total		n	9	15	16	40	
		%	100.0%	100.0%	100.0%	100.0%	

Table 4 compares the percentage of participants in each group who completed the post-test on pelvic floor muscle strength. In Group A, the very weak contraction percentage was 100.0%, weak contraction was 66.7%, moderate contraction was 43.8%, and good contraction was 22.2%. For Group B, the percentages were 0.0%, 33.3%, 56.3%, and 77.8% for very weak contraction, weak contraction, moderate contraction, and good contraction, respectively (Table 4).

Table 4: Comparison of pelvic floor muscle strength between two groups (post-test)

			Post test scores				Total	p-value
			Very weak PFM Contraction	Weak PFM contraction	Moderate PFM contraction	Good PFM contraction		
Post test	Pelvic floor ex's	n	3	8	7	2	20	0.01
		%	100.0%	66.7%	43.8%	22.2%	50.0%	
	Pelvic Floor ex's with gym	n	0	4	9	7	20	
		%	0.0%	33.3%	56.3%	77.8%	50.0%	

	ball						
Total		n	3	12	16	9	40
		%	100.0%	100.0%	100.0%	100.0%	100.0%

Thus, the results indicate that the average pre-test value for Group A was 2.15 and the post-test value was 2.40. Since the calculated t-value of 0.200 is less than the t-table value of 2.145, performing pelvic floor exercises alone does not significantly increase pelvic floor strength. For Group B, the average pre-test value was 2.20 and the post-test value was 3.15. The calculated t-value of 2.900, being higher than the t-table value of 2.145, demonstrates that utilizing a gym ball for pelvic floor exercises significantly improves pelvic floor strength. The p-value and statistical significance show that the difference between pelvic floor exercises alone (Group A) and those with a gym ball (Group B) is statistically significant (Table 1, Table 2).

DISCUSSION

In this study, two Kegel exercise protocols were examined. Group A performed pelvic floor exercises, while Group B performed pelvic floor exercises with a gym ball. Pelvic floor exercises are crucial for enhancing muscle strength, reducing urinary incontinence, and improving the quality of life in postmenopausal women (Samsonova et al., 2023). Incorporating a gym ball into these exercises provides additional resistance, further improving muscle strength, core stability, and posture (Martinho et al., 2016).

The primary goal of this study was to determine how pelvic floor weakness impacts various lifestyle-related issues faced by postmenopausal women. Post-menopause, hormonal changes lead to a natural decline in the suppleness of pelvic floor muscles, resulting in reduced muscle strength (Bodner-Adler et al., 2020). This was evident in the pretest scores of both groups. Digital palpation combined with the Modified Oxford Scale was used to assess pelvic floor muscle strength (Arab et al., 2009). The results align with previous literature, indicating that postmenopausal hormonal changes lead to a decline in pelvic floor muscle suppleness and strength, resulting in complications such as urinary incontinence and decreased sexual function (Omodei et al., 2019; Nazarpour et al., 2018; Sipilä et al., 2001; Bo, 2004; Bo et al., 1990). These findings underscore the importance of early identification and intervention to improve the quality of life for postmenopausal women.

Pelvic floor exercises are effective in enhancing muscle strength and function in postmenopausal women. Our study demonstrated a significant improvement in muscle strength in Group A, with post-test scores increasing to 2.40±0.883 and a p-value of 0.02. This finding is consistent with previous studies that have shown the benefits of Kegel exercises in reducing symptoms of urinary incontinence and improving pelvic organ support (Kashanian et al., 2011; Cross et al., 2023; Bo et al., 1990; Burgio et al., 1986). Strengthening the pelvic floor muscles can lead to improved bladder and bowel control, reducing stress incontinence and the tendency to leak urine during activities such as coughing or sneezing (Fricke et al., 2021; Samsioe, 2007). Incorporating pelvic floor exercises using a gym ball is also gaining popularity among trainers in urogynecologic rehabilitation for its efficacy in decreasing urinary symptoms.

The initial evaluation using digital palpation with the Modified Oxford Scale was followed by reassessment after the intervention period to measure improvements. Pelvic floor exercises can be effective both with and without a gym ball. However, the effectiveness of pelvic floor exercises using a gym ball is multifaceted. Strengthening the pelvic floor muscles can lead to improved bladder and bowel control, reducing stress incontinence and the tendency to leak urine during activities such as coughing or sneezing (Culligan et al., 2010; Fu et al., 2019). Enhanced core strength is another significant benefit, as strengthening deep abdominal muscles provides stability for the pelvic floor, resulting in better overall stability and core strength. Additionally, a stronger pelvic floor can reduce the risk of pelvic organ prolapse, a common issue among postmenopausal women (Hagen et al., 2017).

Incorporating a gym ball into pelvic floor exercises provides additional resistance, leading to greater improvements in muscle strength. Using a gym ball promotes optimal alignment, improving posture and potentially reducing back pain. Our results showed that Group B, which used a gym ball, had a significant increase in post-test scores to 3.15±0.745, with a highly significant p-value of <0.001. This suggests that the gym ball enhances the effectiveness of pelvic floor exercises by engaging additional muscle groups and increasing the intensity of the workout (Ladi Seyedian et al., 2014). The gym ball's instability requires more muscle coordination, which likely contributed to the improved outcomes observed in Group B. This is achieved by strengthening the pelvic floor muscles and the core, which play a crucial role in maintaining proper posture (Yan et al., 2014). Improved sexual function and sensation are also correlated with a robust pelvic floor, contributing to better quality of life.

The intergroup comparison revealed no significant difference at baseline, with p=0.88, but a significant difference post-intervention, with Group B outperforming Group A (p=0.001). This study's novel approach involves integrating a gym ball into pelvic floor exercises, providing a comprehensive workout targeting not only the pelvic floor muscles but also the core and lower back muscles. This multi-faceted approach is supported by previous

literature, which highlights the benefits of resistance training in improving muscle strength and overall stability in various populations, including children with dysfunctional voiding, postnatal women, patients with lower back pain, sedentary women, antenatal women, individuals with polycystic ovarian syndrome, subjects with Parkinson's disease, and those with postural syndrome (Ladi Seyedian et al., 2014; Marques et al., 2013; Patil et al., 2024; Meenakshi et al., 2024; Gangatharan & Sankaralingam, 2023; Suganthirababu et al., 2024). However, limited studies have focused on strengthening pelvic floor muscle strength in postmenopausal women (Panchal et al., 2019; Martinho et al., 2016). By introducing the gym ball, this study offers a new and effective method for enhancing pelvic floor muscle strength in postmenopausal women. The added advantage of using a gym ball is its ability to provide resistance, thereby enhancing the effectiveness of the exercises. The gym ball's resistance helps in indirectly strengthening the pelvic floor muscles by engaging the abdominopelvic region during exercises (Setyawan et al., 2021). The findings have significant implications for clinical practices and can guide physiotherapists in adopting innovative exercise techniques to prevent and manage pelvic floor dysfunction.

In summary, this study highlighted the importance of addressing pelvic floor weakness, a condition that many people are unaware of, which can become more pronounced with age-related issues like menopause. The findings underscore the importance of raising awareness about pelvic floor dysfunctions among postmenopausal women, who may be unaware of these issues. Pelvic floor exercises, both with and without a gym ball, were introduced to mitigate these issues. The results showed that while both groups experienced improvement, the group using a gym ball had significantly greater gains in pelvic floor strength. These findings suggest that incorporating a gym ball into pelvic floor exercise routines could be a beneficial strategy for enhancing muscle strength and overall quality of life in postmenopausal women. However, further research with larger sample sizes is necessary to confirm these results and explore additional benefits. While the study demonstrated the practical and statistical effectiveness of pelvic floor muscle training using a gym ball, the limited sample size suggests the need for future research with larger populations. Expanding the study to include diverse populations and varying age groups could provide more comprehensive insights into the benefits of pelvic floor exercises with a gym ball. Future studies could also explore the long-term effects of these exercises and the potential for integrating them into routine postmenopausal care.

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