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Original Research Paper

EFFECTIVENESS OF GRADED ABDOMINAL EXERCISES ON PFT IN POST MENOPAUSAL WOMEN

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Background: Postmenopausal women commonly experience reductions in pulmonary function, muscle strength, and core stability due to hormonal and age-related changes, which may affect overall functional performance and quality of life.

Objective: To evaluate the effectiveness of a structured exercise program on Peak Expiratory Flow Rate (PEFR), abdominal muscle strength, and core endurance in postmenopausal women.

Methods: 60 postmenopausal women were included in this study. Baseline measurements were recorded using PEFR, Manual Muscle Testing (MMT) for abdominal strength, and the plank hold test for core endurance. Participants underwent a structured physiotherapy program comprising breathing exercises and core strengthening exercises over a specified duration. Post-intervention assessments were conducted using the same outcome measures. Statistical analysis was performed using paired t-test and chi-square test, with significance set at $p < 0.05$.

Results: A statistically significant improvement in PEFR was observed following the intervention ($p < 0.001$), indicating enhanced pulmonary function. Participants also demonstrated improvement in abdominal muscle strength, with progression to higher MMT grades. Additionally, core endurance improved as evidenced by increased plank holding time. All outcome measures showed significant enhancement post-intervention.

Conclusion: The structured exercise program was effective in improving pulmonary function, abdominal muscle strength, and core endurance in postmenopausal women. These findings support the role of physiotherapy interventions in improving functional capacity and promoting overall health in this population.

KEYWORDS: Postmenopausal women, Peak Expiratory Flow Rate, Core strength, Physiotherapy, Exercise therapy, Abdominal muscles, Pulmonary function

INTRODUCTION

Menopause represents a natural biological transition in a woman's life, characterized by the permanent cessation of menstruation and the end of reproductive capability. This phase occurs due to reduced ovarian activity and a decline in hormones such as estrogen and progesterone. These hormonal changes are associated with several physiological alterations, including increased body fat, reduced muscle mass, and decreased efficiency of the respiratory system (11).

In postmenopausal women, pulmonary function tends to decline as a result of weakening of respiratory and abdominal musculature along with age-related structural changes (10,11). Additionally, increased body weight and obesity can negatively affect breathing mechanics by exerting pressure on the diaphragm and thoracic cavity, thereby limiting lung expansion and ventilation (11).

Peak Expiratory Flow Rate (PEFR) is widely used as an indicator of ventilatory performance. It reflects the maximum speed of expiration following full inspiration and is useful for evaluating airway function (6). Reduced PEFR values are commonly observed in postmenopausal women due to diminished muscle strength and reduced elasticity of lung tissues.

The abdominal muscle group, including the rectus abdominis, transverse abdominis, and obliques, plays a significant role in forced expiration by increasing

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intra-abdominal pressure. These muscles contribute to effective breathing, particularly during physical exertion, and their weakness may impair respiratory efficiency (9).

With advancing age, there is a gradual decline in muscle mass and strength, a condition referred to as sarcopenia. This decline becomes more evident after menopause and can significantly affect physical performance and functional independence (10). In addition to respiratory changes, postmenopausal women often experience a reduction in overall physical activity levels, which further contributes to decreased muscle strength and endurance. Sedentary lifestyle patterns are commonly observed in this population, leading to deconditioning of both respiratory and skeletal muscles. This reduction in activity not only affects pulmonary efficiency but also impacts balance, coordination, and functional independence in daily life **(2,5)**.

Core stability plays a fundamental role in maintaining postural control and efficient movement patterns. The muscles of the abdominal region form an essential component of the core musculature and provide support to the spine and thoracic structures during breathing and physical activity. Weakness in these muscles can lead to poor posture, reduced trunk stability, and inefficient breathing mechanics. Therefore, strengthening the core muscles may have a dual benefit of improving both musculoskeletal stability and respiratory function **(8,9)**.

Furthermore, physiotherapy-based exercise interventions have been widely recognized as safe and effective strategies for improving physical performance in older adults. Structured exercise programs that include breathing techniques and strengthening exercises can

enhance respiratory muscle performance, increase lung capacity, and improve overall endurance. Such interventions are especially beneficial in postmenopausal women, as they address both age-related and hormonal changes affecting the body **(5,12)**.

Therefore, strengthening abdominal muscles may help improve respiratory efficiency and overall functional capacity.

METHODS

This experimental, randomized clinical trial aims to evaluate the effectiveness of graded abdominal exercise on pulmonary function test in post-menopausal women The study will be conducted over six months in Karad, with a sample size of 60 participants selected through simple random sampling. Participants will be included if they are post-menopausal Women, capable of following instructions and performing exercises, willing to participate and provide informed consent, have a history of menopause more than a year and are medically cleared for physical exercise. Exclusion criteria include the presence of other neurological disorders, uncontrolled cardiopulmonary conditions, severe cognitive impairments, recent medication changes, or psychiatric conditions affecting history of Hysterectomy, Recent surgery The primary outcome measure is the Peak expiratory flow rate Ethical approval will be obtained, and informed consent will be collected from participants after explaining the study procedure. A baseline assessment will be conducted using the handheld peak flow metre device, Abdominal MMT, Core endurance followed by a six-week intervention involving exercises designed to improve core endurance and PEFR, three days per week. Post-assessment will be performed at the end of the intervention using the same. Data collected will be analysed statistically to determine the impact of the intervention on balance. The study will conclude with a discussion of the results and their implications for improving. Peak expiratory flow rate and abdominal strength.

ETHICAL COMMITTEE APPROVAL

The approval of this study is gained from the institutional ethics committee of Krishna Vishwa Vidyapeeth (Deemed to be university), Karad. Respondents were given a detailed explanation about the procedure which is to be conducted along with the proper explanation of the inclusion and exclusion criteria as well and an inform consent was collected from each and every participant participating in this study. There was a volunteer involvement of all the respondents in this study whose confidentiality was thoroughly maintained.

STATISTICAL ANALYSIS –

RESULT AND INTERPRETATION –

Table 1: Comparison of PEFR (Pre vs Post Intervention)

Parameter	Mean ± SD (Pre)	Mean ± SD (Post)	Mean Difference	p-value
PEFR (L/min)	274.46 ± 35.12	325.71 ± 40.2	51.25	<0.001

There is a highly significant improvement in PEFR following the intervention ($p < 0.001$), indicating improved pulmonary function.

Table 2: Abdominal Muscle Strength (MMT Grades)

MMT GRADE	Pre(n)	Post (n)
Grade1	18	5
Grade2	22	15
Grade3	15	20
Grade4	5	20

There is a shift toward higher muscle grades, showing improvement in abdominal muscle strength after intervention.

Table3: Plank Hold Test (Core Endurance)

Duration	Pre(n)	Post(n)
<15 sec	25	8
15–20 sec	20	12
20–30 sec	10	20
>30 sec	5	20

Participants showed significant improvement in core endurance, with more individuals achieving longer hold durations post-intervention.

Statistical Analysis

Paired t-test was used for PEFR comparison

Chi-square test was used for categorical variables (MMT & plank test)

All outcome measures showed statistically significant improvement ($p < 0.001$)

INTERPRETATION

The study demonstrates that the intervention program produced statistically significant improvements in PEFR, abdominal muscle strength, and core endurance ($p < 0.001$) among postmenopausal women.

DISCUSSION-

The results of the present study indicate that a structured exercise program can effectively enhance pulmonary function and core muscle strength in postmenopausal women (1,4,12). The observed improvement in PEFR may be attributed to increased strength and coordination of respiratory muscles, along with improved mobility of the thoracic cage. Breathing exercises likely contributed to more efficient ventilation and oxygen exchange (12).

The increase in abdominal muscle strength can be explained by the targeted core strengthening exercises included in the intervention. Improved core stability is essential for maintaining posture and performing daily activities independently. The improvement in plank holding time further indicates enhanced muscular endurance and stability.

The significant improvement in PEFR suggests better expiratory muscle performance and airflow dynamics. Strengthened abdominal muscles enhance forceful expiration, while improved chest expansion supports better lung compliance and ventilation (12).

Age-related hormonal changes in postmenopausal women are associated with a decline in respiratory efficiency due to reduced muscle strength and lung elasticity (11). The findings of this study demonstrate that regular exercise can counteract these effects and improve functional respiratory capacity.

From a clinical perspective, improved pulmonary function contributes to better airway clearance, reduced risk of respiratory complications, and enhanced exercise tolerance. These improvements ultimately lead to a better quality of life and greater independence (2,5).

CONCLUSION

The present study concludes that the structured exercise program resulted in significant improvements in pulmonary function, abdominal muscle strength, and core endurance among postmenopausal women. The statistically significant increase in Peak Expiratory Flow Rate (PEFR) ($p < 0.001$) indicates enhanced respiratory efficiency, which may be

attributed to improved strength and coordination of the respiratory muscles as well as better thoracic mobility.

The findings also revealed a clear shift toward higher Manual Muscle Testing (MMT) grades following the intervention, demonstrating a substantial improvement in abdominal muscle strength. Strengthening of these muscles plays a vital role in supporting respiratory mechanics, maintaining posture, and enhancing overall functional ability. In addition, the results of the plank hold test showed a considerable increase in the duration participants were able to maintain the position, reflecting improved core stability and muscular endurance.

All outcome measures showed statistically significant improvement, confirming the effectiveness of the structured exercise program. These improvements are clinically important, as better respiratory function and core strength contribute to enhanced physical performance, reduced risk of falls, and greater independence in daily activities among postmenopausal women.

Overall, the study highlights that a combination of breathing exercises and core strengthening techniques is an effective and practical approach to address the physiological changes associated with menopause. Such interventions are safe, cost-effective, and can be easily incorporated into routine physiotherapy and health promotion programs.

Further research with larger sample sizes and long-term follow-up is recommended to validate these findings and to assess the sustainability of the improvements over time.

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