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Effect of Static Cycling on Physical Fitness in Postmenopausal Women: A Pilot Study

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Abstract

Background: Postmenopausal women often experience declines in physical fitness due to hormonal changes, leading to reduced muscle mass, flexibility, and cardiovascular endurance. Regular physical activity, such as cycling, may mitigate these effects.

Objective: To evaluate the impact of a 4-week static cycling program on the physical fitness of postmenopausal women.

Methods: A pilot study was conducted with 20 postmenopausal women aged 40–55 years in Ahmedabad, Gujarat. Participants engaged in static cycling thrice weekly for four weeks. Physical fitness was assessed pre- and post-intervention using the Senior Fitness Test (SFT), which includes measures of strength, flexibility, endurance, and agility.

Results: Post-intervention assessments showed significant improvements in lower and upper body strength, aerobic endurance, and agility. Flexibility measures also improved but were not statistically significant.

Conclusion: A structured static cycling program can enhance physical fitness in postmenopausal women, suggesting its potential as an effective intervention in physiotherapy settings.

Keywords: Static cycling, postmenopausal women, physical fitness, Senior Fitness Test, physiotherapy.

Introduction

Menopause represents a critical transition in a woman's life, typically occurring between the ages of 45 and 55, and is clinically defined as the permanent cessation of menstruation for 12 consecutive months in the absence of any pathological cause.[1] This period marks the end of reproductive capacity and is accompanied by a profound decline in circulating estrogen levels, primarily estradiol, which exerts far-reaching effects on nearly all physiological systems.[(2,3)]

The postmenopausal period is associated with a various metabolic, cardiovascular, musculoskeletal, and psychological changes. Estrogen deficiency leads to unfavorable alterations in lipid profiles, endothelial dysfunction, and increased central adiposity, which together elevate the risk of developing cardiovascular diseases—the leading cause of death in postmenopausal women.[4] Additionally, the loss of estrogen contributes to a rapid decline in bone mineral density, thereby increasing susceptibility to osteopenia, osteoporosis, and related fractures.[5] Beyond skeletal health, postmenopausal women also experience significant reductions in lean muscle mass, muscular strength, flexibility, balance, and overall functional capacity—factors that are closely linked to frailty, falls, and reduced independence.[(6,7,8)]

The natural aging process, compounded by hormonal changes, often results in decreased physical activity and increased sedentary behavior among postmenopausal women. These lifestyle patterns further exacerbate the decline in physical fitness and metabolic health. [9.10] Regular physical activity has been consistently recommended by the World Health Organization (WHO) and the American College of Sports Medicine (ACSM) as a cornerstone strategy for promoting healthy aging, reducing disease burden, and improving quality of life. [11,12]

Aerobic exercises such as walking, swimming, and cycling have been found to positively affect cardiovascular endurance, body composition, and psychological well-being in older adults. [13,14] Among these, cycling stands out as a non-weight-bearing aerobic activity that is particularly suited for aging populations with joint limitations or decreased mobility. Unlike weight-bearing activities, cycling minimizes joint loading while still allowing for substantial cardiovascular and muscular engagement.[15] This makes cycling an accessible and sustainable option for older adults, including postmenopausal women.

Static cycling, also known as indoor cycling, provides many of the same physiological benefits as outdoor cycling but in a controlled and safe environment. It offers advantages such as protection from traffic, weather, and fall risks—factors that are particularly important for older individuals.[16] Moreover, static cycling allows for better control of intensity, duration, and progression, making it ideal for tailoring to individual fitness levels and medical conditions. Research has shown that even short-duration cycling interventions (e.g., 4–12 weeks) can significantly improve balance, aerobic capacity, leg strength, and metabolic health in older .[17]

Despite the increasing popularity of cycling as a low-impact form of exercise, relatively few studies have explored its effects on multidimensional physical fitness specifically in postmenopausal women. Most available literature focuses on singular outcomes such as cardiovascular health or weight loss, with limited attention given to comprehensive functional fitness—an essential determinant of independence and quality of life in aging populations.[18] Functional fitness encompasses muscular strength, endurance, flexibility, balance, and agility, all of which are integral to performing everyday tasks such as climbing stairs, carrying groceries, or rising from a chair.[19]

To objectively assess these dimensions of fitness, the Senior Fitness Test (SFT**)** was developed by Rikli and Jones[19]. It includes validated components such as the 30-second chair stand (lower-body strength), arm curl test (upper-body strength), 6-minute walk test (aerobic endurance), chair sit-and-reach (lower-body flexibility), back scratch test (upper-body flexibility), and 8-foot up-and-go (agility and balance). These tests have been widely used in both research and clinical settings to evaluate interventions aimed at improving physical function in older adults. [19,20]

Given the pressing need for safe and effective interventions to maintain physical fitness in postmenopausal women, and the promising characteristics of static cycling as a feasible exercise modality, this pilot study seeks to examine the effect of a four-week static cycling intervention on the multidimensional components of physical fitness, as assessed by the SFT. This study is intended to serve as a foundational step toward integrating low-cost, low-risk exercise strategies into health promotion and physiotherapy programs targeted at postmenopausal populations.

Materials and Methodology

This pilot interventional study was conducted to assess the effects of aerobic cycling on physical fitness in postmenopausal women. The study was carried out in the Department of Physiotherapy at Arush Physiotherapy College in Ahmedabad, Gujarat from July 1, 2024, to August 1, 2024. Prior to initiation, ethical clearance was obtained from the university's institutional ethics committee, and the study was prospectively registered with the Clinical Trials Registry of India (CTRI/2024/01/062074).

A total of 20 postmenopausal women were enrolled using purposive sampling. Inclusion criteria were women aged between 40 and 55 years who had experienced natural menopause (defined as the absence of menstruation for at least 12 consecutive months), were sedentary but physically able to participate in an exercise program, and who provided informed consent. Women were excluded if they had osteoarthritis affecting any major joint, a history of recent surgery within the past six months, or any cardiovascular, neurological, or musculoskeletal condition contraindicating exercis. Written informed consent was obtained from each participant, and confidentiality and privacy were maintained throughout the study.

The intervention consisted of a supervised aerobic cycling program using stationary ergometers. Each session was 50 minutes long and conducted three times per week for four weeks. Sessions included a 10-minute warm-up, 30 minutes of moderate-intensity aerobic cycling, and a 10-minute cool-down.Two trained physiotherapists supervised each session to ensure adherence, monitor safety, and maintain standardized procedures.

The primary outcome measure was the Senior Fitness Test (SFT), developed by Rikli and Jones, which evaluates multiple domains of functional fitness in older adults and has been widely adopted in research involving middle-aged and postmenopausal women. The SFT includes six components: (1) the Chair Stand Test, assessing lower limb strength by counting the number of sit-to-stands performed in 30 seconds; (2) the Arm Curl Test, evaluating upper limb strength by counting the number of biceps curls performed with a 5 lb (2.27 kg) dumbbell in 30 seconds; (3) the 6-Minute Walk Test, measuring aerobic endurance based on distance walked in six minutes; (4) the Chair Sit-and-Reach Test, evaluating lower body flexibility based on the distance between the fingertips and the toes while seated; (5) the Back Scratch Test, assessing upper body flexibility based on overlap or gap between hands behind the back; and (6) the 2.45-meter Up-and-Go Test, measuring agility and dynamic balance by timing the participant as they stand, walk 2.45 meters, turn, and return to the chair.

All tests were conducted in the physiotherapy department. Before each test, instructions and demonstrations were provided to ensure participant understanding. Each test was performed three times, and the best score was used for analysis. Baseline data were recorded prior to the intervention, and post-intervention data were collected at the end of the four-week program. Data were entered into Microsoft Excel and analyzed using SPSS version 20.0. Descriptive statistics, including mean and standard deviation, were used to summarize the data. Paired sample t-tests were applied to compare pre- and post-intervention scores. A p-value < 0.05 was considered statistically significant.

Results

A total of 20 postmenopausal women participated in this pilot study. The physical fitness of the participants was evaluated before and after a 4-week aerobic cycling intervention using the Senior Fitness Test. The intervention consisted of 10 minutes of warm-up, 30 minutes of cycling, and 10 minutes of cool-down, performed three times a week.

The results indicated significant improvements in multiple components of physical fitness following the intervention. Lower body strength, measured by the Chair Stand Test, increased significantly from a mean of 16.4 ± 2.9 repetitions pre-intervention to 19.15 ± 3.1 repetitions post-intervention ($p = 0.0073$). Upper body strength, assessed by the Biceps Curl Test, showed an even greater improvement, increasing from 12.6 ± 2.8 repetitions to 16.65 ± 2.9 repetitions ($p < 0.0001$).

Aerobic endurance, measured by the 6-Minute Walk Test, also improved significantly, with the average distance walked increasing from 503 ± 21.1 meters at baseline to 517.25 ± 15.7 meters post-intervention ($p = 0.0207$).
Flexibility results were variable. The Chair Sit-and-Reach Test, reflecting lower body flexibility, showed a slight non-significant decrease from 25.05 ± 6.3 cm to 21.55 ± 5.4 cm ($p = 0.0695$). In contrast, upper body flexibility, measured by the Back Scratch Test, significantly improved, with the mean distance reducing from 15.55 ± 3.1 cm to 12.55 ± 2.3 cm ($p = 0.0015$), indicating better reach.
Dynamic balance and agility, assessed using the 2.45-meter Up-and-Go Test, improved significantly. The time taken to complete the test decreased from 8.95 ± 1.1 seconds before intervention to 7.35 ± 1.0 seconds after intervention ($p < 0.0001$).
Overall, these results demonstrate that a four-week program of aerobic cycling significantly enhances several domains of physical fitness, including strength, endurance, flexibility, and agility, in postmenopausal women.

Table 1: Pre- and Post-Intervention Physical Fitness Scores

Test	**Pre-Intervention Mean ± SD**	**Post-Intervention Mean ± SD**	**p-value**
Chair Stand Test (Reps)	16.4 ± 2.9	19.15 ± 3.1	0.0073
Biceps Curl Test (Reps)	12.6 ± 2.8	16.65 ± 2.9	<0.0001
6-Minute Walk Test (Meters)	503 ± 21.1	517.25 ± 15.7	0.0207
Chair Sit & Reach Test (cm)	25.05 ± 6.3	21.55 ± 5.4	0.0695
Back Scratch Test (cm)	15.55 ± 3.1	12.55 ± 2.3	0.0015
2.45-M Up & Go Test (sec)	8.95 ± 1.1	7.35 ± 1.0	<0.0001

Discussion

The present study aimed to evaluate the effect of aerobic cycling on various components of physical fitness in postmenopausal women. The findings indicate that a four-week cycling intervention significantly improved lower and upper body strength, aerobic endurance, upper body flexibility, and dynamic balance/agility. These improvements underscore the positive impact of regular cycling exercise on physical fitness, which is crucial for maintaining functional independence in aging women.
Lower body strength, measured by the Chair Stand Test, showed significant enhancement after the intervention. This finding aligns with previous research indicating that cycling, as a low-impact aerobic exercise, effectively strengthens the lower extremity muscles, particularly the quadriceps and gluteal muscles.[16] Improved lower limb strength is vital in older adults to perform daily activities such as standing and walking, thereby reducing the risk of falls and improving mobility.[21]
Similarly, upper body strength improved significantly, as demonstrated by the Biceps Curl Test results. Although cycling primarily targets the lower body, the cycling protocol used in this study likely included warm-up and cool-down exercises involving upper limbs, contributing to this improvement. Strengthening the upper limbs is essential in maintaining overall physical function and independence, especially in women who often manage household tasks requiring arm strength.[15]

Aerobic endurance also improved significantly, as evidenced by increased distances in the 6-Minute Walk Test. Regular aerobic exercise such as cycling has been shown to enhance cardiovascular fitness by improving heart rate, stroke volume, and oxygen uptake, which are critical factors in preventing cardiovascular diseases prevalent in postmenopausal women. [22,23] Increased aerobic capacity contributes to better endurance, allowing individuals to perform prolonged activities without undue fatigue.

The results regarding flexibility were mixed. The Back Scratch Test, which assesses upper body flexibility, showed significant improvement, while the Chair Sit-and-Reach Test for lower body flexibility showed a non-significant decline. The improvement in upper body flexibility could be related to the comprehensive exercise protocol, including warm-up and cool-down routines. However, the decline in lower body flexibility might be due to the static cycling position, which limits dynamic stretching of the hamstrings and calf muscles.[24] These findings suggest that combining cycling with specific flexibility exercises might be beneficial to improve or maintain overall flexibility.

Dynamic balance and agility, measured by the 2.45-meter Up-and-Go Test, showed significant improvement, which is consistent with findings from Rissel et al. who demonstrated that cycling improves balance and leg strength in older adults.[16] Improved agility and balance are critical for fall prevention, a major concern in the aging population.[25] The reduction in time to complete the agility test reflects enhanced neuromuscular coordination and lower limb strength gained from the cycling regimen.

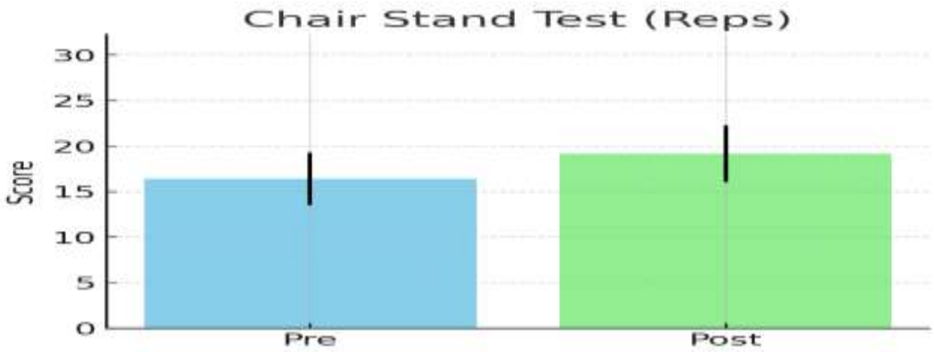
Overall, these findings reinforce the role of cycling as a practical, accessible, and effective exercise to improve physical fitness in postmenopausal women. The improvements observed in strength, endurance, flexibility, and balance collectively contribute to enhanced functional capacity and quality of life. This supports previous literature highlighting the benefits of cycling in reducing the risk of chronic diseases and physical decline associated with aging. [15,18]

Conclusion

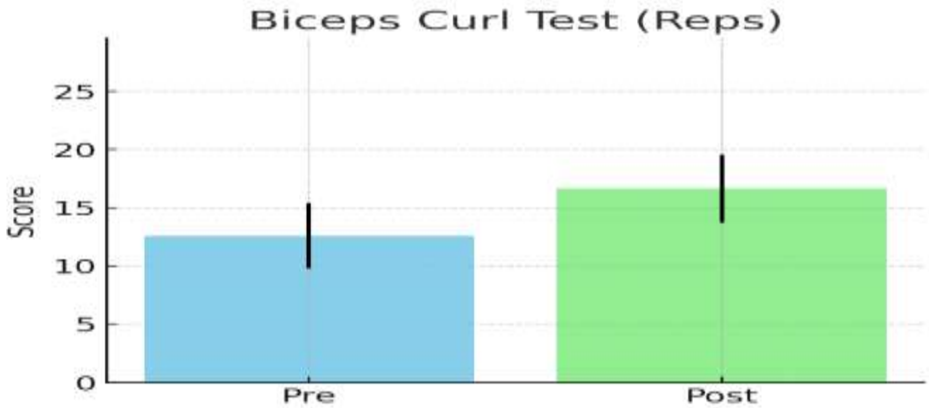
This pilot study demonstrates that a structured aerobic cycling program conducted three times a week over four weeks significantly improves multiple components of physical fitness in postmenopausal women, including lower and upper body strength, aerobic endurance, upper body flexibility, and dynamic balance/agility. These improvements suggest that cycling is an effective, low-impact exercise that can help enhance functional capacity and potentially reduce the risk of age-related physical decline in this population. Incorporating cycling into regular physical activity routines could play a vital role in promoting healthier aging and maintaining independence among postmenopausal women.

Limitations

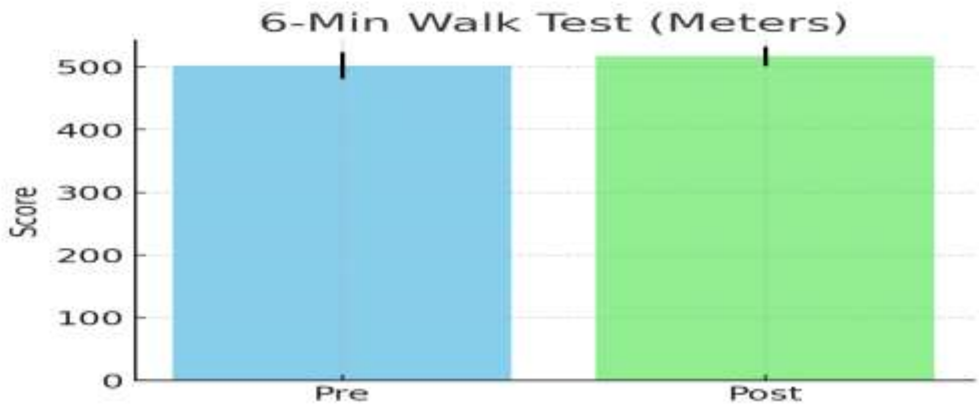
The study had a small sample size and short duration, limiting generalizability and long-term insights. It lacked a control group, making it difficult to attribute improvements solely to cycling. Adherence outside supervised sessions was not tracked, and women with joint issues were excluded, which may affect applicability to all postmenopausal women. Future research should address these limitations.



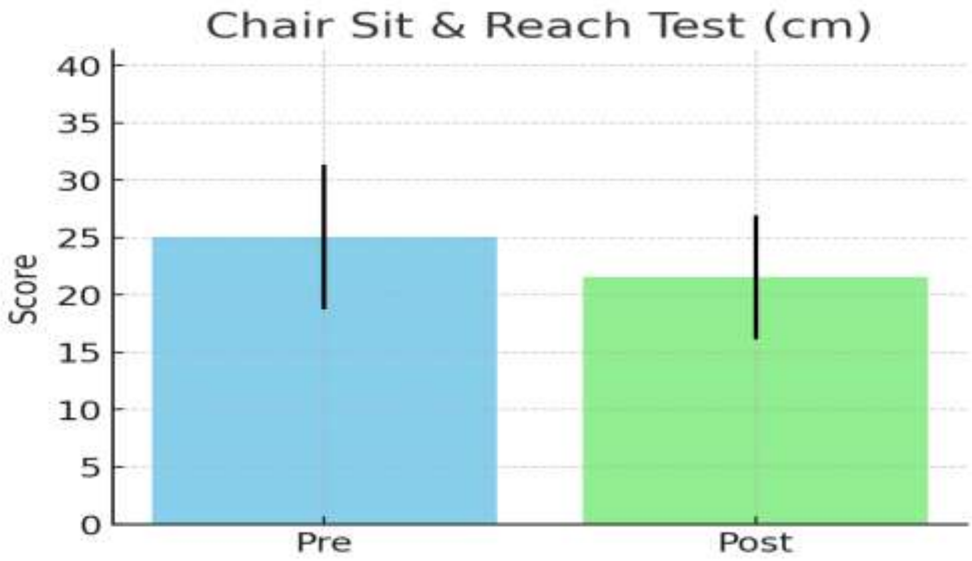
Comparision of score of Chair stand test pre and post cycling intervention



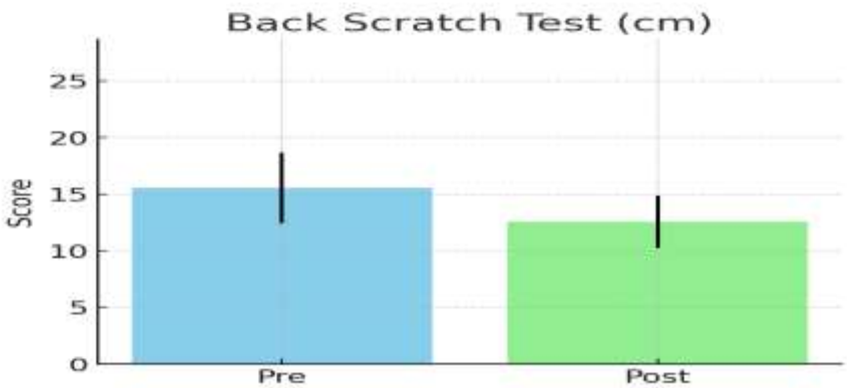
Comparision of score of Biceps Curl test pre and post cycling intervention



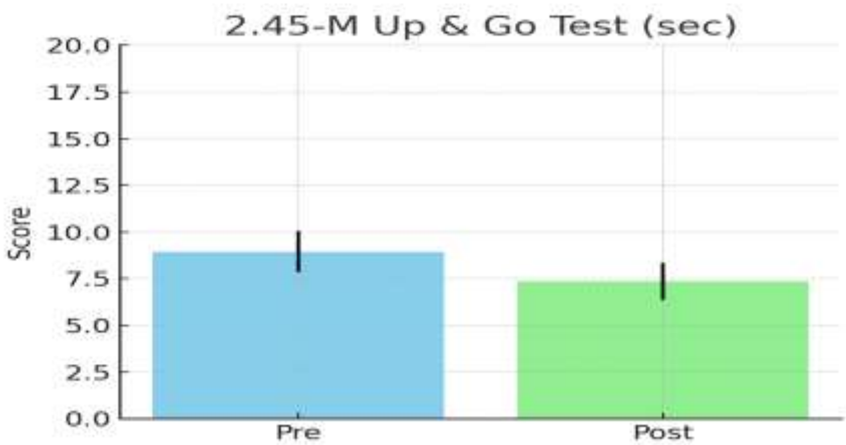
Comparision of score of 6- min walk test pre and post cycling intervention



Comparision of score of Chair Sit & Reach test pre and post cycling intervention



Comparision of score of Back Scratch test pre and post cycling intervention



Comparision of score of 2.45 M Up & Go test pre and post cycling intervention

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