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Effect of Aerobic Exercise on Sleep, Depression, and Quality of Life in Postmenopausal Women

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ABSTRACT

Objectives: Menopause is a normal life stage that frequently brings with it emotional and physical difficulties that affect women's Quality of life (QoL) and interfere with their ability to sleep. The objective of this study was to examine how postmenopausal women (PMWs) responded to supervised aerobic exercise training versus unsupervised Walking in terms of sleep, QoL, and depression. In addition, the impact on body composition was also assessed as a secondary outcome measure.

Material and Methods: Fifty PMWs (aged 45–60) were divided into two groups at random: The control group (n = 25) performed standard unsupervised Walking, and the experimental group (n = 25) performed scheduled supervised aerobic exercise training. The Pittsburgh sleep quality index (PSQI), the 36-item short-form survey, the beck depression inventory (BDI), and the body mass index (BMI) were among the evaluations used in the 6-week, 3-day program.

Results: Remarkable advancements ($P < 0.05$) were noted in the aerobic training cohort. The experimental group increased total sleep duration by 37.9% and fell asleep 44.8% faster, resulting in a noteworthy 61.7% improvement in the PSQI score. BDI scores improved by 55.6%, and there was a 6.8% variation in BMI between the groups.

Conclusion: A 6-week aerobic intervention can improve sleep quality, reduce menopausal symptoms, and enhance life quality in PMW. Furthermore, the results revealed that a regulated exercise group may offer more benefits than an unregulated one. This observation underscores the potential advantages of structured and monitored aerobic exercise program in achieving specific health and fitness goals.

Keywords: Postmenopausal women, aerobic exercise program, Sleep quality, Quality of life, Mental health, Body composition

INTRODUCTION

Menopause is a natural process that lasts a year and is accompanied by emotional and physical difficulties.[1] Between 8% and 15% of women experience depression at this time.[2] Depression and mood disorders are influenced by hormonal changes, namely, low levels of estrogen. Postmenopausal women (PMW) frequently experience sleep problems; between 40% and 60% of them report having trouble sleeping and experiencing insomnia throughout menopause.[3,4] These sleep disorders have an adverse effect on one's physical and mental health and are related to a lower life quality. Sleep, mood, and memory are impacted by changes in the GABA-ergic, serotonergic, noradrenergic, and dopaminergic systems during menopause. Cardiovascular problems and depression are exacerbated by changes in hormones.[2,3]

Frequent aerobic exercise has been shown to improve middle-aged women's general health and reduce menopausal symptoms. Depression symptoms can result from sleep problems, which are frequently caused by vasomotor symptoms such as night sweats, hot flashes, and palpitations. Exercise may lessen daytime sleepiness and enhance the Quality of sleep, according to epidemiological studies.[4-6] Walking appears to provide several advantages for PMW, as evidenced by research. These benefits include decreased risk of osteoporosis, increased mental health, and improved cardiovascular health, all of which improve overall health and Quality of life (QoL). Walking on a regular basis has also been linked to higher-quality sleep, which may help with frequent sleep issues during the menopausal transition.[7] This study examines the relative effects on important dimensions of well-being, such as body composition, mental health, general QoL, and sleep quality among PMW, between scheduled supervised aerobic exercise training and frequent unsupervised Walking.

MATERIAL AND METHODS

Subjects and criteria

The present study was an experimental study design. The study was approved by the Delhi Pharmaceutical Sciences and Research University (DPSRU) School of Physiotherapy Research Committee. Potential participants were screened for eligibility. The inclusion criteria included being a PMW who was willing to participate and being 45–60 years old, having the onset of menopause for at least 2 years, having body mass index (BMI) in the range of 25–30 kg/m^2, being able to converse in Hindi or English, attending DPSRU outpatient department, and having Pittsburgh sleep quality index (PSQI) scores >5 and beck depression inventory (BDI) scores >11. The exclusion criteria included: Subjects with orthopedic or neurological problems that might affect their compliance to participate in the study, PMW taking sleeping pills, with a history of recent surgery, and the presence of systemic, respiratory, or cardiovascular disease.

Procedure

Following their enrollment in the trial, 50 PMW were given a thorough explanation, and their informed consent was obtained. Following baseline evaluations, individuals were randomized into two groups using a simple random sampling method: The experimental group (n = 25) undertook a daily regimen of scheduled, supervised aerobic exercise on a treadmill, whereas the control group (n = 25) walked regularly but unsupervised at home. Demographic data, sleep quality, QoL, and mental health were gathered using self-structured questionnaires completed in person. Every participant underwent baseline evaluations, and baseline, 3rd, and 6th week data were gathered after the protocol. Figure 1 shows flow of the study.

Outcome measures

PSQI: A widely used self-report tool for measuring sleep quality over a month. It has 19 items total that are divided into seven categories: Subjective quality of sleep, sleep latency, length, habitual efficiency of sleep, sleep disruptions, usage of sleep drugs, and dysfunction throughout the day. Higher scores indicate lower sleep quality overall. The total score, which runs from 0 to 21, helps assess overall sleep quality.[8]

36-item Short-Form Survey (SF-36), an established tool, was used to assess QoL. Eight dimensions are covered by this questionnaire: social functioning, physical functioning, mental health, perceptions of general health, role limits resulting from emotional issues, role restrictions resulting from physical health, and physical pain. An established measure for a thorough evaluation of an individual's well-being across multiple aspects is the SF-36. Each domain ranges from 0 to l00, l00 being the best score and 0 the worst.[9]

BDI uses a 21-item scale with a score range of 0–13 to evaluate depressive symptoms. Elevated scores signify an increased level of depression.[10]

BMI: The formula for calculating a person's body composition is to divide their weight in kilograms by the square of their height in meters, or BMI. A higher BMI could indicate a larger fat percentage in the body.

Treatments

Group A: Experimental group (n = 25): Scheduled supervised vigorous aerobic training

The exercise program consisted of eighteen sessions of 30 min each, three times a week on alternate days of the week, of submaximal aerobic Walking on a treadmill. A 3-min warm-up, a 3–4-min target heart rate (THR) ascent, a 20-min THR maintenance, and a 3-min cool-down comprised the treadmill program.

Exercise intensity increased progressively over the 6 weeks: 50% heart rate reserve (HRR) during the first 2 weeks, 55% HRR during the next two, and 60% HRR during the past 2 weeks. Throughout the workout program, blood pressure and heart rate were continuously monitored.

Group B: Control group (n = 25): It was a standard unsupervised walking group

Subjects were instructed to engage in 30 min of daily Walking as part of their routine. Walking was performed by the subjects at home at their convenient time, without breaks. It was an unsupervised session. The control group was specifically asked to maintain their usual physical activity and dietary habits throughout the 6 weeks. The control group was maintained on a waitlist without any intervention during this period.

Data analysis

Values means, and standard deviations were computed through the use of Microsoft Excel and Statistical Package for the Social Sciences software version 24 for analysis of data. Statistical significance was attained when P <0.05. Between-group analysis employed the independent *t*-test, while within-group analysis utilized Repeated Measure two-way mixed-model analysis of variance (ANOVA) at various levels to assess the impact of aerobic exercise on study variables in the experimental and control groups. Further, the analysis involved pairwise comparisons with Bonferroni correction to scrutinize any statistically significant between-group differences in change scores from baseline to the final treatment session.

RESULTS

The study was done on 50 PMW. The mean comparison of weight, height, and BMI was done. The demographic features of both groups were similar at baseline.

As indicated by the mean PSQI score reduction, the 6-week study showed significant improvements in sleep quality for both Experimental Group A (61.7%) and Control Group B (49.2%). Significant differences in PSQI scores were found for both groups using repeated measures ANOVA (Experimental: F(1.34, 32.29) = 248.09; Control: F(1.68, 40.49) = 96.41, $P < 0.05$). Significant improvements were found for both groups at weeks 3 and 6 by *post hoc* analysis ($P < 0.01$). Furthermore, the Experimental Group showed significant improvements in both sleep duration and time to fall asleep, increasing it by 43.4% and 44.8%, respectively, compared to the Control Group's gains of 37.9% and 44.8%.

Mental health

The BDI scores of both groups showed significant reductions: The experimental group showed a noteworthy 55.6% improvement, indicating improved outcomes and the control group showed a 41.4% increase. Repeated measures ANOVA confirmed substantial changes in the BDI over time for both Control Group B (F[1.97, 47.40] = 215.23, $P < 0.05$) and Experimental Group A (F[1.16 28.03] = 112.40). Significant improvements were verified by *post hoc* analysis for both groups at weeks 3 and 6 ($P < 0.01$).

Body mass index (BMI)

The experimental group's BMI differed significantly (6.8%) from that of the control group in terms of body composition. A significant reduction in BMI was observed over time for both groups in the repeated measures ANOVA. Experimental: F(1.37, 33.03) = 105.99; Control: F(1.48,35.58) = 96.41,$P < 0.05$, with gains evident from baseline to week 3 [Table 1].

Quality of life (QoL)

The result in Table 2 revealed significant improvements ($P < 0.05$) in almost all aspects of QoL (emotional problems, general health, energy/fatigue, social functioning, and physical functioning), exceptional emotional well-being, and pain.

DISCUSSION

Menopause, a recognized physiological occurrence in women's lives, is the end of menstruation due to the reduction of ovarian follicular function. Together with hormonal changes – specifically, a decrease in estrogen levels – biological, psychological, and social changes also occur.[1] The study was conducted on 50 PMW to study the effect of scheduled supervised aerobic exercise on sleep quality, mental health, QoL, and BMI. The average age of the participants was 49.34 years.

Pittsburgh sleep quality index (PSQI)

Baseline PSQI ratings in this study did not show a significant difference between the experimental and control groups. Still, significant reductions were noted in both groups between the third and the end of the 6th week, indicating improvements within the group. These results are in line with the study of Cai *et al*. When compared to the control group, group therapy-based aerobic exercise resulted in a substantial improvement in PSQI in the training group.[11] Through a number of physiological mechanisms, aerobic exercise has a beneficial effect on sleep. Strong circadian rhythms and the promotion of sleep onset are established by hormonal management, which includes the release of cortisol and melatonin before and after exercise. Better sleep quality is also influenced by the release of endorphins, stress reduction, and metabolism management. Moreover, the amelioration of anxiety and depression symptoms brought on by exercise may indirectly improve general sleep patterns.

The results of this study are consistent with those of Buchanan *et al*., showing significant but moderate improvements in self-reported insomnia symptoms and sleep quality after aerobic exercise as opposed to routine activities.[12] The results are consistent with Sternfeld *et al*., showing that although the changes were small, the exercise group reported higher improvements in subjective sleep quality ($P = 0.01$) and symptoms of insomnia[13] ($P = 0.03$). Furthermore, the outcomes are consistent with Tadayon *et al*., showing that the intervention group significantly outperformed the control group in terms of improvements in subjective sleep quality, sleep latency, duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and dysfunction during the day after 12 weeks ($P < 0.05$). The intervention group's overall sleep quality score was significantly greater than the control group's.[14]

Table 1: Baseline and final measurement and change scores for PSQI, BDI, and BMI.

Variables	Baseline	3rd week	6th week
PSQI			
Experimental	9.72±1.74	6.56±0.76	3.72±0.45
Control	10.48±1.96	7.32±0.94	5.32±0.74
Within-group difference			
Experimental		3.16 (2.46–3.85)*	6.00 (5.12–6.87)*
Control		3.16 (2.10–4.21)*	5.16 (4.09–6.22)*
Between-group difference		−0.76 (−1.25–0.27)*	−1.6 (−1.95–1.24)*
BDI			
Experimental	13.52±1.68	11.56±2.31	6±3.14
Control	14.28±1.42	10.48±0.77	8.36±0.75
Within-group difference			
Experimental		1.96 (0.85–3.06)*	7.52 (5.70–9.33)*
Control		3.80 (3.04–4.55)*	5.92 (5.14–6.69)*
Between-group difference		1.08 (0.10–2.06)*	−2.36 (−3.66–1.05)*
BMI			
Experimental	26.57±1.05	25.26±1.40	24.04±1.19
Control	27.02±1.05	26.43±1.01	26.28±0.98
Within-group difference			
Experimental		1.30 (0.93–1.67)*	2.53 (2.17–2.89)*
Control		1.02 (0.54–1.50)*	1.81 (1.34–2.29)*
Between-group difference		−1.17 (−1.84–0.42)*	−2.24 (−2.81–1.60)*

Values are mean±std. Deviation, *Significant improvement. PSQI: Pittsburgh sleep quality index, BDI: Beck depression inventory, BMI: Body mass index

Table 2: Baseline and final measurement for SF-36.

Components	Groups	Baseline^	Final (after 6 weeks)	*P*-value
Physical functioning	Experimental	436±118.6	735±97.09	0.00*
	Control	453±62.21	658±70.23	
Role-physical health	Experimental	82±93.4	388±200.66	0.88ns
	Control	100±57.73	382±43.01	
Role-emotional problems	Experimental	58±58.94	192±81.24	0.00*
	Control	36±48.99	252±50.99	
Energy/fatigue	Experimental	122.4±37.67	241.6±82.24	0.03*
	Control	113.6±14.96	204±24.49	
Emotional well-being	Experimental	252.8±65.79	311.2±57.46	0.50ns
	Control	238.4±60.53	320±30.55	
Social functioning	Experimental	107.8±35.73	180.2±65.24	0.02*
	Control	104±51.88	150±14.43	
Pain	Experimental	97±14.93	140.6±29.87	0.45ns
	Control	91.6±14.19	145.4±11.35	
General Health	Experimental	217±51.72	397±66.66	0.00*
	Control	210±38.18	341±53.46	

ns: Non-significant, *Significant, ^Values are mean±std. deviation, SF-36: 36-item short-form survey

Beck depression inventory (BDI)

The BDI scores in the present study significantly reduced from the beginning of the study to the end of the 6th week. After 8 and 12 weeks, the intervention group's anxiety and sleeplessness reduced, which is consistent with the findings of Abedi *et al*.'s study.[15] By the 12-week point, the intervention group's depression intensity had significantly diminished. The results also support the findings of Khoshnab and Nikseresht, which showed that interventional groups receiving medicine, exercise, or both had a significant reduction in depression-related variables.[16]

Long-term aerobic activity may raise plasma concentrations of free tryptophan, which may impact its synthesis and release and account for the reported benefits in depression, according to a number of studies. The observed improvements in depression markers may be explained by

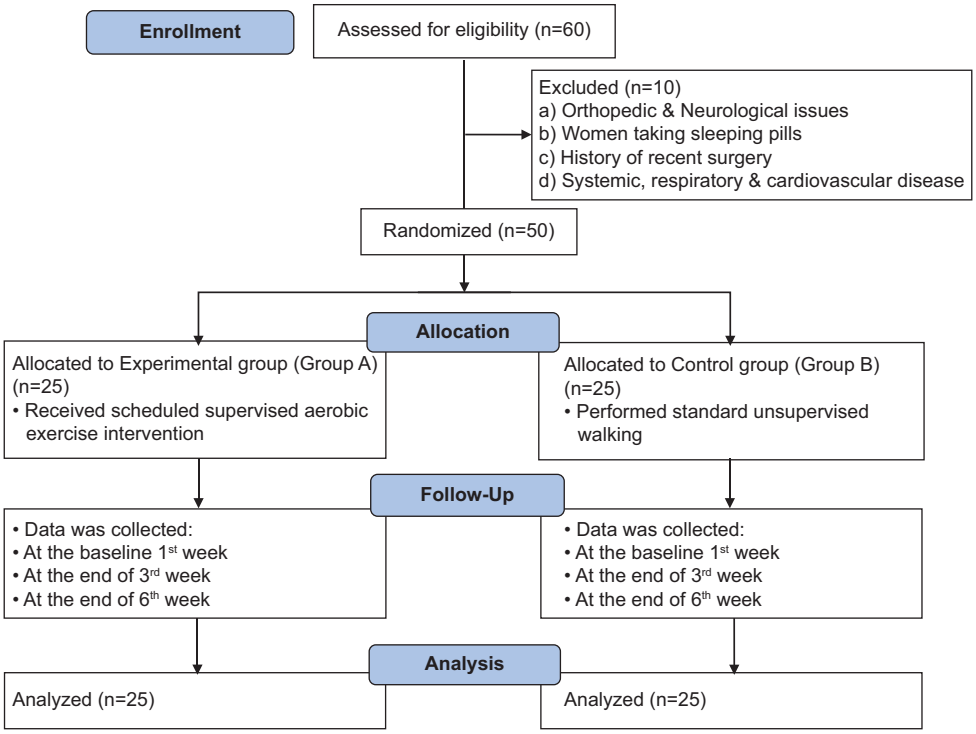

Figure 1: Flowchart of study.

the beneficial effects of aerobic exercise on physiological indices of the hypothalamic-pituitary-adrenal axis, such as enhanced brain release of beta-endorphins and monoamines, improved oxygen availability, and decreased stress.[17]

Body mass index (BMI)

There was a significant difference in BMI between the experimental and control groups by 6.8% at the end of the intervention. Proposed mechanisms are engaging in aerobic activities which use energy from stored fat and glycogen to fuel the exercise, leading to weight loss over time. Consistent aerobic exercise can boost metabolic rate, which is particularly helpful for maintaining weight loss and improving overall body composition. While aerobic exercises primarily target cardiovascular fitness, they can also help preserve lean muscle mass. Preserving muscle is important during weight loss as muscles burn more calories than fat mass, thus supporting your overall efforts to improve BMI.[13,18]

The results of a study that found that among overweight to obese PMW, moderate-to-vigorous aerobic exercise regimens led to clinically significant and important decreases in body weight and improvements in body composition provide support for the findings of this investigation.[17]

Quality of life (QoL)

The present study showed improvements in nearly every area of QoL, in contrast to Akwa *et al*.'s study, which reported no significant differences in several parameters between the sedentary and activity groups of PMW before the experiment.[19] Improvements were noted in the areas of pain, general health, social health, emotional stability, physical functioning, and general health. These findings are consistent with studies suggesting that QoL may differ depending on one's geographic location and that QoL may be adversely affected by climacteric symptoms as opposed to menopause itself. While there are arguments that the physical, social, and psychological changes associated with menopause may negatively impact QoL, ethnic variety may also play a role in regional variations in QoL.

Furthermore, the results of this study align with the previous studies indicating that aerobic exercise is superior to resistance exercise in terms of modifying inflammatory cytokines and enhancing QoL in PMW.[20,21] These findings corroborate those of a study by Nikpour and Haghani, highlighting the positive effects of a regular, controlled exercise program spread over 6 weeks on PMW's QoL.[22]

CONCLUSION

A 6-week aerobic intervention can improve sleep quality, reduce menopausal symptoms, and enhance life quality in PMW. Furthermore, the results revealed that a regulated exercise group may offer more benefits than an unregulated one. This observation underscores the potential advantages of structured and monitored exercise programs in achieving specific health and fitness goals.

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Ethical approval

The Research was approved by the Research Review Development Committee of School of Physiotherapy, DPSRU VIDE NO 10/801/PT/DPSRU/2022/20328, dated 01/12/2022.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI.

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