



EFFECTIVENESS OF AEROBIC EXERCISES ON SLEEP QUALITY, COGNITION AND QUALITY OF LIFE AMONG POST-MENOPAUSAL WOMEN

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Abstract:

Background: Post-menopause is a cessation of menses that lasts for 12 months or longer. It induces many symptoms and alterations on women's body such as poor sleep and insomnia which results in poor quality of life when it became severe. Exercises are said to be extremely important throughout the women's life time and particularly when she gets old. A daily moderate exercise has shown benefits in treating women with insomnia. Aerobic exercise plays an important role in maintaining quality of life, so the purpose of study was to investigate the effects of aerobic exercise on sleep quality, cognition, & quality of life in post-menopausal women.

Methodology: In this study 49 post-menopausal women aged from 45-55 years were included. Subjects were selected according to the inclusion and exclusion criteria. Procedure was thoroughly explained to the subjects selected for the study. Selected subjects were received aerobics exercises protocol for 5 days/ week for 3 weeks. A pre & post sleep quality, cognition & quality of life of the selected subjects were assessed using Sleep quality scale(SSQ), Montreal cognitive assessment (MOCA), Menopause Specific Quality of Life questionnaire (MENQOL) respectively & results were analyzed statistically using paired t-test.

Result: Significant improvements were observed after aerobic training in sleep quality (p-value 0.000), quality of life (p-value of 0.000) and there was no significant improvement in cognitive function (p-value 0.093).

Conclusion: The post-menopausal women who aged from 45-55 years showed a beneficial effects on sleep quality and quality of life, but there was no significant improvement on cognitive function.

Keywords: Aerobics, Cognition, Post-menopause, Quality of life, Sleep quality.

INTRODUCTION

Menopause is a loss of ovarian follicular activity that leads to permanent termination of menstruation at the conclusion of reproductive life. Average age of menopause in women in India is 47.5 years. Postmenopausal women face sleep difficulties with a higher frequency than in younger women. During the menopause transition, poor sleep and insomnia are reported by 40% to 60% of women, which results in poor quality of life when it became severe. General health quality is reduced due to poor sleep quality and it is associated with physical and psychological problems and a non-optimal amount of sleep is significantly associated with all that cause mortality in older individuals. After menopause there is increased risk of mood disorders. In women without a history of depression or anxiety, compared to pre-menopause and post-menopausal stages shows increased risk of greater symptoms of anxiety. ⁽¹⁾

Menopause is an event that causes plenty of physiological variation in female body. Moreover, 51 and 50.7 years are the average of the onset of menopause in USA and Europe documented respectively, whereas in Pakistan it is 49.3, in India 45.0 and in Saudi Arabia it is found to be 48.9 years. Women spend their one-third of the life span in the post-menopausal state with the associated symptoms. Which includes hot flushes (65%), mood swings (42.4%), vaginal dryness (34%), sleep problems (47.4%), night sweats (44%), memory loss (32.3%), urinary symptoms (18.3%), osteoporosis (12.6%), anxiety (5.8%), musculoskeletal pain (40.1%), depression (27.5%) and irritability (5.9%) have been documented. It evident these during the process of aging and menopause, especially due to endocrinal changes that is level of estrogen hormone, that leads to both physiological and psychological changes in body. ⁽⁷⁾

Menopause can be the major cause of post-menopausal osteoporosis which decreases the mechanical stimulation with increasing age and can be an important confounding factor. Exercises play an important role in maintaining or increasing bone density. With exercise training, involuntional bone loss might be reversed without the side effects of medical therapy and could result in improvement of physical fitness and also Quality of Life among post-menopausal women. ⁽²⁾

Physical activity is one of the most significant factors behind improving sleep quality. Variety of studies reported exercises as an effective non-pharmacological modality for improving the sleep quality in both healthy and unhealthy individuals. There are two types of exercises, namely, aerobic and anaerobic exercises. Aerobic exercise is a prolonged moderate-intensity exercises which increases heart rate and respiratory rates for long periods of time, while anaerobic exercise is a short-period high-intensity exercises that put muscles under intense pressure. Both the types of aerobic and anaerobic exercises can show different effects on body metabolism and thereby sleep quality. ⁽³⁾

The American College of Sports Medicine (ACSM) defines aerobic exercise as any activity that uses large muscle groups, can be maintained continuously and is rhythmic in nature. As the name implies, muscle groups activated by this type of exercise rely on aerobic metabolism to extract energy in the form of adenosine triphosphate (ATP) from amino acids, carbohydrates and fatty acids. Examples of aerobic exercise include cycling, dancing, hiking, jogging/long distance running, swimming and walking.

Exercises are said to be extremely important throughout the women's life time and particularly when she gets old. A daily moderate exercise has shown benefits in treating women with insomnia. Aerobic training may show the decrease in frequency of hot flushes, also aerobic training for four times per week improved quality of life among symptomatic post-menopausal women. Quality of life improvement was dependent on frequency of training sessions.

Aerobic exercise training, or conditioning, is augmentation of the energy activation of the muscle by means of an exercise program. The improvement of the muscles ability to use energy is a direct result of increased levels of oxidative enzymes in the muscles, increased mitochondrial density and size and an increased muscle fibre capillary supply.

Aerobic Training is dependent on exercises of sufficient intensity, duration and frequency. Training produces cardiovascular and or muscular adaptation in individual's endurance.

There are 3 components of the exercise program, they are-

1.) Warm-up period- It is a time lag existing between the onset of the activity and the bodily adjustments needed to meet the physical requirements of the body. It should be gradual and sufficient so that it increases muscle and core temperature without causing fatigue or reducing energy stores in body. Exercises included in warm up should be low intensity and low speed. It should last at least for 10 mins.

2.) Aerobic exercise period- It is the conditioning part of the exercise program. Attention should be given to the determinants of intensity, duration, frequency and mode of the program. In aerobic exercises submaximal, rhythmic, repetitive, dynamic exercises of large group of muscles is given. The exercise period must be within the person's tolerance, above the threshold level for adaptation and below the level of exercise that evokes clinical symptoms in the body.

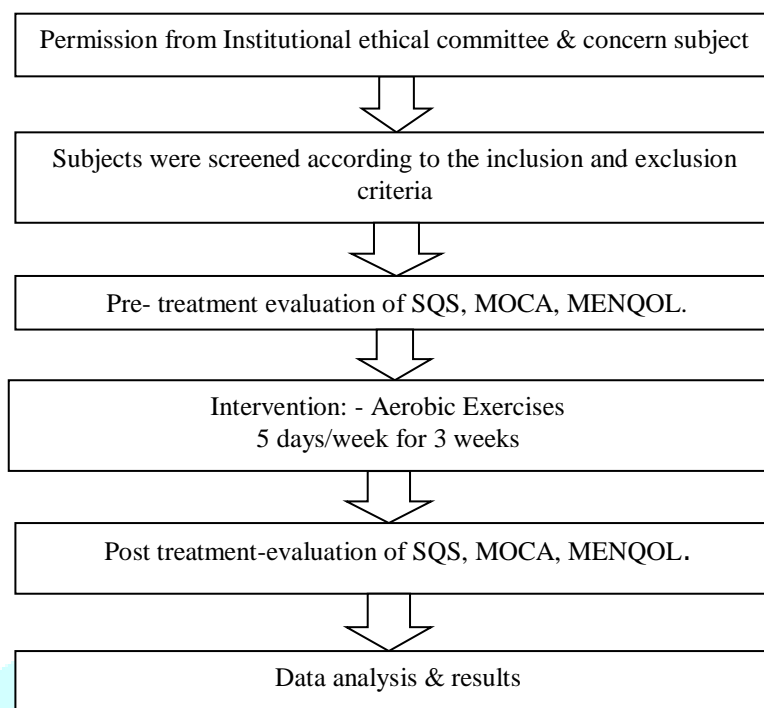
3.) Cool-down period- It prevents pooling of the blood in extremities by continuing use of the muscles to maintain venous return. It enhances the recovery period with the oxidation. Exercises within these periods should include low intensity, calming exercises, stretches and relaxation exercises. This period should at least last for 5-10 mins.

Menopause induces many symptoms and alterations in women's body, affecting their overall system. Some common symptoms are: - hot flushes, irritability, mood swings, insomnia, vaginal dryness, difficulty concentrating, mental confusion, stress incontinence, urge incontinence, osteoporotic symptoms, depression, headache, vasomotor symptoms. Physical activity appears in general to have a positive effect on several health outcomes in post-menopausal women.

So, the purpose of our study is to find out the effectiveness among post-menopausal women to improve sleep quality, cognition and post-menopausal quality of life.

METHODOLOGY

- ❖ **Study Design:** Interventional study.
- ❖ **Sample Size:** 49
- ❖ 49 (minimum sample size to estimate population mean)
 - $n = \frac{4\delta^2}{E^2}$
- ❖ **Study Population:** Post-menopausal women
- ❖ **Study Duration:** 6 Months
- ❖ **Sampling Method:** Purposive Sampling
- ❖ **Study Setting:** Gynecology opd and CBR opd of Dr. Ulhas Patil Medical College and Hospital.
- ❖ **Criteria Of Selection:**
 - (A) **Inclusion Criteria:**
 - 1) Post-menopausal women Aged from 45-55 years
 - 2) Able to follow instructions & perform exercise intervention
 - 3) Subjects willing to participate.
 - (B) **Exclusion Criteria:**
 - 1) Subjects with history of cardiovascular & pulmonary surgery
 - 2) Subjects with artificial cardiac pacemaker.
 - 3) Subjects with history of pulmonary & cardiac diseases.
 - 4) Women with history of hysterectomy.
 - 5) Any recent musculoskeletal impairment, surgeries or implants.
 - 6) Subjects with any recent neurological condition/ impairment.
 - 7) Aggravating pain during movements.
 - 8) Women doing fitness training.
- ❖ **Materials**
 - 1) Informed consent
 - 2) Scales and questionnaire
 - 3) Stopwatch
 - 4) Stepper

PROCEDURE

In this study 49 subjects were included as sample size, which was calculated using the minimum sample size to estimate population mean formula. To conduct the study Permission from Institutional ethical committee & consent from subject was taken. Subjects are selected according to the inclusion and exclusion criteria. Procedure is thoroughly explained to the subjects selected for the study. Earlier the demographic data of each and every individual was taken in consideration.

Baseline measurements prior the treatment is taken, that is sleep quality scale (SQS) for sleep determining sleep quality changes, Montreal cognitive assessment (MOCA) for cognitive functioning and the menopause specific quality of life (MENQOL) questionnaire for determining post- menopausal changes, but in this questionnaire sexual domain was not included(to not harm cultural background), these outcomes were assessed after 3 weeks.

OUTCOME MEASURES**1. Sleep quality scale (SQS):**

It consists of 28 items, the SQS evaluates six domains of sleep quality: daytime symptoms, restoration after sleep, problems initiating and maintaining sleep, difficulty waking and sleep satisfaction.

Scoring is done using a four- point, Likert- type scale, respondents indicate how frequently they exhibit certain sleep behavior (0= “few”, 1= “sometimes”, 2= “often”, 3= “almost always”). Total scores can range from 0-84, with higher scores demoting more acute sleep problems.

2. Montreal cognitive assessment (MOCA):

The MOCA test’s primary purpose is to detect problems with cognition- how well your brain works to perceive or understand things. The MOCA consist of a series of tasks to see how well your brain is functioning in such cognitive domains as: - (1) Executive\ Visuospatial, (2) Naming, (3) Memory, (4) Attention, (5) Language, (6) Abstraction, (7) Delayed Recall, (8) Orientation.

The scoring is based on a 30 points scale, with points awarded differently depending on the type of questions asked. Overall if you earn 26-30 points, then you are considered to have normal cognitive abilities. A score of 19-25 indicates mild cognitive impairments and score between 11-21 suggests mild Alzheimer’s disease.

3. Menopause Specific Quality of Life (MENQOL) questionnaire:

The MENQOL is self-administered and consist of a total of 29 items in a Likert-scale format. Each item assesses the impact of one or four domains of menopausal symptoms experienced over the last month: (1) Vasomotor domain (item 1-3), (2) Psychosocial domain (item 4-10), (3) Physical domain (item 11-26), (4) Sexual domain (item 27-29).

Items pertaining to a specific symptom are rated as present or not present and if present, how bothersome on a Zero (not bothersome) to Six (extremely bothersome). Means are computed for each subscale by dividing the sum of the domain’s item by the no. of items within that domain. In this questionnaire 4th domain that is sexual domain is not included.

Procedure for Aerobic exercises

Exercises was started with easy and basic movement first which all can perform easily and comfortably. Movements which aggravate pain was restricted. Some general guidelines for aerobic exercise training program were followed: -

1. First we established the target heart rate and maximum heart rate.
2. Followed by Warm up for 5 to 10 mins, including stretching and repetitive motions at slow speeds with gradually the efforts.
3. Then increased the pace of the activity so that the target heart rate was maintained for 20 to 30 mins.
4. Cool down for 5 to 10 mins with slow, total body, repetitive motions and stretching activities and relaxation activities.

Exercise prescription (FITT) for aerobic exercises on post-menopausal subjects-

Frequency:- 5 sessions per week.

Intensity:- Low to moderate intensity exercises, RPE of 3-4 (10- point scale), HR_{max}

Type:- Aerobic exercises.

- Group exercises should be encouraged.
- Upper and lower extremity free exercises as per patient’s tolerance.
- Heel digs, step touch, biceps curl, hammer curls, knee lifts, V-box steps, cha-cha-cha, alternate biceps curl, alternate hammer curls, arm circles, brisk walking, neck movements are included in session.

Time\ Duration:- Minimum 30 min of continuous activities and progress upto 60 min of continuous activities, according to patient’s tolerance.

<p><u>Heel digs</u></p> 	
<p><u>Step touch</u></p> 	
<p><u>V box steps</u></p> 	
<p><u>Cha cha cha</u></p> 	
<p><u>Knee lift</u></p> 	
<p><u>Knee lift with stepper</u></p> 	

<p><u>Bicep curls</u></p>	
<p><u>Alternate bicep curls</u></p>	
<p><u>Hammer curls</u></p>	
<p><u>Alternate hammer curls</u></p>	
<p><u>Arm circles</u></p>	
<p><u>Brisk walking</u></p>	

STATISTICAL ANALYSIS

The collected data i.e., pre and post values of sleep quality, cognition and menopause specific quality of life in post-menopausal women performing aerobics is quantitative in nature. All the statistical analysis is performed using Minitab 13 and MS-excel software.

RESULTS

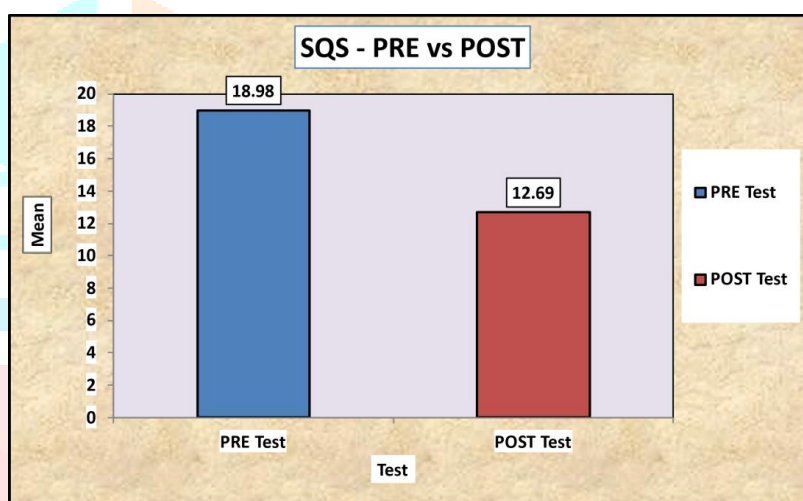
Table no.1 represents mean age, mean age at menopause and mean BMI distribution

	Mean	SD	Minimum	Maximum
Age	51.83	3.69	45	59
Age at Menopause	46.1	3.83	37	53
BMI	25.49	3.27	16	32.9

Table no. 2 - SQS score

Variable	Groups	N	Mean	SD	t value	p value
SQS	PRE-Test	49	18.98	10.29	7.50	0.000
	POST Test	49	12.69	7.78		

- Among 49 samples in pre-test, mean calculated is 18.98 whereas post-test show decreased mean of 12.69 with the p-value of 0.000 (<0.01) which is highly statistically significant.

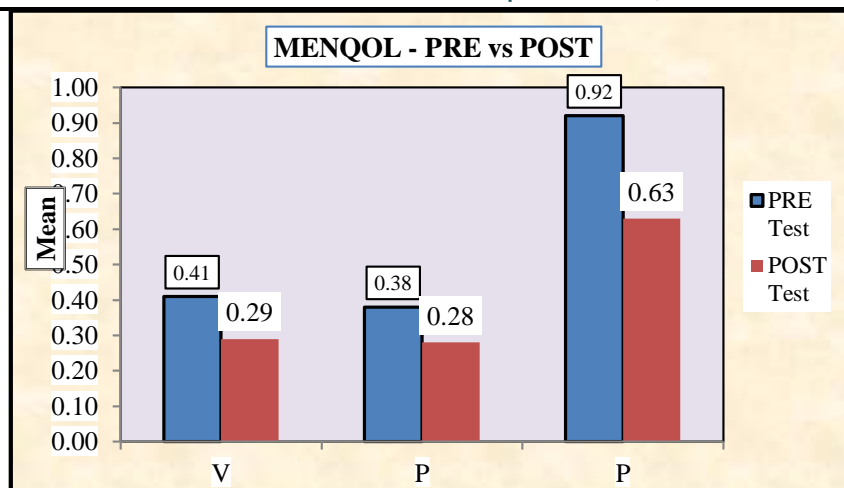


The bar graph shows Sleep Quality scale (SQS) score, the score represents pre-test had poorer sleep quality and post-test having good sleep quality, thus sleep quality improved after aerobic exercise.

Table no. 3 represents MENQOL questionnaire scoring

Variable	Groups	N	Mean	SD	t value	p value
V	PRE-Test	49	0.41	0.56	3.25	0.002
	POST Test	49	0.29	0.45		
P	PRE-Test	49	0.38	0.46	3.69	0.001
	POST Test	49	0.28	0.34		
P	PRE-Test	49	0.92	0.68	6.84	0.000
	POST Test	49	0.63	0.49		

- Among 49 post-menopausal women, pre-post MENQOL questionnaire was assessed. There were significant improvement observed in vasomotor domain (p-value 0.002), psychosocial domain (p-value of 0.001), physical domain (p-value of 0.000).

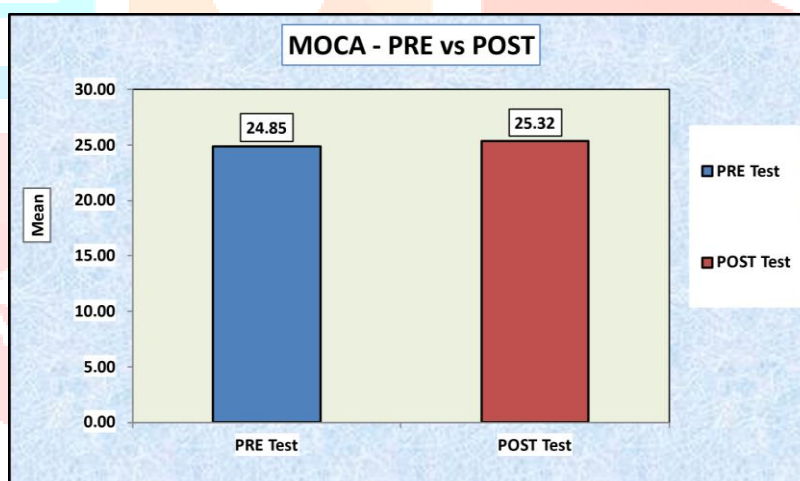


The bar graph shows menopause specific quality of life (MENQOL) questionnaire showing significant changes in vasomotor, psychosocial and physical domains.

Table no. 4 MOCA test scoring

Variable	Groups	N	Mean	SD	t value	p value
MOCA	PRE-Test	49	24.85	3.22	1.71	0.093
	POST -Test	49	25.32	2.34		

Among 49 post-menopausal women, the cognitive function does not show any significant difference as the p-value is 0.093(>0.005) which is not significant.



The graph represents Montreal cognitive assessment (MOCA) test showing no significant differences.

DISCUSSION

This study evaluates the effects of aerobic exercises on sleep quality, cognition and menopause specific quality of life in post-menopausal women aged 45-55 years of age. Our results showed that there is a significant improvement in the sleep quality and menopause specific quality of life in post-menopausal women, undergoing aerobic exercise program.

Exercises are said to be extremely important throughout the women's life time and particularly when she gets old. A daily moderate exercise has shown benefits in treating women with insomnia. Aerobic training shows decrease in frequency of symptoms in post-menopausal women. It has been suggested that the increased fitness by aerobic exercises may help to maintain good cognitive function in older age. ⁽³³⁾

An article by Kirsi Mansikkamaki et.al (2012) performed a randomized controlled trial on sleep quality and aerobic training among menopausal women, they took sedentary women with post-menopausal symptoms and given unsupervised aerobic training for 6 months. They found that aerobic training for 6 months may improve sleep quality and reduce hot flushes among symptomatic menopausal women. ⁽⁸⁾

Augustin Aibar in 2019 studied the effects of Pilates training on sleep quality, anxiety, depression and fatigue in post-menopausal women: A randomized controlled trial. In this a total of 110 women participated and allocated in control group and Pilates group. Outcome measure were PSQI, FSS and HADS. Study showed significant improvement after Pilates training in all PSQI domains as well as in PSQI total score but the analysis does not reveal the existence of any statistical difference between both study groups. ⁽¹⁾

The physiological changes that occur with training in cardiovascular system are increased stroke volume, increased cardiac output, increased extraction of oxygen by the working muscle, decreased blood flow per kilogram of the working muscle, decreased myocardial oxygen consumption. Respiratory changes during training are increased ventilatory efficiency, increased maximum minute ventilation. Metabolic changes are increased capacity to mobilize and oxidize fat, increased glycogen storage in muscle. Other systemic changes are decrease in body fat, decrease in blood cholesterol, increased heat acclimatization, increased tensile strength of tendons. ⁽³³⁾

The post-menopausal women who performed 3 weeks of aerobic exercises showed good results regarding their sleep as the difficulty in sleep quality is reduced. Improvement in sleep quality may be due to serotonin level as it regulates mood and behavior. ⁽³⁹⁾

The differences in findings can be due to confounding factors such as marital, employment status, household type, intake of herbal medicine and exercise type. Physical activity may decrease fatigue level and promote sleep quality through various mechanisms, possible reason could be due to anxiety reduction through exercises. Physical activity increase body temperature, the body seeks to regain its homeostasis and thereby uses the same processes during the sleep period to decrease body temperature in dilation of blood vessels and increased blood flow to the peripheral regions of the body. This process therefore acts as catalyst of sleep initiation. Moreover, studies showed the anti-depressant effects of exercise which mediated by nightly increases of non-rapid eye movement (NREM) and decreases in REM sleep as well as alteration of slow-wave sleep (SWS) through temperature elevation. Exercise is often advocated for physiological health benefits and could improve mental health by affecting fatigue level. ⁽²⁾

Also, satisfied results were seen in improving quality of life among post-menopausal women as their physical fitness, psychosocial factors are improved which usually affect after menopause. Hormonal changes particularly reduction of estrogen level with biological, psychological and social changes depending on the disorders of ovarian function and therefore lack of estrogen in post-menopausal period. Thus, symptoms are observed in the early period periods which affect the quality of life of women adversely. Therefore, post-menopausal symptoms can be prevented significantly encouraging the women over middle age to gain the habit of exercising regularly.

During this study, Sexual Domain was removed from the study due to cultural background and inconvenience in answering the type of personal questions. So in MENQOL questionnaire only vasomotor, psychosocial and physical domains were included.

The study by Linda Amalia, in dec 2021 studied the effects of aerobic exercises on estradiol plasma, quality of sleep and cognitive function in menopausal women. They took PSQI, MOCA as their outcome measure. They performed aerobic exercise for 90 mins twice a week for 12 weeks. Results showed that aerobic exercises can improve sleep quality and cognitive function but intensity of the exercises must be moderate to high and for more duration.

Early menopause was screened that why MOCA shows no significance in this study. Statistically it showed that among the total sample size i.e., 49, there is a significant change in SQS and MENQOL pre and post test score, whereas no significant difference is seen in MOCA test.

The statistic value of the outcome measures is: the p-value of SQS test is 0.000, p-value of MENQOL questionnaire according to the domains are- vasomotor with p-value of 0.002, psychosocial with p-value of 0.001, physical with p-value of 0.000, and lastly the p-value for MOCA test is 0.093 (> 0.005) which means it does not show any significant changes

In this study overall improvement is observed in sleep quality and quality of life among post-menopausal women performing aerobic exercises.

CONCLUSION

Aerobic exercises are helpful in providing all over improvements in symptomatic post-menopausal women. Thus, the post-menopausal women who aged from 45-55years who performed 3 weeks of aerobic exercise intervention had beneficial effects on sleep quality and quality of life but showed no significant changes on cognitive function.

LIMITATIONS:

- 1) Short intervention period.
- 2) Sample size can be more.

SUGGESTIONS:

- 1) Various Interventions can be performed for cognitive function in further studies.
- 2) More evaluations can be performed to study the effects of aerobics.
- 3) Follow ups should be taken.

FUNDING:

No funding was required

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