Comparative Study of the Effect of Resistance Exercises versus Aerobic Exercises in Postmenopausal Women Suffering from Insomnia

Gayatri Karandikar-Agashe, Ronika Agrawal

Incidence of insomnia is 35%–60% in postmenopausal women. Affected sleep quality, sleep duration may have a direct association with mortality. Sleeping pills are prescribed to tackle postmenopausal insomnia in women but have numerous side effects.

On the other hand, physiotherapy exercises provide various benefits when used to treat women. Thus, exercises such as aerobic and resistance training are useful in treatment of insomnia. This therapy is a safe and cost-effective method.

Study Objectives: The main objective of the study is to compare the effectiveness of resistance exercises versus aerobic exercises in postmenopausal women suffering from insomnia using the Pittsburgh Sleep Quality Index (PSQI). Materials and Methods: Sixty postmenopausal women with menopause <10 years, suffering from insomnia for >1 month and on no supplementary exercises were recruited and categorized conveniently into two groups of 30 each. Group A received resistance exercises and Group B aerobic exercises. PSQI was used to screen postmenopausal women. Women on hormone replacement therapy, with artificial menopause, with diagnosed osteoporosis (t > 2) were excluded. Group A underwent general strengthening program in the form of closed-chain exercise. Group B received aerobic exercises after calculating target heart rate (HR) using Karvonen’s formula in the form of brisk walking three times a week at 30%–60% of HRmax.

Results: Paired t-test done to evaluate pre- and postmean values of PSQI for Group A. P < 0.001 which is highly statistically significant. Paired t-test done to evaluate pre- and postmean values of PSQI for Group B. P < 0.001, which is highly statistically significant. Unpaired t-test was carried out to compare the mean difference (pre-post) of PSQI values of both the groups. P < 0.001 which is highly significant. The mean difference of Group A (i.e., 4) is more than the mean difference of Group B (i.e., 2.63) indicating that the intervention of resistance exercises is more effective. Conclusion: Aerobic exercises and resistance exercises, both are effective in reducing insomnia in postmenopausal women, but resistance exercises are more beneficial than aerobic exercises.

Keywords: Aerobic exercises, insomnia, postmenopausal women, resistance exercises

INTRODUCTION

Menopause means loss of ovarian follicular activity leading to permanent termination of menstruation at the conclusion of reproductive life. The clinical diagnosis is established following cessation of menstruation (amenorrhea) for 12 successive months without any other pathology.[1]
Average age of menopause in Indian women is 47.5 years. Insomnia is defined as difficulty with the initiation, maintenance, duration, or quality of sleep that results in the impairment of daytime functioning despite adequate opportunity and circumstances for sleep. Complaints of insomnia are common among postmenopausal women. Hormonal and physiological changes as well as lifestyle factors contribute to the high prevalence of sleep problems. Recognizing and appropriately treating sleep disorders represent an opportunity not only for improving the quality of life of women but also an opportunity to prevent the development of mood and medical disorders later in life.

Exercise is extremely important throughout woman’s lifetime and particularly as she gets older. There is a connection between insomnia and exercise. A daily moderate exercise has shown great benefits for insomnia. A study has shown that resistance training led to improvements in sleep as measured by a self-report sleep questionnaire. The training resulted in significant improvement in sleep quality by 38%. The Royal College of Obstetricians and Gynaecologists in the UK and The North American Menopause Society, 2002, has recommended aerobic exercises to improve psychological health and quality of life in vasomotor symptomatic women.

Insomnia symptoms affect negatively at home and workplace. Sleeping pills are prescribed to treat symptoms of postmenopausal insomnia but have various side effects. On the other hand, physiotherapy exercises provide lot of benefits. However, there is a scarcity of substantial literature comparing the effect of resistance exercises versus aerobic exercises used for solving this problem so the need of the study.

**Materials and Methods**

After obtaining ethical clearance from institutional ethical committee, 60 postmenopausal women with menopause <10 years, suffering from insomnia for >1 month, and on no supplementary exercises were recruited and categorized conveniently into two groups of 30 each: Group A received resistance exercises and Group B aerobic exercises. Pittsburgh Sleep Quality Index (PSQI) was used to screen postmenopausal women.

Women on hormone replacement therapy, those with artificial menopause, and those with diagnosed osteoporosis (t > 2) were excluded from the study.

Group A underwent general strengthening program in the form of closed-chain exercise. Frequency was three times a week (1 set in the 1st week, 2 sets in the 2nd week, and 3 sets in the 3rd week) for the duration of 20 min in 1st and 2nd week, 30 min in 3rd and 4th week. Exercises included 10–15 repetitions of modified push-ups, squats, forward backward and sideways lunges, calf raises, bridging, marching, and chair sit-ups. After every set rest period was given. Warm-up exercises (which included spot marching slowly and gradually increasing the speed) were given before conditioning phase and cool down exercises which included active stretching of the large muscle groups) followed the conditioning phase.

Group B received aerobic exercises after calculating target heart rate (THR) using Karvonen’s formula. Participants received training in the form of brisk walking three times a week at 30%–60% of HRmax (maximum HR) for 20 min in 1st and 2nd week, 30 min in 3rd and 4th week. For the first 2 weeks, participants were made to walk at 30% of HRmax and for remaining 2 weeks they walked between 40% and 60% of HRmax. Warm-up was given by asking the participant to do spot marching slowly and gradually increasing the speed. The exercise session was followed by cool down phase which included active stretching of large muscle groups.

**Results**

Unpaired *t*-test was done to compare the mean values of age and menopausal age for both the groups. The *P* value obtained was 0.266 and 0.674, respectively, which is insignificant. This indicates that both the groups are comparable as their baseline is equal [Table 1].

Paired *t*-test was done to evaluate pre- and postmean values of PSQI for Group A. *P* value obtained was <0.001 which is highly statistically significant [Table 2].

**Table 1: Comparison of mean age and menopausal age among both the groups using unpaired *t*-test (sample size 30)**

| Group          | Mean±SD     | *t*  | *P*  |
|----------------|-------------|------|------|
| Age            |             |      |      |
| Group A        | 50.70±2.95  | 1.123| 0.266|
| Group B        | 51.63±3.469 |      |      |
| Menopausal age |             |      |      |
| Group A        | 3.97±1.921  | 0.422| 0.674|
| Group B        | 4.17±1.744  |      |      |

*P*≤0.05 statistically significant. SD: Standard deviation

**Table 2: Comparison of mean Pittsburgh Sleep Quality Index values in Group A (resistance exercises) pre- and post-intervention using paired *t*-test (sample size 30)**

| PSQI                | Mean±SD     | *t*  | *P*  |
|---------------------|-------------|------|------|
| Preintervention     | 12±2.15     | 31.532| <0.001|
| Postintervention    | 8±1.819     |      |      |

*P*≤0.05 statistically significant. PSQI: Pittsburgh Sleep Quality Index, SD: Standard deviation
Paired *t*-test was done to evaluate pre- and post-mean values of PSQI for Group B. *P* value obtained was <0.001 which is highly statistically significant [Table 3].

Unpaired *t*-test was done to compare the mean difference (pre-post) of PSQI values of both the groups. The *P* value obtained was <0.001 which is highly statistically significant. The mean difference of Group A (i.e., 4) is more than the mean difference of Group B (i.e., 2.63), thus indicating that the intervention for Group A is statistically more effective [Table 4].

**DISCUSSION**

The aim of our study was to compare the effectiveness of resistance exercises versus aerobic exercises in postmenopausal women suffering from insomnia. Participants of age between 45 and 57 years were part of the study. They were selected from various areas in and around Pune.

Table 1 shows comparison of two groups for age and menopausal age before intervention. *P* value is 0.266 and 0.674, respectively. This shows two groups were similar at baseline, thus the results obtained are because of the intervention only.

According to Table 2, mean pre- and post-PSQI scores for Group A (resistance training group) are 12 and 8, respectively, with *P* < 0.001 that is highly statistically significant.

Participants in our study underwent resistance training in the form of closed-chain exercises of the upper limb and lower limb. In the body, the pineal gland is a neuroendocrine organ secreting melatonin which plays the central role in coordination of circadian rhythm and system. The circadian system consists of a central biological master clock located in the suprachiasmatic nucleus of the hypothalamus and peripherally located biological clocks in the skeletal muscle tissues. This peripheral clock can work independently but is synchronized by the master clock. Master clock responds to external cues such as exercise, light-dark cycle, and nutrient intake.[20]

Most important hormones which are affected by circadian clock are melatonin and growth hormone. Melatonin chemically causes drowsiness and lowers body temperature. Growth hormone is essential to the repair and restoration processes of the body are also secreted during sleep, particularly during deep, non-rapid eye movement sleep. These hormones are regulated by actual sleep and not by circadian rhythm per se,[6] so when the participants performed resistance exercises, it stimulated the peripheral clock and resulted in the secretion of melatonin and growth hormone. Therefore, actual sleep was induced.

According to Table 3, the mean pre- and post-PSQI scores for Group B (aerobic training group) are 11.57 and 8.93, respectively, with *P* < 0.001 that is highly statistically significant.

It is observed that anxiety is one of the markers of insomnia and a stimulus capable of reducing anxiety improves sleep.[18] In the study, intensity of aerobic exercise ranged from 30% to 60% of THR that is moderate intensity. This is supported by Lianas AC et al., who concluded that moderate exercise is more effective than strenuous as strenuous exercise work against the original goal of reducing insomnia due to increase in anxiety level.[19] This study found that exercise training induced significant improvement in subjective sleep quality in postmenopausal women due to reduction in anxiety. Furthermore, aerobic exercise triggered an increase in body temperature followed by a postexercise drop in temperature that promoted falling asleep.

Table 4 shows comparison of mean differences of pre-post-PSQI values of Group A and Group B, respectively, with *P* < 0.001 that is statistically significant. Since the mean difference value of Group A (that is 4) is more than that of Group B (that is 2.63), it statistically showed that resistance exercises were more effective than aerobic exercises.

Resistance training activates the peripheral clock which synchronizes with the circadian clock of the body. As circadian clock regulates sleep through production and release of melatonin and also reduces core body temperature simultaneously, while aerobic exercise only works on core body temperature than hormonal release. Hence, resistance training was more effective than aerobic training.[20,21]

### Table 3: Comparison of mean Pittsburgh Sleep Quality Index values in Group B (aerobic exercises) pre- and post-intervention using paired *t*-test (sample size 30)

| PSQI      | Mean±SD             | *t* | *P*  |
|-----------|---------------------|-----|------|
| Preintervention | 11.57±2.144         | 13.135 | <0.001 |
| Postintervention | 8.93±2.303         |       |      |

*P*≤0.05 statistically significant. SD: Standard deviation, PSQI: Pittsburgh Sleep Quality Index

### Table 4: Comparison of mean difference (pre-post) of Pittsburgh Sleep Quality Index values among both the groups Using unpaired *t*-test (sample size 30)

| PSQI | Mean difference±SD | *t* | *P*  |
|------|--------------------|-----|------|
| Group A | 4±0.694          | 5.761 | <0.001 |
| Group B | 2.63±1.098       |       |      |

*P*≤0.05 statistically significant. SD: Standard deviation, PSQI: Pittsburgh Sleep Quality Index
In the study, baseline comprehensive sleep assessment of participants was not done. Furthermore, though the groups were similar at the baseline which was confirmed by statistical tests, confounding factors pertaining to differences between groups such as depression were not considered. These were the limitations of the study.

**CONCLUSION**

Aerobic exercises and resistance exercises, both are effective in reducing insomnia in postmenopausal women, but resistance exercises are more beneficial than aerobic exercises.

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**Conflicts of interest**

There are no conflicts of interest.

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