Effect of Home-Based Simplified Resistive Exercise on Insomnia, Sleep Quality, and Psychological Well-being among Postmenopausal Older Women

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Abstract

Postmenopausal women often experience insomnia as one of the major complaints and a public health concern, which affect sleep quality and psychological well-being with advancing age. Therefore, the study **aims** to appraise the effect of a home-based simplified resistive exercise on insomnia, sleep quality and psychological well-being among postmenopausal older women. **Methods:** A quasi-experimental design was employed, with a purposive sample of 184 women aged 60 years and above assigned to either an exercise group (n = 92) or a control group (n = 92) from Elzankloun village in Zagazig city. The control group received a health education, while the exercise group received a similar education and resistive exercise training program. Pre and post intervention assessments were collected from both groups using Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI) and Psychological Well-being Scale (PWBS). **Results:** The exercise group exhibited a significant improvement in sleep quality (p <.01), psychological wellbeing (p <.01), and insomnia severity (p <.01) post-intervention compared to the control group. **Conclusion:** The findings support the beneficial effects of a home-based simplified resistive exercise on insomnia, sleep quality, and psychological well-being among postmenopausal older women. **Recommendations:** Further research is recommended to validate these findings and explore the underlying mechanisms of other types of physical exercise on the outcomes of interest. Adopting an active lifestyle after menopause through designing and implementing variety of exercise programs specifically tailored for older adult's women.

Keywords: Home-Based, Insomnia, Older Women, Postmenopausal, Psychological Well-Being, Resistive Exercise, Sleep Quality

Introduction

Menopause is a natural biopsychosocial phenomenon in older women that associated with the hormonal fluctuation and slow deterioration of ovarian follicles **(Jalal, 2024)**. Hormonal changes, such as a significant drop in progesterone and estrogen levels, have been specifically determined to be the cause of a loss in physical health and a range of menopausal symptoms, involving hot flashes, night sweating, swings in mood, palpitations, headaches, anxiety, depression, sleep issues, and genitourinary problems. It is observed that older women's sleep, general well-being, and everyday functioning are all directly affected by these vasomotor complaints **(Bagga et al., 2024)**.

Sleep is crucial for the body's maintenance and repair, particularly during menopause, the significant transitional period with changing hormone levels. Poor sleep quality has been linked to a number of detrimental health consequences, including cardiovascular disease, high mortality, declines in cognitive and physical function, and poor health-related quality of life **(Seo & Mattos, 2024)**. Sleep problems are common among women; who experiencing trouble falling asleep and report having insomnia after menopause **(Carmona et al., 2023)**.

Insomnia defined as a disturbance in initiation, maintenance, duration, or quality of sleep that interferes with daily functioning, even in the presence of suitable sleep opportunities and conditions. Actually, the menopausal stage is when many sleep issues, such as shorter sleep duration, poorer sleep quality, and early morning awakenings, first appear **(Massoud et al., 2023)**. Compared to the early stages of menopause, insomnia symptoms were more common in the latter. Up to 26% of women after menopause suffer from chronic clinical insomnia, which is typified by significant sleep complaints and daytime impairment **(Benge et al., 2024)**.

One of the consequences of insomnia can be on the psychological health of older adults. Achieving psychological well-being involves a complex interaction of social, cognitive, and emotional elements that help managing stress, upholding positive relationships, and feeling fulfilled in life **(Okulicz-Kozaryn & Morawski, 2021)**. It encompasses resilience [capacity to overcome adversity], self-esteem [belief in own abilities and value], life satisfaction [overall assessment of person's life], and positive affect [experience of positive emotions] **(Hossen & Mohd Pauzi, 2023)**.

Sustaining psychological well-being in old age is essential for promoting sense of purpose, independence, and better physical health outcomes **(Dennis et al., 2023; Zhang et al., 2023)**.

Interestingly, one of the emotional responses that older persons who participate in active physical activity frequently express following exercise is psychological well-being, which is a phenomenon of emotional improvement or hedonistic pleasure **(lee et al., 2022)**.

Resistive exercises boost not only the physical and psychological health of older adults but also have a beneficial role in promoting healthy sleep and reducing postmenopausal symptoms, contributing to significantly balanced and active aging **(Souza et al., 2022)**. In this context, one multifaceted strategy that can address both the psychological and physical facets of health is physical exercise. Reduced sleep latency, longer deep sleep duration, and fewer nighttime interruptions are from the improvements of exercising in old age. Furthermore, physical activity, particularly functional exercise, demonstrate a positive impact on reducing insomnia and promoting more consistent sleep patterns in postmenopausal women (PMW) **(Darraz et al., 2021; Peixoto, 2021)**.

Health-related educational programs seem to be vital for the older adults to improve the quality of life. A collection of personal practices known as "sleep hygiene" improves also the quality of sleep **(Kovacevic et al., 2018)**. Therefore, one of the main responsibilities of gerontological nurses is to inform postmenopausal women about environmental and behavioral variables that support better sleep. These include limiting naps, avoiding caffeine and excessive drinks in the afternoon, establishing a regular bedtime, getting enough sunlight, and creating a sleep environment that promotes rest. Additionally, early sleep hygiene techniques and active lifestyle as resistance exercise training have become a public health priority and a crucial health promotion strategy for supporting mental and physical health in old age **(Meghani et al., 2018; Jeon, 2024)**.

Significance of the study

As life expectancy increases, more women experience menopause for about one-third of their lives **(Qian et al., 2023)**. Postmenopausal women frequently experience sleep issues; between 35 to 60 percent report having insomnia, one of the most common sleep disorders, as a result of menopausal symptoms **(Carmona et al., 2023)**. Sleep disturbances have detrimental short and long-term consequences on the older age group, posing greatly distress for menopausal women. Short-term effects include increased stress responsiveness, poor quality of life, mood and mental health disorders, memory problems, and psychological well-being issues, while long term effects include dyslipidemia, hypertension, and cardiovascular disease **(Gupta et al., 2022)**. In light of the substantial public health challenges, economic burdens, and adverse effects of traditional treatments of sleep problems on postmenopausal women, it is a paramount importance to adopt and implement non-pharmaceutical, and alternative affordable approaches. Sleep hygiene and physical exercises emerge as a supportive strategy to counteract hormonal and physiological changes that interfere with sleep patterns and cause a spectrum of sleep-related challenges in older adults, especially women. Physical activity has numerous benefits for physical and psychological health for older adults experiencing postmenopausal challenges as a key health promotion strategy. Consequently, this study was executed to appraise the effect of home-based simplified resistive exercise on insomnia, sleep quality, and psychological well-being among postmenopausal older women.

Aim

The study aimed to appraise the effect of a home-based simplified resistive exercise on insomnia, sleep quality and psychological well-being among postmenopausal older women.

Objectives

- Assess insomnia severity, sleep quality, and psychological wellbeing levels among post-menopausal older women.
- Develop and implement resistive exercise training program for postmenopausal older women.
- Evaluate the effect of resistive exercise training program on insomnia severity, sleep quality, and psychological wellbeing levels among postmenopausal older women.

Research hypotheses

Hypothesis 1: Insomnia severity will be decreased among exercise group compared to control group after implementing resistive exercise training program.

Hypothesis 2: Sleep quality will be improved among exercise group compared to control group after implementing resistive exercise training program.

Hypothesis 3: Psychological well-being will be enhanced among exercise group compared to control group after implementing resistive exercise training program.

Subjects and methods

Design

A quasi-experimental design with pre-posttest was used to execute the study.

Setting

The study was implemented in a village called " Elzankloun "; that was one of the 75 villages of " Zagazig center" which located in Sharqia governorate, Egypt. A multistage cluster technique was used in

recruiting study subjects as shown in **fig. 1** according to the eligibility criteria, as followed:

1st stage (selection of district): The study was carried out in Sharkia Governorate, which comprises 23 districts. Simple random sampling technique was used to pick up district, it was Zagazig district.

2nd stage (selection of village): The researcher picked up one village, "Elzankloun," at random from the 75 major villages.

3rd stage (selection of participants): The chosen village was divided into multiple clusters. From each cluster five streets were selected randomly and finally building from these streets included (door to another door) to yield the desired sample.

Study subjects

A purposive sample of 184 postmenopausal older women (92 in the exercise group and 92 in the control group) were selected from the above-mentioned setting. Participants with the following characteristics were included: women aged ≥ 60 years, and able to communicate. Exclusion criteria included (1) women who are use hormonal replacement therapy (2) women who had undergone ovariectomy and hysterectomy; (3) suffer from hearing or physical disabilities, and (4) participants with debilitating neurological diseases as Alzheimer's and Parkinson's. The sample size was calculated according to **ELvasky & McAuley (2007)**, who found that Mean ±SD of sleep quality post intervention program in older women was (6.9±3.94) and (5.46± 2.96) in control group, confidence level is 95% two side with power of study 80%. Sample size calculated using Open Epi, is 92 older women in each group.

Data collection

Tool I: A structured schedule questionnaire

The researchers reviewed the relevant literature to collect the data required for the study. This questionnaire included the following demographic information; age, marital status, educational level, income, occupation, and age at menopause. Additionally, it comprised postmenopausal symptoms as sweating, feeling tense or anxious, feeling dissatisfied with personal life, having trouble remembering things, feeling less accomplished, having gas or bloating, pain in muscles and joints, and feeling tired or exhausted. Problems associated with sleep involved pain, nocturnal urination, snoring at night, and difficulty breathing were also collected.

Tool II: Insomnia Severity Index (ISI)

Insomnia Severity Index is a seven-item measure that developed by Bastien et al. (2001) to evaluate the severity of insomnia as well as the type and symptoms of sleep problems. The ISI includes a five-point Likert scale from zero to four, with higher scores indicate more severe insomnia symptoms. The questionnaire asks about subjective aspects of the sleep, such as the severity of symptoms, the respondent's satisfaction with her sleep patterns, the degree to which insomnia interferes with daily functioning, how noticeable the respondent feels her insomnia is, and the overall level of distress from the sleep problem. The total scores ranging from 0 to 7 indicate "no clinically significant insomnia," 8 to 14 indicate "sub threshold insomnia," 15 to 21 indicate "clinical insomnia (moderate severity)," and 22 to 28 indicate "clinical insomnia (severe degree of insomnia).

Tool III: Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index is a self-report questionnaire consisting of 19 items that developed by Buysse et al. (1989) to evaluate sleep disturbances and quality over one month. Respondents were asked about their typical bedtime, time to fall asleep, typical wake-up time, and actual sleep duration in the first PSQI items. The remaining 15 Likert-type items ask about subjective sleep quality and the frequency of sleep disturbances during the previous month. It involves nine items in total, but the fifth question has ten sub-items. The items are scored on a four-point Likert scale, with zero denoting no problem and three denoting significant difficulties. There are seven subscales in this questionnaire, including subjective sleep quality, latency, duration, habitual efficiency, disturbances, sleep medication use, and daytime dysfunction.

One global score, ranging from 0 to 21, is attained by adding the scores of the seven component parts and higher scores indicate lower-quality sleep. A global score of ≤ five indicates good sleep quality, while score ≥ five indicate poor sleep quality.

Tool IV: Psychological Well-being Scale (PWBS)

Psychological well-being scale is 18 items self-reported instrument that designed by Ryff and Keyes (1995). The scale assesses six domains of psychological well-being; autonomy, environmental mastery, self-acceptance, personal growth, positive relations with others, and purpose in life. Each of the subscales contains three items. A six-point Likert scale, with 1 denoting "strongly disagree" and 6 denoting "strongly agree," is used to rate the items. Each subscale has a score range of 3–18, and the overall score range is 18–108. Higher psychological well-being is indicated by a higher score.

Methods of data collection

1. A formal approval from Faculty of Nursing Zagazig University and the mayor of Elzankloun village was obtained to conduct the proposed study.

2.The older women give their consent. As participants responded to the questionnaire, the researchers encouraged them to participate and share their emotions.

3. The participants were granted the right to withdraw from the study at any time during its duration, and all data obtained was kept completely confidential and utilized exclusively for scientific purposes.
4. To ensure that the instruments met the study's goals, three experts in the fields of community health nursing, psychiatric nursing, and gerontological nursing at Zagazig University evaluated the instruments.
5. Before the main study started, a pilot sample of 20 older women (10% of the sample) was gathered to make sure the items were clear and understandable and to gauge how much time it would take to complete the tools.
6. The reliability of the ISI, PSQI, and PWBS showed satisfactory Cronbach's alpha reliability coefficients of.632, .850, and.882, respectively. The study included data from the piloted women because no changes were required.

Fieldwork

The study was carried out at Elzankloun village over a six-month period, from the start of October 2023 to the end of March 2024. Participation in the study required informed consent prior to the beginning of the intervention. Data was collected from the control group, which received regular health check-ups and medication management along with health education on stress management, sleep hygiene, and menopause management. A program of resistance exercise training and health education was given to the exercise group. The researchers interviewed two to five older woman each day.

For ten weeks, each member of the exercise group received ten sessions (six theoretical and four practical) in their homes once a week. Resistive exercises such as chair stands and balance drills, as well as upper body exercises like seated row and lower body squats, are examples of resistant exercises. Pre-exercise preparation, a 5- to 10-minute warm-up consisting of light cardio (walking & marching) and dynamic stretching (arm circles & leg swings), breathing techniques that promote deep, diaphragmatic breathing, and posture correction are some of the preventative measures for older adults' resistance training. Exercise techniques include maintaining proper posture and alignment, focusing on slow and controlled muscle lengthening, increasing resistance gradually as strength increases, and, lastly, mobilizing soft tissues. The assessment, planning, execution, and evaluation were all included in the program.

Assessment phase

The pretest was taken individually by each woman in the exercise and control groups one week before starting the intervention. Each item on the data collection tool was explained to older women by the researchers, who then recorded their answers. Individually 30-45 minutes exercise group sessions were conducted once a week for ten weeks.

Planning phase

A health education colored illustrative booklet was established in simple Arabic language to be distributed to each participant in the study. The booklet's objectives and content were tailored to the needs of the older women. There were two main sections in this booklet. First, the theoretical section covered the introduction about of menopause and its definition, postmenopausal symptoms, sleep stages, sleep changes with ageing, and common sleep problems. It also covered benefits of physical activity for elderly and its types, resistive exercises; definition, and importance, psychological well-being, definition and its dimensions. Second, a section with practical training on resistive exercises, strategies to improve sleep, and five ways to enhance psychological well-being.

Implementation

There were ten sessions, the duration of each session differed based on how well older women retained the material and varied by their response, accessibility to time, and the subject matter of each session. Each session ranged 30 to 45 minutes and including 5 minutes for discussion and feedback. The lecture, discussion, and demonstration method were used to impart knowledge and practice the exercises. Additionally, self-designed pamphlets and leaflets were distributed after the session to promote knowledge and understanding of the value of resistive exercise. The following sessions were held for older women in the exercise group.

- ***Session 1***: The researchers started this session by introducing themselves to the older women and explaining the goal of the training program. This session's content included a quick overview of menopause and postmenopausal symptoms. The session finished with a summary and feedback. Pre-test information was gathered from every participated woman.
- ***Session 2***: Educating participants the stages of sleep and sleep changes with aging.
- ***Session 3***: Informing participants about common sleep problems, definition of insomnia and its symptoms.
- ***Session 4:*** Providing a comprehensive overview about strategies to improve the sleep and the general safety guidelines during exercising.
- ***Session 5***: Educating participants types of resistive exercises and its importance.
- ***Session 6***: Educating participants domains and factors contributing psychological well-being.
- ***Session 7***: Training participants overhead press exercise and elbow side extension exercise. Most

participants were cooperative and asked to continue the exercises training.

- ***Session 8***: Training participants squats by using a chair, and chest press exercise using dumbbells or resistance bands.
- ***Session 9***: Training participants seated rows exercise using dumbbells or resistance bands, and leg extensions exercise using ankle weights or resistance bands.
- ***Session 10***: Training the participants abdominal crunch exercise and seated shoulder press exercise.

Evaluation

After one month following the intervention, the evaluation (Post-test) was conducted to evaluate participant's sleep quality, insomnia severity, and psychological well-being using the same tools as the pre-test.

Ethical considerations

The study was formally approved by the faculty of nursing's research ethics committee under code ID/ZU.Nur.REC#:0123. Furthermore, the Mayor of Elzankloun village received official letters from the Dean of Zagazig University's Faculty of Nursing, granting permission for the intervention's implementation and data collection. After being fully explained the purpose of the study, each women gave her consent to participate. In addition to being given the option to decline participation at any point during study. They were also assured that all data would be kept confidential and used exclusively for the study.

Data analysis

Utilizing the Statistical Package for Social Science (SPSS) version 25 for Windows on an IBM compatible computer, the gathered data was arranged, tabulated, and statistically examined. Descriptive statistics were applied in the form of frequency, percentages, mean and standard deviation. The Chi-square test was used to compare qualitative variables, and the paired and independent samples t-tests were used to compare quantitative variables. The correlation between the variables under study was examined using the correlation coefficient test (r). The relationship between a scalar response and one or more explanatory variables was modeled using a linear regression model. Cronbach's Alpha was used to assess the study tools' reliability. $P < 0.05$ was regarded as a significant level value, and $p < 0.01$ as a highly significant level value. When $p \geq 0.05$, no statistically significant difference was taken into account.

Results

Table 1 shows that mean age of the exercise and control group was 67.65 ± 4.34 and 68.32 ± 4.27, respectively. While the mean age at menopause was 51.77 ± 3.47 for exercise group and 52.29 ± 2.91 for control group. For exercise group, 32.6%, 62.0%, 93.5%, and 56.5% had intermediate education, unmarried, not working and enough monthly income, respectively.

Table 2 clarifies that the most common postmenopausal symptoms in the exercise and control group were muscles and joint pain with percentage 65.5% and 52.2%, respectively. while sweating was reported with percentage 40.2% and 35.9% in the exercise and control group, respectively. Also, the table reveals that the most reported sleep problems in the exercise and control group was snoring at night (40.2% & 37.0%, respectively).

Table 3 indicates that there was a significant decrease in insomnia severity in the exercise group after the training program with a highly statistically significant difference ($P \leq 0.01$). As proof, 6.5% of the exercise group have no clinically significant insomnia at pre intervention, while increased to 56.5% post intervention. Also, there is no significant difference between exercise and control group regarding insomnia severity at pre intervention ($P \geq 0.05$). Moreover, there is no significant difference between insomnia severity among the control group at pre and post implementation of resistive exercise training program ($P \geq 0.05$).

Table 4 denotes that 18.5% of the exercise group has good sleep quality at pre-intervention phase with Mean ± SD was 11.0 ± 4.2, while increased to 78.3% post-intervention phase with Mean ± SD was 5.67 ± 1.7. The same table also shows that 21.7% of the control group had good sleep quality at pre-intervention phase with Mean ± SD was 10.2 ± 3.7, while improved to 25.0% at post-intervention phase with Mean ± SD was 10.07 ± 3.8.

Table 5 shows a significant improvement in all psychological well-being domains among exercise group after the training program with a highly statistically significant difference ($P \leq 0.01$). The exercise group's mean score for overall psychological well-being was 48.96 ± 11.2 before the intervention and improved to 76.01 ± 10.9 after the intervention. Additionally, there is no significant difference between the exercise and control groups in any of the psychological well-being domains ($P \geq 0.05$) at the pre-intervention phase. Moreover, there is not a significant difference in any of the psychological well-being domains among the control group at pre and post intervention phase ($P \geq 0.05$).

Figure 2 displays that total mean score of sleep quality and psychological well-being in the exercise group was improved post intervention (from 11 and 48.9 to 5.67 and 76.01, respectively) compared to control group (from 10.02 and 48.25 to 10.07 and 48.31, respectively). The figure also shows that total

mean of insomnia severity in the exercise group was decreased post intervention from 14.72 to 7.93. While slightly changed in the control group from 13.94 to 13.89 at post intervention phase.

Table 6 shows a highly statistically significant positive correlation ($p < 0.01$) between the severity of insomnia and poor sleep quality in both exercise and control groups at pre and post intervention phase. Additionally, there was a highly significant negative correlation ($p < 0.01$) between the exercise and control groups' psychological well-being, poor sleep quality, and the severity of insomnia before and after the intervention.

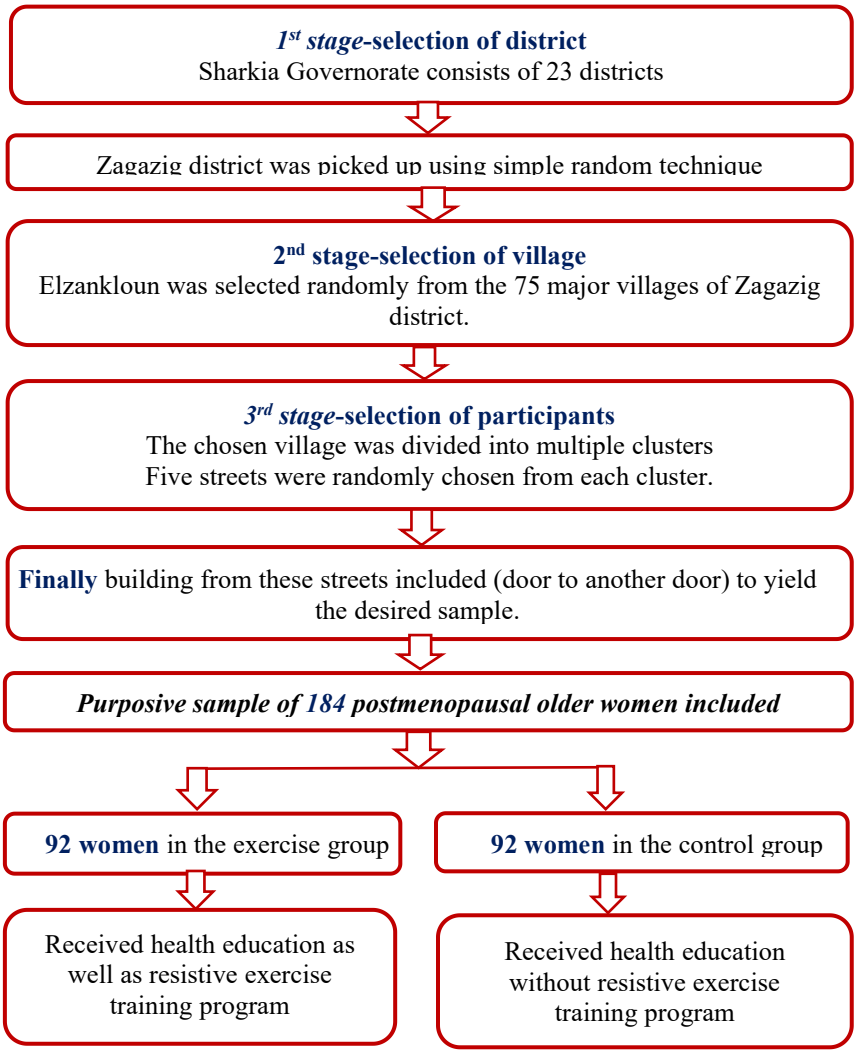

Figure 1. Flow chart of sampling procedure

Table 1. Demographic characteristics of the studied women

Characteristic	Exercise group (N=92)		Control group (N=92)		X^2	P-Value
	No.	%	No.	%		
Age					1.043	.307
60 - 70 years	72	78.3	66	71.7		
71 - 80 years	20	21.7	26	28.3		
Mean ± SD	67.65±4.34		68.32±4.27		t=1.092	.277
Education level					1.439	.837
Illiterate	5	5.4	6	6.5		
Read and write	28	30.4	26	28.3		
Intermediate education	30	32.6	29	31.5		
Above intermediate education	10	10.9	15	16.3		
High education	19	20.7	16	17.4		
Marital status					1.243	.743
Married	35	38.0	39	42.4		
Unmarried	57	62.0	53	57.6		
Age at menopause					.970	.325
45 -< 50 years	18	19.6	13	14.1		
50 - 55 years	74	80.4	79	85.9		
Mean ± SD	51.77±3.47		52.29±2.91		t=1.104	0.271
Occupation					.083	.774
Working	6	6.5	7	7.6		
Not working	86	93.5	85	92.4		
Monthly Income					2.095	.351
Not Enough	34	37.0	36	39.1		
Enough	52	56.5	54	58.7		
Enough and more	6	6.5	2	2.2		
Source of monthly income					1.543	0.462
Pension	71	77.2	76	82.6		
Social assistance	13	14.1	12	13.0		
Assistance from relatives	8	8.7	4	4.3		
Living with					1.723	0.423
Wife	35	38.0	39	42.4		
One of the children	30	32.6	22	23.9		
One of the relatives	0	0.0	0	0.0		
Alone	27	29.3	31	33.7		
Body mass index					2.865	0.413
Underweight	2	2.2	3	3.3		
Normal weight	47	51.1	37	40.2		
Over weight	25	27.2	26	28.3		
Obese	18	19.6	26	28.3		

X^2: Chi-square test. **SD**: Standard deviation.
t: Independent t-test
No Statistically significant at p >0.05.

Table 2. Postmenopausal symptoms and problems while sleeping in the studied women

Characteristic	Exercise group (N=92)		Control group (N=92)		X^2	P-Value
	No.	%	No.	%		
Postmenopausal Symptoms						
Night sweats	19	20.7	15	16.3	.577	.447
Sweating	37	40.2	33	35.9	.369	.544
Dissatisfaction with personal life	16	17.4	17	18.5	.037	.848
Feeling anxious or tense	27	29.3	31	33.7	.403	.526
Poor memory	16	17.4	20	21.7	.553	.457
less accomplishment	37	40.2	34	37.0	.206	.650
Bloating/gas pain	22	23.9	26	28.3	.451	.502
Muscle and joint pain	52	56.5	48	52.2	.350	.554
Feeling tired or exhausted	32	34.8	28	30.4	.396	.529
Have problems while sleeping						
Feeling pain	27	29.3	24	26.1	.244	.621
Nocturnal urination	12	13.0	15	16.3	.391	.532
Snoring at night	37	40.2	28	30.4	1.927	.165
Difficulty breathing	5	5.4	10	10.9	1.815	.178
Nothing	34	37.0	40	43.5	.814	.367

X^2: Chi-square test.
No Statistically significant at p >0.05.

Table 3. Insomnia severity among the exercise and control group at pre and post intervention

Insomnia severity	Exercise group (N=92)				Control group (N=92)				Test of significance			
	Pre intervention		Post intervention		Pre intervention		Post intervention		(p_1)	(p_2)	(p_3)	(p_4)
	No.	%	No.	%	No.	%	No.	%				
No clinically significant insomnia	6	6.5	52	56.5	9	9.8	10	10.9	**X^2=86.69 p=0.000****	**X^2=0.216 p=0.975**	**X^2=1.206 p=0.751**	**X^2=69.46 p=0.000****
Subthreshold insomnia	36	39.1	40	43.5	39	42.4	41	44.5				
Moderate	40	43.5	0	0	34	36.9	32	34.8				
Severe	10	10.9	0	0	10	10.9	9	9.8				
Mean ± SD	**14.72±5.04**		**7.93±2.99**		**13.94±5.39**		**13.89±5.20**		**t^1=11.10 p=0.000****	**t^1=0.070 p=0.945**	**t^2=1.016 p=0.311**	**t^2=9.516 p=0.000****

X^2: Chi-square test. **t^1:** Paired t-test. **t^2:** Independent t-test**. P:** p-value. **SD:** Standard deviation**.**
No significant at p >0.05. ******Highly significant at p ‹ 0.01.
P_1: p value for comparing between the (**Exercise group**) in pre and post intervention.
P_2: p value for comparing between the (**Control group**) in pre and post intervention.
p_3: p value for comparing between the **(Exercise and Control group)** in pre intervention.
p_4: p value for comparing between the **(Exercise and Control group)** in post intervention

Table 4. Sleep quality among the exercise and control group at pre and post intervention

Sleep quality components		Exercise group (N=92)				Control group (N=92)				Test of significance			
		Pre		Post		Pre		Post		(p_1)	(p_2)	(p_3)	(p_4)
		No.	%	No.	%	No	%	No.	%				
Subjective sleep quality	Very good	9	9.8	29	31.5	11	12	9	9.8	**X^2=36.47 p=0.000****	**X^2=0.245 p=0.970**	**X^2=1.056 p=0.788**	**X^2=32.16 p=0.000****
	Fairly good	42	45.7	54	58.7	43	46.7	45	78.9				
	Fairly bad	22	23.9	9	9.8	24	26.7	24	26.1				
	Very bad	19	20.7	0	0	14	15.2	14	15.2				
Sleep latency (min)	≤15	8	8.7	30	32.6	11	12.0	10	10.9	**X^2=55.34 p=0.000****	**X^2=0.145 p=0.986**	**X^2=2.109 p=0.550**	**X^2=42.11 p=0.000****
	16 ~ 30	21	22.8	30	32.6	26	28.3	28	30.4				
	31 ~ 60	21	22.8	31	33.7	22	23.9	21	22.8				
	≥60	42	45.7	1	1.1	33	35.9	33	35.9				
Sleep duration (h)	≥7	12	13	21	22.8	10	10.9	10	10.9	**X^2=14.55 p=0.002****	**X^2=0.231 p=0.972**	**X^2=3.516 p=0.319**	**X^2=8.254 p=0.041***
	6 ~ 6.9	28	30.4	36	39.1	39	42.4	42	45.7				
	5 ~ 5.9	21	22.8	25	27.2	21	22.8	20	21.7				
	≤4.9	31	33.7	10	10.9	22	23.9	20	21.7				
Sleep efficiency (%)	≥85	14	15.2	26	28.3	12	13	12	13	**X^2=43.27 p=0.000****	**X^2=0.242 p=0.970**	**X^2=2.719 p=0.437**	**X^2=28.63 p=0.000****
	75 ~ 84	29	31.5	58	63	38	41.3	41	44.6				
	65 ~ 74	21	22.8	5	5.4	22	23.9	21	22.8				
	≤64	28	30.4	3	3.3	20	21.7	18	19.6				
Sleep disturbance	0	4	4.3	24	26.1	1	1.1	1	1.1	**X^2=46.23 p=0.000****	**X^2=0.04 p=0.999**	**X^2=3.297 p=0.348**	**X^2=43.43 p=0.000****
	1 ~ 9	35	38	56	60.9	44	47.8	45	48.9				
	10 ~ 18	45	48.9	12	13	41	44.6	40	43.5				
	19 ~ 27	8	8.7	0	0	6	6.5	6	6.5				
Use of sleep medication	Not during past month	27	29.3	65	70.7	28	30.4	31	33.7	**X^2=49.06 p=0.000****	**X^2=0.264 p=0.967**	**X^2=2.175 p=0.537**	**X^2=37.38 p=0.000****
	< once/week	17	18.5	20	21.7	23	25	21	22.8				
	1 or 2 times/week	25	27.2	7	7.6	25	27.2	24	26.1				
	≥ 3 times/week	23	25	0	0	16	17.4	16	17.4				
Daytime dysfunction	Very good	28	30.4	44	47.8	32	34.8	33	35.9	**X^2=23.71 p=0.000****	**X^2=0.029 p=0.986**	**X^2=3.506 p=0.320**	**X^2=15.74 p=0.000****
	Fairly good	35	38	44	47.8	37	40.2	36	39.1				
	Fairly bad	26	28.3	4	4.2	23	25.0	23	25				
	Very bad	3	3.3	0	0.0	0	0.0	0	0.0				
Global sleep quality	**Good quality (≤5)**	**17**	**18.5**	**72**	**78.3**	**20**	**21.7**	**23**	**25**	**X^2=65.83 p=0.000****	**X^2=0.273 p=0.601**	**X^2=0.304 p=0.581**	**X^2=52.25 p=0.000****
	Poor quality (> 5)	**75**	**81.5**	**20**	**21.7**	**72**	**78.3**	**69**	**75**				
Mean ± SD		**11.0±4.2**		**5.67±1.7**		**10.2±3.7**		**10.07±3.8**		**t^1=11.25 p=0.000****	**t^1=0.269 p=0.788**	**t^2=1.375 p=0.171**	**t^2=9.934 p=0.000****

X^2: Chi-square test. **t^1:** Paired t-test. **t^2:** Independent t-test**. P:** p-value. **SD:** Standard deviation**.**
No significant at p >0.05. ***** Significant at p ‹ 0.05. ******Highly significant at p ‹ 0.01.
P_1: p value for comparing between the (**Exercise group**) in pre and post intervention.
P_2: p value for comparing between the (**Control group**) in pre and post intervention.
p_3: p value for comparing between the **(Exercise and Control group)** in pre intervention.
p_4: p value for comparing between the **(Exercise and Control group)** in post intervention.

Table 5. Psychological well-being among the exercise and control group at pre and post intervention.

Domains	Exercise group (N=92)		Control group (N=92)		Test of significance			
	Pre intervention Mean ± SD	Post intervention Mean ± SD	Pre intervention Mean ± SD	Post intervention Mean ± SD	(p_1)	(p_2)	(p_3)	(p_4)
Autonomy	9.09±2.55	13.53±2.84	9.26±2.90	9.38±2.94	**t^1=10.48 p=0.000****	**t^1=0.661 p=0.510**	**t^2=0.404 p=0.687**	**t^2=9.717 p=0.000****
Environmental mastery	8.28±2.43	13.20±3.13	8.45±2.45	8.48±2.45	**t^1=11.45 p=0.000****	**t^1=0.418 p=0.677**	**t^2=0.483 p=0.630**	**t^2=11.37 p=0.000****
Personal growth	9.60±3.36	13.65±3.59	9.36±3.27	9.48±3.30	**t^1=7.779 p=0.000****	**t^1=0.661 p=0.510**	**t^2=0.489 p=0.626**	**t^2=8.174 p=0.000****
Positive relations with others	7.38±2.68	11.72±2.88	7.23±2.75	7.26±2.65	**t^1=10.40 p=0.000****	**t^1=0.352 p=0.726**	**t^2=0.352 p=0.725**	**t^2=10.92 p=0.000****
Purpose in life	6.75±2.48	11.53±2.60	6.15±2.42	6.02±2.45	**t^1=13.39 p=0.000****	**t^1=1.561 p=0.122**	**t^2=1.650 p=0.101**	**t^2=14.76 p=0.000****
Self-acceptance	7.40±2.19	12.35±4.21	7.58±2.63	7.47±2.62	**t^1=10.27 p=0.000****	**t^1=1.734 p=0.086**	**t^2=0.517 p=0.606**	**t^2=9.426 p=0.000****
Overall psychological well-being	48.96±11.2	76.01±10.9	48.25±13.2	48.31±13.2	**t^1=15.57 p=0.000****	**t^1=0.150 p=0.881**	**t^2=0.396 p=0.692**	**t^2=15.50 p=0.000****

t^1: Paired t-test. **t^2:** Independent t-test. **P:** p-value. **SD:** Standard deviation.
No significant at p >0.05. **Highly significant at p ‹ 0.01.
P_1: p value for comparing between the (**Exercise group**) in pre and post intervention.
P_2: p value for comparing between the (**Control group**) in pre and post intervention.
p_3: p value for comparing between the **(Exercise and Control group)** in pre intervention.
p_4: p value for comparing between the **(Exercise and Control group)** in post intervention.

Figure 2. Pre and post intervention total mean scores of insomnia severity, sleep quality, and psychological well-being among the exercise and control group (N=184)

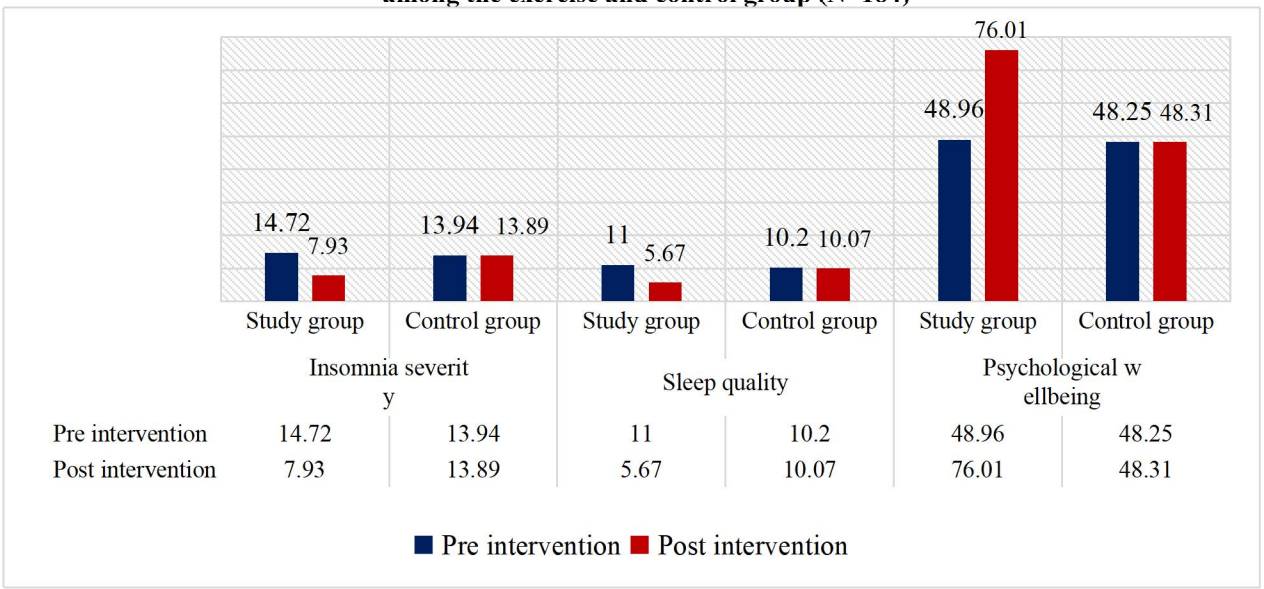

Table 6. Correlation between insomnia, sleep quality and psychological well-being among the studied groups at pre and post intervention.

Group	Variables		Insomnia severity		Sleep quality	
			Pre intervention	Post intervention	Pre intervention	Post intervention
Exercise group	Insomnia severity	r	1	1		
		p				
	Sleep quality	r	0.770	0.600	1	1
		p	0.000**	0.000**		
	Psychological well-being	r	-0.499-	-0.638-	-0.680-	-0.531-
		p	0.000**	0.000**	0.000**	0.000**
Control group	Insomnia severity	r	1	1		
		p				
	Sleep quality	r	0.737	0.554	1	1
		p	0.000**	0.000**		
	Psychological well-being	r	-0.656-	-0.580-	-0.721-	-0.633-
		p	0.000**	0.000**	0.000**	0.000**

r= correlation coefficient test. **p**= p0-value**.** **(-)** = Negative correlation**.** ****highly significant at p ‹ 0.01.**
Interpretation of r: **Weak** (0.1-0.24) **intermediate** (0.25-0.74) **Strong** (0.75-0.99) **Perfect** (1).

Discussion

Postmenopausal older women frequently experience sleep disturbances, which impact their physical and mental health by causing daytime fatigue, exhaustion, anxiety, behavioral issues, and problems with concentration, attention, and memory **(Massoud et al., 2023)**. Therefore, the aim of the present study was to appraise the effect of home-based simplified resistive exercise on insomnia, sleep quality, and psychological well-being among postmenopausal older women. The mean age of menopause was 51.7 years and 52.2 years for the exercise and control group, respectively. Similarly, earlier research conducted by **Almeida et al. (2020)** in São Paulo and **Augoulea et al. (2019)** in Greece, revealed that the mean age of menopause among the women participated in the study was 52.1 years.

According to current findings, severity of insomnia among the exercise group significantly decreased following the implementation of the training program involving resistive exercise, and this difference was highly statistically significant when compared to the control group. This may be clarified by the fact that exercise raises energy expenditure and endorphin release, which improves sleep quality for the body's recuperation. Additionally, aerobic exercise caused a rise in body temperature that was followed by a subsequent decrease in temperature post exercise that enhanced falling asleep. In the same stream, the results of a study carried out by **Karandikar-Agashe & Agrawal (2020)** in India, showed that there was a highly statistically significant difference in the degree of insomnia that postmenopausal women experience when engaging in resistance and aerobic exercises.

Consistent with previous studies **(Carolina et al., 2019; Chen et al., 2024)**, sleep quality was significantly improved in the exercise group following the training program when compared to the control group. Such result might be due to the fact that resistance training stimulates peripheral clock, which harmonizes with the body's circadian rhythm. Because melatonin production and release are regulated by the circadian clock, which also lowers body temperature, insomnia is less severe and sleep quality is improved. According to a meta-analysis by **Hassan et al. (2022)**, the best way to improve older adults' sleep quality is to combine walking with moderate-intensity muscle endurance training. The findings were also supported by **D'Aurea et al. (2019)** in Helsinki, who found that the resistance group's global PSQI score differed significantly from the control group. Moreover, a recent study by **Sharma et al. (2024)** exhibited that the exercise group fell asleep 44.8% faster, resulting in a noteworthy 61.7% improvement in the PSQI score

In the current study, a significant improvement in all psychological well-being domains among exercise group was considerably found after the training program. This result might be attributed to the advantages of the exercises beyond physical health. Interestingly, physical activity mediates psychological well-being through influencing the hypothalamus-pituitary-adrenal axis. Improved sleep via exercise can further lead to an improvement in mood and cognition, thereby enhancing the psychological well-being. In a similar line, a study carried out by **Coskun (2023)** in Turkey, revealed that the majority of exercise regimens significantly improved older adults' psychological well-being variables.

The results supported the study hypothesis, **Lialy et al. (2023)** conducted a systematic review and evaluated the effects of different physical activities and exercises, including resistance training, aerobics, walking, Pilates, and aquatic exercises on insomnia and psychological parameters of postmenopausal women. The results showed a strong correlation between these activities and better sleep, psychological well-being, and less severe insomnia.

A highly statistically significant positive correlation was found between insomnia severity and sleep quality among the exercise and control group at pre and post intervention. This finding might be due to that limited or poor-quality sleep is the result of difficulties falling asleep, staying asleep, or both. This result is supported by earlier research conducted by **Guidozzi et al. (2014)** and an Indian study by **Karandikar-Agashe & Agrawal (2020)**, which found that sleep quality and the severity of insomnia were corelated in postmenopausal older women following a resistive exercise intervention.

A highly statistically significant negative correlation was found between insomnia severity, sleep quality, and psychological well-being among the exercise and control group at pre and post intervention. This might be elucidated by that poor sleep is linked to depression, a rise in metabolic and cardiovascular risk, a general decline in health status, and ultimately, poor psychological health. Additionally, the hormonal changes and vasomotor symptoms that accompany the post-menopausal period led to poor sleep, which has a detrimental impact on psychological well-being. Similar to this, a study implemented by **Valiensi et al. (2019)** in Argentina found that severe degree of insomnia had a negative detrimental impact on the psychological health and sleep quality of postmenopausal older women.

Conclusion and recommendation

Resistive exercise is effective modality in reducing insomnia severity and enhancing sleep quality, which in turn improves the psychological well-being. PMW should be encouraged to adopt an active lifestyle and physical activity by creating plans and establishing goals and gaining support by exercising with friends or family, as a way to improve sleep and psychological well-being. Designing and executing periodic awareness programs of various types of exercises is also recommended specifically tailored for older adult's women post menopause. To determine the key elements of this health issue and generalize the findings, the study recommend to be repeated using a larger probability sample that was gathered from various regions of Egypt.

Study limitations

Future research should look into the long-term effects of resistive exercise because this study was limited by the lack of regular follow-up following the program. Additionally, a small percentage of older women were uncooperative, so the researcher assisted them in reducing the procedure's waiting time.

Operational definitions

- Home-based simplified resistive exercise: A structured, low-intensity exercise program performed at home.
- Insomnia: Presence of a prolonged sleep latency, frequent nighttime awakenings, or extended periods of wakefulness throughout sleep phase or even recurrent transient arousals.
- Sleep quality: The degree to which person's sleep experience is satisfying and restorative based on factors such as length of sleep, latency, efficiency, disturbances, and daytime dysfunction.
- Psychological well-being: A feeling of ongoing personal growth and development, the belief that life has meaning and purpose, positive interpersonal relationships, the ability to effectively manage life and the environment, and sense of self-determination.
- Postmenopausal older women: Women aged 60 years and over, experiencing natural menopause (12 consecutive months of amenorrhea).

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The author(s) have declared that they have no potential conflicts of interest with respect to the research, writing, and/or publication of this article.

List of Abbreviations

(PMW): Postmenopausal women, (PSQI): Pittsburgh Sleep Quality Index, (PWB): Psychological well-being, (ISI): Insomnia severity Index.

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References

Almeida, J.N., Prado, W.L., Terra, C.M., Oliveira, M.G., Garcia, R.A., Pinfildi, C.E., Botero, J. P. (2020). Effects Of Photobiomodulation on Muscle Strength In Post-Menopausal Women Submitted To A Resistance Training Program. *Lasers in medical science*, *35*(2), 355–363, https://doi.org/10.1007/s10103-019-02822-4

Augoulea, A., Moros, M., Kokras, N., Karageorgiou, V., Paschou, S. A., Lymberi, R., Panoulis, K., Kaparos, G., Lykeridou, A., & Lambrinoudaki, I. (2019). Association of Menopausal Symptoms with Sociodemographic Factors and Personality Traits. *Przeglad menopauzalny Menopause review*, 18(4), 191–197. https://doi.org/10.5114/pm.2019.93117

Bagga, S. S., Tayade, S., Lohiya, N., Tyagi, A., & Chauhan, A. (2024). Menopause Dynamics: From Symptoms to Quality Of Life, Unraveling

the Complexities of the Hormonal Shift. *Multidisciplinary Reviews*, 8(2), 1-8, 2025057. https://doi.org/10.31893/multirev.2025057

Bastien, C. H., Vallières, A., & Morin, C. M. (2001). Validation of the insomnia severity index as an outcome measure for insomnia research. *Sleep Medicine*, 2(4), 297–307 https://doi.org/10.1016/s1389-9457 (00)00065-4

Benge, E., Pavlova, M., & Javaheri, S. (2024). Sleep Health Challenges among Women: Insomnia across the Lifespan. *Frontiers in Sleep*, 3, P. 1322761. doi: 10.3389/frsle.2024.1322761.

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry research*, 28(2), 193–213. https://doi.org/10.1016/0165-1781(89)90047-4

Carmona, N. E., Millett, G. E., Green, S. M., and Carney, C. E. (2023). Cognitive-Behavioral, Behavioural and Mindfulness-Based Therapies for Insomnia in Menopause. *Behav. Sleep Med.* 21(4), 488–499. doi: 10.1080/15402002.2022.2109640.

Carolina, C. V. R., Poyares, D., Passos, G. S., Santana, M. G., Youngstedt, S. D., Souza, A. A., Bicudo, J., Tufik, S., & de Mello, M. T. (2019). Effects of Resistance Exercise Training and Stretching on Chronic Insomnia. *Revista brasileira de psiquiatria (Sao Paulo, Brazil: 1999)*, 41(1), 51–57. https://doi.org/10.1590/1516-4446-2018-0030

Chen, R., Wang, S., Hu, Q., Kang, N., Xie, H., Liu, M., Shan, H., Long, Y., Hao, Y., Qin, B., Su, H., Zhuang, Y., Li, L., Li, W., Sun, W., Wu, D., Cao, W., Mai, X., Chen, G., Wang, D., Zou, Q. (2024). Exercise Intervention in Middle-Aged And Elderly Individuals With Insomnia Improves Sleep And Restores Connectivity In The Motor Network. *Translational psychiatry*, 14(1), 159-169. https://doi.org/10.1038/s41398-024-02875-2

Coskun Benlidayi, I. (2023). The Effects of Exercising on Psychological Well-Being in Older Adults. *Anti-Aging Eastern Europe*, 2(1), 36-41. https://doi.org/10.56543/aaeeu.2023.2.1.06

D'Aurea, C.V.R., Poyares, D., Passos, G.S., et al. (2019). Effects of Resistance Exercise Training and Stretching on Chronic Insomnia. *Braz J Psychiatry*, 41(1), 51–7. https://doi.org/10.1590/1516-4446-2018-0030

Darraz, S. B., González-Roldán, A. M., Arrebola, J. M., & Montoro-Aguilar, C. I. (2021). Physical Exercise Impact on Variables Related to Emotional and Functional Well-Being in Older Adults. G*erontology*, 56 (3), 136-143.

Dennis, M., Barker, A., Anderson, J., Ashton, J.C., Cavan, G., Cook, P.A., French, D., Gilchrist, A., James, P., Phillipson, C., Tzoulas, K., Wheater, C.P., Wossink, A. & Lindley, S. (2023). Integrating Knowledge on Green Infrastructure, Health and Well-Being in Ageing Populations: Principles for Research and Practice. *Ambio*, 52 (1), 107-125. doi: 10.1007/s13280-022-01765-5

Elavsky, S. & McAuley, E. (2007). Lack of Perceived Sleep Improvement After 4-Month Structured Exercise Programs. *Menopause (New York, N.Y.)*, 14(3), 535–540. https://doi.org/10.1097/01.gme.0000243568.70946.d4

Guidozzi, F., Alperstein, A., Bagratee, J.S., Dalmeyer, P., Davey, M., et al. (2014). South African Menopause Society Revised Consensus Position Statement on Menopausal Hormone Therapy. *S Afr Med J,* 104(8), 537–543. doi: 10.7196/samj.8423

Gupta, R., Grover, S., Basu, A., Krishnan, V., Tripathi, A., Subramanyam, A., Nischal, A., Hussain, A., Mehra, A., Ambekar, A., Saha, G., Mishra, K. K., Bathla, M., Jagiwala, M., Manjunatha, N., Nebhinani, N., Gaur, N., Kumar, N., Dalal, P. K., Kumar, P., Avasthi, A. (2022). Changes in Sleep Pattern and Sleep Quality during COVID-19 Lockdown. *Indian journal of psychiatry*, 62(4), 370–378. https://doi.org/10.4103/psychiatry.IndianJPsychiatry_523_20

Hasan, F., Tu, Y.K., Lin, C.M., Chuang, L.P., Jeng, C., Yuliana, L.T., Chen, T.J., Chiu, H.Y. (2022). Comparative Efficacy of Exercise Regimens on Sleep Quality in Older Adults: A Systematic Review and Network Meta-Analysis. *Sleep Med Rev*, 104 (8), 537–54. doi: 10.1016/j.smrv.2022.101673.

Hossen, M.S. & Mohd-pauzi. (2023). "Social Influences on the Psychological Well-Being of Elderly Individuals", *Journal of Humanities and Applied Social Sciences*, Vol. ahead-of-print No. ahead-of-print, 1-18. https://doi.org/10.1108/JHASS-01-2024-0010

Jalal, S. M. (2024). Physical Activity, Self-Care, and Menopausal Symptoms among Women in Al-Ahsa, Saudi Arabia: Adherence to Postmenopausal Guidelines (PMGs). *Healthcare (Basel, Switzerland)*, 12(9), P. 886. https://doi.org/10.3390/healthcare12090886

Jeon, G. H. (2024). Insomnia in Postmenopausal Women: How to Approach and Treat It. *Journal of clinical medicine*, 13(2), P.428. https://doi.org/10.3390/jcm13020428

Karandikar-Agashe, G., & Agrawal, R. (2020). Comparative Study of the Effect of Resistance Exercises versus Aerobic Exercises in

Postmenopausal Women Suffering from Insomnia. *Journal of mid-life health*, 11(1), 2–5. https://doi.org/10.4103/jmh.JMH_35_19

Kovacevic, A., Mavros, Y., Heisz, J. J., & Fiatarone Singh, M. A. (2018). The Effect of Resistance Exercise on Sleep: A Systematic Review of Randomized Controlled Trials. *Sleep medicine reviews*, 39, 52–68. https://doi.org/10.1016/j.smrv.2017.07.002

Lee, S., Jeong, S., & Choi, Y. (2022). Effects of Psychological Well-Being and Depression on Menopausal Symptoms in Middle-Aged South Korean Women and the Necessity of Exercise. *Journal of environmental and public health*, 6529393, 1-8. doi: 10.1155/2022/6529393

Lialy, H. E., Mohamed, M. A., AbdAllatif, L. A., Khalid, M., & Elhelbawy, A. (2023). Effects of Different Physiotherapy Modalities on Insomnia and Depression in Perimenopausal, Menopausal, And Post-Menopausal Women: A Systematic Review. *BMC women's health*, 23(1), P.363. https://doi.org/10.1186/s12905-023-02515-9

Massoud, E.F., ElDeeb, A.M., Samir, S.H. et al. (2023). Effect of Resistive Exercise on Insomnia and Sleep Quality in Postmenopausal Women: A Randomized Controlled Trial. *Bull Fac Phys Ther,* 28(12), 1-8. https://doi.org/10.1186/s43161-023-00124-z

Meghani, N. A. A., Hudson, J., Stratton, G., & Mullins, J. (2023). Older Adults' Perspectives on Physical Activity and Sedentary Behavior within Their Home Using Socio-Ecological Model. *PloS one*, 18(11), P.0294715. https://doi.org/10.1371/journal.pone.0294715

Okulicz-Kozaryn, A., & Morawski, L. (2021). A Similar Effect of Volunteering and Pensions on Subjective Wellbeing of Elderly. *Economics and Sociology*, 14(2), 11-39. doi:10.14254/2071-789X.2021/14-2/1

Peixoto, E. M. (2021). Physical Exercise: Understanding The Reasons for Its Practice and Positive Psychological Outcomes. Aval. *Psicol*, 20(1), 1-8. https://doi.org/10.15689/ap.2021.2001.18940.06

Qian, J., Sun, S., Wang, M., Sun, Y., Sun, X., Jevitt, C., & Yu, X. (2023). The Effect of Exercise Intervention on Improving Sleep in Menopausal Women: A Systematic Review and Meta-Analysis. *Frontiers in medicine*, 10(1092294), 1-8. doi: 10.3389/fmed.2023.1092294

Ryff, C. D., & Keyes, C. L. M. (1995). The structure of psychological well-being revisited. *J. Pers. Soc. Psychol.* 69(4), 719–727. doi: 10.1037/0022-3514.69.4.719

Seo, S., & Mattos, M. K. (2024). The Relationship between Social Support and Sleep Quality in Older Adults: A Review of the Evidence. *Archives of gerontology and geriatrics*, 117, P.105179. doi: 10.1016/j.archger.2023.105179

Sharma, S., Kalra, S., Rai, R.H., Parveen, A., Raghav, D., Nashua,N. (2024). Effect of Aerobic Exercise on Sleep, Depression, and Quality of Life in Postmenopausal Women. *j Card Crit Care TSS*, 8(2); 95-100. doi:10.25259/JCCC_72_2023

Souza, H.D.S., de Melo, C. M., Piovezan, R. D., Miranda, R. E. E. P. C., Carneiro-Junior, M. A., Silva, B. M., Thomatieli-Santos, R. V., Tufik, S., Poyares, D., & D'Almeida, V. (2022). Resistance Training Improves Sleep and Anti-Inflammatory Parameters in Sarcopenic Older Adults: A Randomized Controlled Trial. *International journal of environmental research and public health*, 19 (23), P.16322. https://doi.org/10.3390/ijerph192316322

Valiensi, S. M., Belardo, M. A., Pilnik, S., Izbizky, G., Starvaggi, A. P., & Castelo Branco, C. (2019). Sleep Quality and Related Factors in Postmenopausal Women. *Maturitas*, 123, 73–77. https://doi.org/10.1016/j.maturitas.2019.02.008

Zhang, P., Guo, S., Zeng, W. and Wu, L. (2023). Development of the Well-Being Scale for Urban Elderly Tourists Who Travel in the Countryside for Summer Health. Asia Pacific *Journal of Tourism Research*, 28 (3), 191-211. https://doi.org/10.1080/10941665.2023.2217955