Sleep Hypn. 2018 Mar;20(1):54-59
http://dx.doi.org/10.5350/Sleep.Hypn.2017.19.0134

Sleep and Hypnosis
A Journal of Clinical Neuroscience and Psychopathology

ORIGINAL ARTICLE

The Exercise-Induced Weight Loss Improves Self-Reported Quality of Sleep in Obese Elderly Women with Sleep Disorders

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ABSTRACT

Study Objective: Epidemiological studies have shown a close correlation between obesity and sleep disorders which threatens the quality of life in the elderly. Thus, the purpose of this research was to study the effect of the aerobic exercise (with the aim of decreasing obesity) on quality of sleep in obese elderly women.

Method: 34 obese elderly women with sleep disorder recognized by Pittsburgh Sleep Quality Index (PSQI), were recruited purposefully from the Preventive healthcare Center and randomly allocated to two groups either aerobic training (3 sessions a week for 12 wk.), or a control group. All Obesity indexes measures including Body Mass Index (BMI), Waist Hip Ratio (WHR), and Percent Body Fat (PBF) were measured using bioelectrical impedance analysis.

Results: The results suggested that PSQI, Sleep quality, Sleep duration, Sleep Efficiency, Sleep disturbance, Sleep medications and Daytime dysfunction were significantly improved in experimental group, besides ($p<0.05$). All obesity indexes including BMI, PBF and WHR were significantly improved after exercise intervention ($p<0.05$).

Conclusion: The exercise-induced weight loss improved the quality of sleep in obese elderly women.

Keywords: Weight loss, sleep quality, obese, elderly

INTRODUCTION

The prevalence of obesity worldwide, over the last three decades demonstrates a major public health epidemic in both the developed and the developing countries (Finucane et al., 2011). Therefore, Obesity and its negative consequences have been of considerable attention as a major health hazard. There are some evidences reporting the close relationship between the sleep disorders and obesity in the elderly. Based on the evidences, aging is associated with sleep disorders (Wolkove, Elkholy, Baltzan, & Palayew, 2007), and body composition changes especially sarcopenia (Walston, 2012). Of the reasons, inactive lifestyle, along with a variety of physical, mental and social problems has made a myriad of challenges in aging.

Of all factors, motor limitations are main cause for dependency in older adults in doing regular daily activities which negatively affects the elderly's quality of life. With Aging, quality and structure of sleep changes for many different reasons such as malfunction of circadian clock and variability of melatonin rhythm (Karimi et al., 2016). So all these changes may result in

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Sleep and Hypnosis
Journal homepage:
www.sleepandhypnosis.org
ISSN:1302-1192 (Print) 2458-9101 (Online)

sleep disorders and consequently poor health in the elderly. On the other hand, a growing body of research suggests that there's a link between how much people sleep and how much they weigh (Beccuti & Pannain, 2011, Olivieri & de Dios, 2007). The sleep process not only affects the physical and physiological functions (Morteza Taheri & Arabameri, 2012), but also have a direct influence on cognitive performance capabilities (Morales, Lozano, & Casal, 2005) and is also effective in good quality of life (Martín & Gudalewska, 2016). There are some evidences suggesting the relationship between quality of sleep and body composition. An inverse relationship was found between sleep duration and body mass index (BMI) in an epidemiological study (Hursel, Gonnissen, Rutters, Martens, & Westerterp-Plantenga, 2013). Based on clinical evidences, abdominal obesity, especially visceral fat has an important role in quality of life in obese people (Arboledas & Roselló, 2007, Morteza Taheri & Irandoust, 2014).

The obese people usually have adjacent fat deposits to the pharynx, soft palate which narrow the nasopharyngeal rout, on the other hand, Obesity is associated with decreases in lung volumes, which may be a cause for sleep disorder (Murugan & Sharma, 2008). The prevalence of undiagnosed sleep-disordered breathing is high among men, but much higher than previously suspected in women (Young, Palta, Dempsey, Skatrud, Weber, & Badr, 1993). It should be noted that sleep disorder may be present in the absence of respiratory problems in up to 35% of obese persons, which proves the probable role of obesity in providing the obese ones with sleep disorders (Rabec, C., de Lucas Ramos, P., & Veale, 2011). As a result, knowing the factors which modulate sleep and obesity simultaneously in geriatric population must be considered seriously to improve the quality of life in elderly people. In spite of several extensive studies, the exact mechanisms underlying the association between sleep quality and obesity is unclear. There are strong objective and subjective data demonstrating that the quality of sleep among obese persons are significantly low compared with non-obese ones (Beccuti & Pannain, 2011; Lyytikäinen, Lallukka, Lahelma, & Rahkonen, 2011). It seems that lack of sleep may disrupt the balance of key hormones that control appetite, so low quality of sleep may be a key factor for highly sense of hunger (Reid et al., 2010). Based on recent trends showing rising rates of obesity and sleep disorders among the elderly, it would be of great public health importance to examine the effectiveness of weight loss Exercise on quality of sleep in obese elderly persons. Although there are so many investigations related to the effects of exercise on different variables affecting the quality of life among older adults, there is a lack of evidence surrounding the effect of exercise induced weight loss on the quality of sleep in this vulnerable population. Accordingly, the principal aim of this study was to investigate the quality of sleep following a weight loss exercise intervention in a group of older obese women.

METHOD

Participants and procedure

Eligible obese female elders for other sleep disorders were screened with Pittsburgh Sleep Quality Index (PSQI) and recruited from Dr Irandoust Preventive Healthcare Center. The study included 34 participants (aged 60 years and above), conducted in Qazvin, Iran and fewer than 10% of subjects decided not to proceed. A total of 31 participants completed all phases of the study. They were randomly allocated to two groups. One group went on an aerobic exercise training, while the other group only had no training intervention.

Exercise intervention

Aerobic exercise group (AEG) group trained for 60 min/session, three sessions a week for 2 months. The training protocol was divided into three phases: the warm up period (10 minutes), the main program (aerobic exercise; 40 minutes), and a cool down period (10 minutes). The aerobic regimen included the submaximal aerobic exercise program (50-60% of maximal heart rate reserve) on either treadmill or jogging monitored by an exercise physiologist.

Both groups were strictly instructed to maintain their prescribed isocaloric diet and checked by 24-h recall

questionnaire. A nutritionist monitored the nutritional program with visits every 2 weeks during the 2 month intervention.

Pittsburgh Sleep Quality Index (PSQI)

A 19-item self-report questionnaire designed to assess sleep quality. The PSQI yields a score ranging between 0 and 21. The participants filled out the PSQI at the beginning and end of the study to identify sleep problems. total score was calculated as a sleep quality scale for each subject.

Obesity Measurement

All Obesity indexes measures including Body Mass Index (BMI), Waist Hip Ratio (WHR), and Percent Body Fat (PBF) were measured using bioelectrical impedance analysis (In Body 230, Bio space, Seoul, South Korea). All the subjects gave written informed consent before starting the study protocol, in accordance with the Declaration of Helsinki. All experiments were approved by ethical committee of Imam Khomeini International University.

Statistical Analysis

Normality distribution of variables was tested using Kolmogorov Smirnov test. Data were analyzed using paired t-test to determine if there were differences between groups in pre and post-test data and Pearson's correlation coefficient between the different dimensions of sleep indexes and obesity variables was carried out. Significance is reported at $p < 0.05$, and all values are reported as means ± standard deviation (SD).

RESULTS

There was not significantly difference between age and height of two groups (respectively, p= 0.8196, t= -0.23; p= 0.9728, t= 0.035).

The obesity factors of participants are shown in Table 1. As suggested in the table 1 and figures1-2, not only all obesity variables (Weight, PBF, BMI and WHR), but also, sleep indexes were improved significantly after exercise intervention.

Table 1: The General characteristics and sleep indexes of subjects before and after intervention

	Groups	Pre-test	Post-test	t (df)	p	Cohen's d
Weight (kg)	AEG	73.1±.2.3	70.4±3.1	19.52(15)	0.001**	2.428
	Control	73.7±2.9	73.1±2.4	1.84 (14)	.086	0.28
BMI (kg/m2	AEG	27.2±09	26.2±0.8**	10.47(15)	0.001**	0.99
	Control	27.3±0.9	27.2±1.0	1.38(14)	0.18	0.11
PBF (%)	AEG	33.1±1.1	31.8±1.2**	10.87(15)	0.001**	2.00
	Control	33.3±1.4	33.2±1.3	-1.74(14)	0.10	-0.40
PSQI	AEG	13.86±2.26	5.00±1.55	20.38(15)	0.001**	4.65
	Control	16.26±1.27	14.00±1.69	1.23(14)	0.36	1.52
Sleep quality	AEG	2.46±0.74	0.46 ±0.51	7.74(15)	0.001**	3.20
	Control	2.26±.0.70	2.40±0.63	-.80(14)	0.43	-0.21
Sleep latency	AEG	0.86±.63	0.73±0.45	1.46(15)	0.164	0.24
	Control	1.96±0.61	1.83±0.25	1.85(14)	0.11	0.30
Sleep duration	AEG	2.00±.65	0.6±0.50	7.35(15)	0.001**	2.43
	Control	1.93±.79	1.93±0.70	0.001(14)	0.99	0.026
Sleep Efficiency	AEG	1.66±1.11	0.73±0.59	4.52(15)	0.001**	1.09
	Control	1 .40±.50	1 .73±0.45	1.26(14)	0.36	0.56
Sleep disturbance	AEG	2.26±.45	1.00±0.02	10.71(15)	0.001**	5.36
	Control	2.40±.50	2.33±0.48	0.56(14)	0.53	0.14
Sleep medications	AEG	2.13±.74	0.60±0.50	6.48(15)	0.001**	2.46
	Control	2.13±.74	2.13±0.51	0.001(14)	0.99	0.001
Daytime dysfunction	AEG	2.46±.51	0.86±0.51	9.76(15)	0.001**	3.13
	Control	2.46±.50	2.43±0.85	2.83(14)	0. 14	0.044

Note. Data are expressed as mean±SD. *p<0. 05; **p<0. 01; *Abbreviations:* AEG= Aerobic Exercise Group; PBF= Percent Body Fat; BMI= Body Mass Index

Table 2: The relationship between obesity variables and sleep indexes

Variables		PSQI	Sleep quality	Sleep latency	Sleep efficiency	Sleep duration	Sleep disturbance	Sleep medications	Daytime dysfunction
BMI	Pearson Correlation	0.6	0.36	0.38	-0.22	0.28	0.37	0.47	0.35
	Sig (2-tailed)	0.01*	0.04*	0.03*	0.23	0.13	0.03*	0.008**	0.56
WHR	Pearson Correlation	-0.33	-0.33	-0.15	0.2	-0.03	0.2	-0.14	0.15
	Sig (2-tailed)	0.06	0.22	0.57	0.46	0.9	0.46	0.61	0.59
PBF	Pearson Correlation	-0.02	-0.17	0.2	-0.59	0.03	0.26	0.14	0.55
	Sig (2-tailed)	0.91	0.54	0.46	0.02*	91	0.34	0.59	0.03*

*Note. *:p<0.05; **:p<0.01; Abbreviations:* BMI=Body mass index, WHR= waist/hip ratio; PBF= Percent body fat

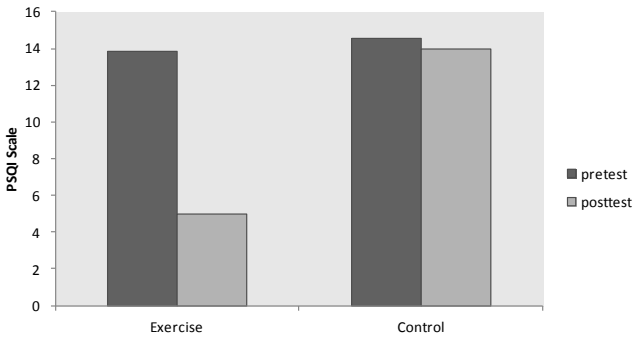

Figure 1: Comparison of the mean sleep quality scores between groups.

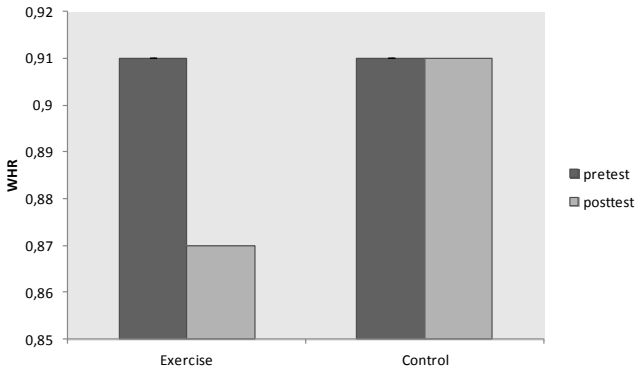

Figure 2: Comparison of the mean waist/hip ratio (WHR) between groups.

DISCUSSION

Nowadays, the treatment of obesity and sleep complications of obese elderly persons represents a new challenge for health systems. Therefore, intervening appropriate strategies for improving the obesity and consequently sleep is of utmost importance. Thus, the aim of study was to investigate the effect of weight loss exercise in self-reported quality of sleep in obese elderly women with sleep disorders. We observed that the exercise resulted in a significant improvement in weight, BMI (kg/m^2), PBF, PSQI, sleep quality, sleep duration, sleep efficiency, sleep disturbance, Sleep medications and daytime dysfunction in obese elderly women. These results highlight the potential of the exercise-induced weight loss to improve the sleep indexes in obese women elderly. To explain the results, decreasing the visceral fat of obese women can be effective in improvement of sleep indexes in the investigated subjects. As shown in Fig 2, WHR of training group (as a visceral fat index) was decreased after exercise intervention which is in consistent with previous studies (Arboledas & Roselló, 2007, Morteza Taheri & Irandoust, 2014). Besides, based on the theory of preserving the energy of the body, exercise can improve the circadian rhythms and increase adenosine levels in the body by which sleep is more regulated (Reid et al., 2010). On the other hand, doing regular exercise results in more growth hormone secretion which play the key role in quality and quantity of sleep and prevents weak performance over the day (Reid et al., 2010). That's why people feel better and have higher motivation and self-confidence following physical activities. Therefore, American Sleep Disorder Association prescribes physical activity as a key sedative medications for sleeping (Reid et al., 2010). It was suggested in a study that exercise can

even improve the sleep latency, but no change was observed for other sleep indices, such as sleep duration, sleep efficiency, sleep disturbance, and daytime functioning (Yang, Ho, Chen, & Chien, 2012). Another meta-analysis on the effect of exercise on sleep quality, including 66 studies, demonstrated positive effects of the exercise in this field (Kredlow, Capozzoli, Hearon, Calkins, & Otto, 2015). Kamath et al. (2014) argued that sleep duration influences on the metabolism and regulates body weight which is consistent with our study, demonstrating the correlation between BMI and sleep quality, sleep latency, sleep disturbance, sleep medications. It was also shown that there was no statistical correlation between sleep duration with BMI and waist-hip ratio. Therefore, in this case, sleep duration did not affect BMI and waist-hip ratio.

Evidences demonstrate that obesity predisposes the elderly people to sleep disorder, so losing weight results in a better sleep quality (Beccuti & Pannain, 2011; Lyytikäinen, Lallukka, Lahelma, & Rahkonen, 2011). The increase in sleep quality observed after aerobic exercise is in accordance with several other longitudinal studies, generally reporting improved sleep quality after exercise programs (Reid et al., 2010, Jennings, Muldoon, & Hall, 2007). However, different methodological approaches and variable study populations limit the ability to compare the results of different studies.

Results from the present study indicated that exercise treatment effectiveness (overall PSQI score, sleep quality, sleep duration, sleep efficiency, sleep disturbance, sleep medications, and daytime dysfunction) improved in the obese elderly who did weight-loss exercises. In this research, it is possible that exercise therapy applied in the daytime may increase melatonin secretion thus maintain longer periods of more optimal sleep quality.

It should be noted that none of the sleep and physical activity literature is reported in populations similar in demography, or physiological characteristics to our subjects (obese elderly women with sleep disorder). In conclusion, aerobic exercise training with the intention of weight loss has demonstrated the positive effect for sleep disorder. However, it should be noted that since an exercise protocol as a single intervention may not be only factor contributing to improve disturbed sleep, further research is needed to confirm and extend these findings in other sleep parameters with different methodological measurements in both obese and non-obese sleep-disturbed elderly. Generally, these results are of clinical importance because a self-reported measure of overall sleep quality is the most widely used measure of insomnia treatment effectiveness in clinical practice. Therefore, it may be as an important to improve and treat the sleep disturbances in geriatric population. However, there are some limitations to be taken into account when considering the results. Only women were included in the study, one more limitation of this study was low sample size of participants, limiting the extent to which the results can be applied to obese elderly women in general. Additional studies involving more subjects, a more controlled environment, and/or more exact tests to measure the sleep and body composition are needed to make crucial conclusion.

Acknowledgment

We thank the study participants; Ms. Samira Yousefi for coordinating and recruitment the participants; Zahra Dadmehr for and screening and evaluating the Anthropometric tests; the technical, and special thanks to Ms. Razipoor for her support and Laboratory personnel's of Dr Irandoust Preventive Healthcare Center.

Conflict of interests

None declared

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