Original article **Int. J. App. Sci. Physic. Edu 2018; 2(1) 60-66**

ISSN (Online): 2538-2438 Received: 10/03/2017 Accepted: 01/04/2018

Contents lists is available online

International Journal of Applied Science in Physical Education

Journal Homepage : www.ijaspe.com

The Effect of Walking on Quality, Quantity and Sleep-Related Physiological Parameters in Elderly Women

Farhad Rahmani Nia[1*], Maryam Ghasemi[2]

[1] Faculty of Physical Education and Sport Sciences, University of Guilan, Guilan, Iran.

[2] Faculty of Physical Education and Sports Science, Islamic Azad University of Rasht.

Corresponding author: frahmani2001@yahoo.com

Keywords

Sleep
Lipoprotein
Exercise
Aged

Abstract

This study seeks to examine the effect of walking program on quality, quantity and some sleep-related physiological parameters in elderly women. Our population of this study included 30 healthy women (age: 64 ± 2.96 years, height: 160.03 ± 5.05 cm, Weight: 67.36 ± 10.26 kg) of Tehran that after voluntarily registration to participate in this study, were randomly divided into two experimental (n = 15) and control (n = 15) groups. Experimental group participated in walking training program (8 weeks / 3 days a week / 30-40 minutes per session) with 60 to 75 percent of heart rate reserve. Sleep quality and quantity of sleep were evaluated before and after the exercise program. Also, sleep-related physiological variables (TG, LDL, HDL, total cholesterol), were evaluated before training program and 48 hours after completion of the training period by blood samples. The results showed that there are significant differences in the rate of change of TG, LDL, HDL and TC after the training period compared with the control group ($P<0.05$) Also, the significant difference was observed to pre-test in other physiological variables measured in the study, except HDL in training group. But, the variables had no significant difference compared to the pre-test in the control group. In addition, both the quality and quantity of sleep in the experimental group was significantly improved compared to the pre-test and control groups, but in the control group had no significant change compared to the pre-test. Furthermore, there was a significant inverse correlation between sleep quality and TG, and quantity of sleep and TC of subjects ($P<0.05$). Although in most physiological indices and indices of sleep studied in this study, there was no relationship, but it was shown improved sleep can be associated with improvement in some of these indicators. In addition, the training program used in this study could improve lipid and lipoprotein profiles, which are associated with cardiovascular disease.

1. Introduction

Sleep is one of the most basic human's requirements to maintain metabolism in a regular status. In other words, it would be considered as a dynamic biological activity, containing plenty of

necessary processes (1). About the one-third of life is spent in sleep, and it is unenviable that the quality of the rest of it completely depends on sleep. For example, during sleep time catecholamines, serotonin and growth hormone (2) release, and this lead to increase cellular nutrition in order to prepare body for subsequent activities (3). It also plays a key role in memory, stress decrement, mental focus, metabolism and daily pleasure (3). Sleeping is one of the most mysterious biological patterns that impressed by such different psychological, biological or even environmental factors. Since it is signed for brain, the imagination of life without sleep seems unrealistic (4).

In elderly people, with regard to weakness or illness, they absolutely need more recovery processes, which just included in sleep. This is because of the existence of useful and regulatory hormones during sleep time. In addition to this, further recoveries in nervous system such as learning and memory improvement would happen in sleep. There are researchers, who have shown that lack of sleep time results in deficiency in glucose mechanism, high blood pressure, cortisol elevation and rising up of sympatric nervous system activity (2). According to NFS (need for sleep) organization, sleep disorders in elderly women affects both quality and quantity of sleep. There are a lot of women who experience sleep disorders around menopause period more than any other time. To be precise, over the 61 percent of women experienced frequent wake-up, delay in falling sleep and be awake more than an hour on bed in the same period (5).

It is well known that exercise training has enough potential to drop off some physical and mental defects related to age, and it can improve physical function and rise up sense of independence (6). It has been reported that exercise is one of the most effective elements in quality and quantity of sleep. Exercise increases fatigue and would bring more relaxation levels, and all of this lead to better sleep. So it seems, exercise could bring a deep dream (7).

Some clinical researches also showed that there is a correlation between aerobic capacity and quality of sleep in patients with sleeping disorders. Up today, there are studies, which have been accomplished in such fields. For instance, Caldwell et al (8) showed that Pilates exercise has a substantial and positive effects on sleep pattern in young people. So that, the subjects achieved a higher quality of sleep, and their physical and mental health increased.Gerber et al (9) represented regular exercise training could bring both deep dream and less drowsiness in young people. Verak and his colleagues (10) stated a significant improvement in the quality of sleep and second sleep stages as a result of chronic exercise training in adolescent (10). Overall, with regard to these studies, it seems exercise training would be considered as a non-pharmacological intervention to improve quality of sleep in people with different ages, and it may be useful in both prevention and treatment sleep disorders.

On the other hand, plenty of cross-sectional studies have been done in comparison of sedentary and active people's lipid profile, and all of them inform us about the optimal lipid profile inactive people. The compatibility of use lipids as energy source during exercise in trained people, results in having lower TG compared to others. Also they usually have higher HDL and lower HDL (11). It is reported that obesity or even overweight is considered as a reason for sleep disorders. Therefore, with regard to the effects of exercise training on weight loss and lipid profile (11), plus sleep disorders as we mentioned. It is expected that a period of exercise training in terms of walking in elderly people could lead to improvements in their sleep pattern and lipid profile, and hope to answer the question what to peruse in the current study.

2. Material & Method

2.1 Subjects

30 elderly women (age= 64±2.96, height= 160.03±5.05, weight=67.36±10.26) were divided into two groups. Beforehand, we used a self-designed questionnaire to be assure of some conditions, including: 1) their age range, 2) lack of specific exercise activity two years before, 3) lack of any kind of particular disease such as heart disease, 4) absence of psychological disorders, 5) their health approve by MD 6) lack of drinking or smoke history, 7) they should not be under pharmacological therapy 8) observance of desire diet.

2.2 Training

The training group (1) performed walking exercise with 60-75 % heart rate reserve (calculated by Caspersen et al formula, 1985). Time for each session was about 30-40 m (12). Their heart rate was monitored and the speed of treadmill controlled continuously to achieve desired intensity. After two weeks, training intensity gradually increased. The subjects performed training protocol 3 times a week, between 9 am to 12 pm for 8 weeks (13). The other group just has their daily routine life.

2.3 Sleep

The quality and quantity of their sleep was recorded after 10 days by time assessment and Petersburg questionnaire respectively. then, the performed walking training and we sampled their blood. Their lipid profile factors including HDL, LDL and TG were measured before and 48 hours after exercise.

2.4 Statistical analysis

All statistical analyses were done by using SPSS software (version 20, SPSS Inc., Chicago, IL, USA). Normal assumption was examined using 1-sample Kolmogorov-Smirnov test. Paired T-tests was used to compare differences between pre-test and post-test. Independent T-test also performed to compare quality and quantity of life. We also implemented Pierson test to find any correlation among the variants. Groups regarding under study variables and significance level was determined at ($P<0.05$).

3. Results

Descriptive characteristics of the subjects represented in table 1. Our results showed that 8 weeks walking training had a significant effect on all the variants (TG, TC, LDL, HDL, quality & quantity of sleep (P<0.05). In a way that, LDL, TG and TC were decreased, but HDL and quality & quantity of sleep were increased. There were some slight changes in control group, but not considerable at all (P>0.05) (table 2). However, we witnessed a significant difference in the variants between control and training group in post-test (P<0.05), with the exception of HDL (P=0.123) (table 2). Moreover, a significant correlation between TG &quality of sleep (P=0.047) as well as TC & quantity of sleep (P=0.008) was seen.

Table 1. Descriptive characteristics of the subjects.

Groups	Age (year)	Height (cm)	Weight (kg)
Train	63/8±3/12	161.26±5.56	67.2±10.55
Control	64/26±2/89	158.8±4.32	67.7±10.32

Table 2. The lipid profile, lipoproteins and sleep factors in groups.

Varients	Groups	Pre-test (M±SD)	Post-test (M±SD)	Sig WG P	Sig BG P
TC (mg/dl)	T	215.93 ±17.98	198.28 ±17.27	0.001*	0.024*
	C	206.93 ±10.21	211.33 ±12.33	0.058	
TG (mg/dl)	T	177.46 ±17.68	178.13 ±18.93	0.001*	0.002*
	C	187.8 ±23.02	193.26 ±20.86	0.058	
HDL (mg/dl)	T	58.13 ±11.59	61 ±10.25	0.014*	0.123
	C	56.4 ±14.33	54.13 ±13.19	0.075	
LDL (mg/dl)	T	113.73 ±15.48	99.93 ±15.04	0.001*	0.002*
	C	116.8 ±14.35	117.06 ±14.2	0.083	
SQl (questionnaire)	T	10.33 ±2.12	8.46 ±1.92	0.001*	0.004*
	C	9.93 ±1.98	10.53 ±1.68	0.095	
SQn (questionnaire)	T	296 ±21.72	322.2 ±19.24	0.001*	0.035*
	C	215.93 ±17.98	198.28 ±17.27	0.001*	

T= Train; C= Control; WG= Within Groups; BG= Between Groups.

Table 3. correlation between lipid profile and lipoproteins with SQn & SQl.

		TC (mean)	TG (mean)	HDL (mean)	LDL (mean)
SQl	Pierson F	-0.228	-0.520	-0.308	0.125
	P	0.414	0.047*	0.264	0.658
SQn	Pierson F	-0.659	0.025	-0.102	0.229
	P	0.008*	0.932	0.718	0.412

* Significant measure (P<0.05).

4. Discussion

Our data showed that after 8 weeks walking training, LDL and TG plasma levels were decreased significantly in Train group compared to control group. Also, HDL levels showed an increasing trend as opposed to control group in the same time.

The changes in TC and LDL levels were in accordance to Pronk et al (14) and Goldhammer et al (15). However, it was inconsistent to Yektayar et al, who stated 8 weeks concurrent training does not lead to significant changes in TC and LDL levels (16). It is well known that plasma insulin decrement is the first and the most important changes after exercise; it leads to lipolysis activation and elevates FFA&LFA concentration, therefore, the Glucagon hormone would be increased simultaneously, So the both hormones result in ketogenesis or change insulin precursor (17, 18). In the involved mechanism in LDL decrement, exercise rises up LPL enzyme activity and drops off HTGL activity. Respecting the enrichment of lipoproteins with TG, the LDL levels is decreased through exercise (19). In the

current study, we can link TG changes to LPL activity during exercise. However, studies have shown that liver lipase enzyme would be decreased after exercise (14). So, TG formation, which is in VLDL and LDL, could be affected by that.

The role of exercise in the formation and degeneration of metabolic factors including LPL, LCAT, PLTP and ABC would be assumed as a reason why HDL increased following an exercise (20, 21). Exercise is one of the non-pharmacological methods in order to improve sleep (22). So that, previous research represented changes and improvement in quality and quantity of sleep by walking training (12). For example, Rahmani-Nia et al showed that the quality & quantity and some physiological factors related to sleep in young men improved after 8 weeks walking training (13). In agreement with their study, our results informed us about positive effects of the same training on both quality and quantity of sleep in elderly women.

Up today the mechanism, involved in exercise effects on quality of sleep remained unclear. Some researchers reported that sleep-wake cycle could be mediated by such psychological, physiological and environmental factors. To give just one example, it has been reported that immune response of cytokines, particularly IL-1b, IL-6 and TNF-a effects on the sleeping cycle. Higher concentration of IL-1b and TNF-a in older adults, may mediate NREM sleep because of sleep nerves perturbation, located in basic frontal lobe. The injection of TNF-a and IL-1b in Somatosensory Cortex to increase slow waves along with NREM, is a compatible truth for that. However, Santos et al claimed that 6 months regular exercise training dropped off waking time, with 21 percent (23). This was accompanied with decrement of inflammatory factors. Therefore, in the elderly people exercise training could exert its effects on sleep improvement through inflammatory mediation.

It is clear that Melatonin is an artificial element to induce sleep (24). But, researches claimed melatonin would be affected by aging, so that, its levels in aged people is lesser in both pineal and other related tissues (25). As the overnight melatonin decreases in aging, its functional effects perturb slightly. There are contradictory reports about the effects of exercise trainings on melatonin. For example, it has been reported that, following an acute incremental exercise and sub-maximal exercise it has been increased and decreased respectively (26). Overall, we proposed melatonin as a variable hormone to exercise. It is logical that 8 weeks' chronic exercise in our study manipulated pineal activity, and resulted in higher quality of sleep.

The literature about anabolic processes shows that regeneration or energy balance happens during sleep. Whenever body wants to compensate its energy sources, which spent on exercise, it has more tendencies for sleep (27). Also, GH hormone is one of the involved factors for restoring energy sources. In other words, the release of GH activator (GHRH) in sleeping time, rises up NREM (28). In the current study we had

an increment in energy expenditure as a result of walking, followed by GH boosting in order to balance energy status. On the other hand, GH releasing rises up during exercise activity, and this can lead to considerable improvement in both quality and quantity of sleep (29).

Our data about lipid profile represents there is a significant and negative correlation between quality of sleep & TG and quantity of sleep & TC, but there was no any relationship among the other factors. There are no audit results about how these elements link themselves; however, some studies inform us about a significant correlation between sleeping time and lipid factors including TG, TC and HDL. The mechanism of sleeping time and metabolic elements relevancy remained unclear, but it is obvious that body fat or obesity are linked with higher TG and TC, and probably are relevant to sleeping time indirectly (30). Insomnia or poor sleep is accompanied with increased sense of starving, particularly, high caloric food (31). However, it has been shown that HDL has a direct correlation with sleeping time (29). Kaneita et al stated that women, who have 7-8 hours sleep time, have better HDL status than the others with less than 5 hours (32).

5. Conclusion

It is true that there was no significant relationship among the physiological and sleep factors in the current study, but it can therefore be argued that improvement in sleeping status could be accompanied with some of those factors. Moreover, our training protocol could mediate their lipid profile, which is important to prevent cardiovascular diseases.

6. References

1. Fiorentino L, Ancoli-Israel S. Insomnia and its treatment in women with breast cancer. Sleep medicine reviews. 2006;10(6):419-29.
2. Aghajanloo A, Haririan H, Ghafourifard M, Bagheri H, Ebrahimi S. Sleep quality of students during final examsin Zanjan University of Medical Sciences. Modern Care Journal. 2012;8(4):230-7.
3. Hays RD, Martin SA, Sesti AM, Spritzer KL. Psychometric properties of the medical outcomes study sleep measure. Sleep medicine. 2005;6(1):41-4.
4. Fietze I, Strauch J, Holzhausen M, et al. Sleep quality in professional ballet dancers. Chronobiology international. 2009;26(6):1249-62.
5. Nedrow A, Miller J, Walker M, Nygren P, Huffman LH, Nelson HD. Complementary and alternative therapies for the management of menopause-related symptoms: a systematic evidence review. Archives of internal medicine. 2006;166(14):1453-65.
6. Frontera WR, Meredith CN, O'Reilly KP, Knuttgen HG, Evans WJ. Strength conditioning in older men: skeletal muscle hypertrophy and improved function. Journal of applied physiology. 1988;64(3):1038-44.
7. Catai A, Chacon-Mikahil M, Martinelli F, et al. Effects of aerobic exercise training on heart rate variability during wakefulness and sleep and cardiorespiratory responses of young and middle-aged healthy men. Brazilian Journal of Medical and Biological Research. 2002;35(6):741-52.
8. Caldwell K, Harrison M, Adams M, Triplett NT. Effect of Pilates and taiji quan training on self-efficacy, sleep quality, mood, and physical performance of college students. Journal of bodywork and movement therapies. 2009;13(2):155-63.
9. Gerber M, Brand S, Holsboer-Trachsler E, Pühse U. Fitness and exercise as correlates of sleep complaints: is it all in our minds? Medicine and science in sports and exercise. 2010;42(5):893-901.
10. Dworak M, Wiater A, Alfer D, Stephan E, Hollmann W, Strüder HK. Increased slow wave sleep and reduced stage 2 sleep in children depending on exercise intensity. Sleep medicine. 2008;9(3):266-72.
11. Durstine JL, Grandjean PW, Cox CA, Thompson PD. Lipids, lipoproteins, and exercise. Journal of Cardiopulmonary Rehabilitation and Prevention. 2002;22(6):385-98.

12. King AC, Pruitt LA, Woo S, et al. Effects of moderate-intensity exercise on polysomnographic and subjective sleep quality in older adults with mild to moderate sleep complaints. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2008;63(9):997-1004.
13. Rahmaninia f, mohebi h, gholi sbm. The effect of walking on quality, quantity and some physiological parameters related to sleep in old men. 2010.
14. Pronk N, Crouse S, O'Brien B, Rohack J. Acute effects of walking on serum lipids and lipoproteins in women. The Journal of sports medicine and physical fitness. 1995;35(1):50-8.
15. Goldhammer E, Tanchilevitch A, Maor I, Beniamini Y, Rosenschein U, Sagiv M. Exercise training modulates cytokines activity in coronary heart disease patients. International journal of cardiology. 2005;100(1):93-9.
16. Yektayar M, Mohammadi S, Ahmadi Deharshid K, Khodamoradpour M. Comparison of the effects of resistance, endurance and combined exercises on lipid profile of non-athlete healthy middle aged men. Scientific Journal of Kurdistan University of Medical Sciences. 2012;16(4):26-36.
17. Etemad Z, Esmailnasab N. The effects of Strength exercise program of anterior muscles on body composition and serum lipids. Scientific Journal of Kurdistan University of Medical Sciences. 2010;14(4).
18. Mack MG, Shaddox LA. Changes in short-term attitudes toward physical activity and exercise of university personal wellness students. College Student Journal. 2004;38(4):587.
19. Askari A, Askari B, Fallah Z. Effect of eight weeks aerobic training on serum lipid and lipoprotein levels in women. Journal of Gorgan University of Medical Sciences. 2012;14(1):26-32.
20. Ghanbari-Niaki A, Saghebjoo M, Hedayati M. A single session of circuit-resistance exercise effects on human peripheral blood lymphocyte ABCA1 expression and plasma HDL-C level. Regulatory peptides. 2011;166(1):42-7.
21. Khabazian BM, Ghanbari-Niaki A, reza Safarzadeh-Golpordesari A, Ebrahimi M, Rahbarizadeh F, Abednazari H. Endurance training enhances ABCA1 expression in rat small intestine. European journal of applied physiology. 2009;107(3):351-8.
22. Kline CE, Sui X, Hall MH, et al. Dose–response effects of exercise training on the subjective sleep quality of postmenopausal women: exploratory analyses of a randomised controlled trial. BMJ open. 2012;2(4):e001044.
23. Santos RVTd, Viana VAR, Boscolo RA, et al. Moderate exercise training modulates cytokine profile and sleep in elderly people. Cytokine. 2012;60(3):731-5.
24. Luboshizsky R, Lavie P. Sleep-inducing effects of exogenous melatonin administration. Sleep medicine reviews. 1998;2(3):191-202.
25. Ramírez-Rodríguez G, Vega-Rivera NM, Benítez-King G, Castro-García M, Ortíz-López L. Melatonin supplementation delays the decline of adult hippocampal neurogenesis during normal aging of mice. Neuroscience letters. 2012;530(1):53-8.
26. Konarska A, Karolkiewicz J, Kasprzak Z, Pilaczyńska-Szcześniak Ł. CHANGES IN MELATONIN CONCENTRATION AFTER PHYSICAL EXERCISE OF VARIABLE INTENSITY. Studies in Physical Culture & Tourism. 2006;13(2).
27. Driver HS, Taylor SR. Exercise and sleep. Sleep medicine reviews. 2000;4(4):387-402.
28. Weltman A, Wideman L, Weltman J, Veldhuis JD. Neuroendocrine control of GH release during acute aerobic exercise. Journal of endocrinological investigation. 2003;26(9):843-50.
29. Ferris LT, Williams JS, Shen CL, O'Keefe KA, Hale KB. Resistance training improves sleep quality in older adults–a pilot study. J Sports Sci Med. 2005;4(3):354-60.
30. Bjorvatn B, Sagen I, Øyane N, et al. The association between sleep duration, body mass index and metabolic measures in the Hordaland Health Study. Journal of sleep research. 2007;16(1):66-76.
31. Chaput JP, Després JP, Bouchard C, Tremblay A. Short sleep duration is associated with reduced leptin levels and increased adiposity: results from the Quebec family study. Obesity. 2007;15(1):253-61.
32. Kaneita Y, Uchiyama M, Yoshiike N, Ohida T. Associations of usual sleep duration with serum lipid and lipoprotein levels. Sleep. 2008;31(5):645.