Original Article

Comparing the Effects of Aerobic and Anaerobic Exercise on Sleep Quality among Male Nonathlete Students

Toktam Kianian, Ali Navidia[1], Fahimeh Aghamohamadi[2], Saman Saber[3]

Community Nursing Research Center, Department of Community Health Nursing, Nursing and Midwifery School, Zahedan University of Medical Science, [1]Pregnancy Health Research Center, Department of Psychological Nursing, Nursing and Midwifery School, Zahedan University of Medical Sciences, Zahedan, [2]Department of Physical Education, Islamic Azad University of Kerman Branch, Kerman, [3]Community Nursing Research Center, Department of Psychological Nursing, Nursing and Midwifery School, Zahedan University of Medical Science, Zahedan, IR Iran

ABSTRACT

Background: Physical activity is among the most significant factors behind sleep quality. However, there are limited data on the effects of different types of physical activity on sleep quality. **Objectives:** This study aimed to compare the effects of aerobic and anaerobic exercise on sleep quality among male nonathlete students. **Methods:** As a three-group randomized controlled trial, this study was done on ninety male nonathlete nursing students of Zahedan Islamic Azad University, Zahedan, Iran. Students were randomly assigned to an aerobic exercise, an anaerobic exercise, and a control group. For 10 consecutive weeks, students in the aerobic and the anaerobic groups respectively attended aerobic and anaerobic exercise programs thrice a week. Data were collected using a demographic questionnaire and the Pittsburgh Sleep Quality Index and were analyzed using the one-way analysis of variance, the Tukey's *post hoc*, the Chi-square, and the paired-sample *t*-tests. **Results:** At baseline, the mean scores of sleep quality in the aerobic exercise, anaerobic exercise, and control groups were 4.06 ± 3.62, 4.56 ± 4.93, and 4.50 ± 4.01, respectively ($P = 0.98$). However, after the intervention, these values significantly changed to 2.03 ± 2.96, 1.96 ± 3.60, and 4.66 ± 4.16, respectively ($P = 0.008$). Pairwise between-group comparisons showed that the mean scores of sleep quality in both intervention groups were significantly lower than the control group ($P < 0.05$) while the difference between the intervention groups was not statistically significant ($P > 0.05$). **Conclusion:** Exercise, either aerobic or anaerobic, significantly improves sleep quality among male nonathlete students.

KEYWORDS: *Aerobic, Anaerobic, Exercise, Sleep quality, Students*

INTRODUCTION

Sleep is among the basic human needs. It alleviates fatigue and helps regain energy and power for doing daily activities.[1,2] As a repetitive behavior, sleep also facilitates body functions such as growth and development, learning, and memorization.[3] Thus, any sleep disorder can cause problems such as daytime sleepiness, stress, anxiety, depression, headache, impaired memory, and decreased coping ability.[4,5] Sleep disorders are of greater importance to students because not only these disorders can affect their daily functioning, but also may result in their academic failure and high-risk behaviors such as quarrel, aggression, and smoking.[6]

Studies reported the increasing prevalence of sleep disorders among students.[6,7] Medical and nursing students are more at risk for sleep disorders due to their greater levels of stress and pressure at work, numerous clinical education courses, and the abundance of to-be-learned educational materials.[8,9] Ghanei *et al*. found that the prevalence of sleep disorders among students living in the dormitories of Urmia University of Medical Sciences, Urmia, Iran, was as high as 43.1%.[5] Alimirzaei *et al*. also reported the high prevalence of

Address for correspondence: Dr. Saman Saber, Department of Psychological Nursing, School of Nursing and Midwifery, Zahedan University of Medical Sciences, Zahedan, IR Iran.
E-mail: samansaber16@gmail.com

How to cite this article: Kianian T, Navidian A, Aghamohamadi F, Saber S. Comparing the effects of aerobic and anaerobic exercise on sleep quality among male nonathlete students. Nurs Midwifery Stud 2017;6:168-73.

Access this article online

Quick Response Code:

Website: www.nmsjournal.com

DOI: 10.4103/nms.nms_56_17

low quality sleep among the students of Kerman Nursing and Midwifery School, Kerman, Iran.[10] These findings highlight the necessity of special attention to students' sleep and the importance of developing strategies for its improvement.

Physical activity is one of the most significant factors behind sleep quality.[11] Different studies reported exercise as an effective nonpharmacological modality for improving the sleep quality of both healthy and unhealthy individuals.[12,13] In general, there are two types of exercise, namely, aerobic and anaerobic. Aerobic exercise is a prolonged moderate-intensity exercise which increases heart and respiratory rates for long periods of time, while anaerobic exercise is a short-period high-intensity exercise which put muscles under intense pressure.[12] Both types of aerobic and anaerobic exercise can have different effects on body metabolism and thereby sleep quality.

There are limited data on the best type of exercise for improving sleep quality.[13,14] Kredlow *et al*. did a review study and reported that despite the known positive effects of exercise on sleep quality and duration, no comparative study had yet evaluated the effects of aerobic and anaerobic exercise on sleep quality.[15] Consequently, a question still comes to mind that "which of the aerobic and anaerobic exercises are more effective in improving the sleep quality?"

Objectives

This study was conducted to compare the effects of aerobic and anaerobic exercise on sleep quality among male nonathlete students.

Methods

Design and sample

This three-group randomized controlled trial was made in 2014 on male nonathlete nursing students of Zahedan Islamic Azad University, Zahedan, Iran.

Students were included if they were nonathlete (i.e., had not done regular or professional exercise during the past 6 months before the study),[16] were physically healthy, had no known cardiopulmonary disease, received no sleeping pills or any other medications, and did not use tobacco. The exclusion criteria were exercise intolerance and irregular attendance at the sessions of the study intervention. Data on the inclusion criteria were collected through interviewing students.

Based on the results of a study undertaken by Soltani *et al*.[17] and with a confidence level of 0.95 and a statistical power of 0.80, sample size was estimated to be 31. Parameters used to calculate sample size were as follows: $\overline{X}_2 = 6.5, \overline{X}_1 = 5.8, S_2 = 1.7, S_1 = 1.7, Z_{1-\alpha/2} = 1.96, Z_{1-\beta} = 0.85$. Due to the limited number of students in the study setting, we could recruit just thirty students to each group. Sampling was done conveniently. Students were randomly assigned to an aerobic exercise, an anaerobic exercise, and a control group. For random allocation, three cards labeled A, B, and C were used. Each student was asked to randomly select one card. Students who selected the A, B, or C card were respectively allocated to the aerobic exercise, anaerobic exercise, and control groups.

Instrument

Data collection instruments were a demographic questionnaire (containing items such as age, weight, height, body mass index, and marital status) and the Pittsburgh Sleep Quality Index (PSQI).[18] PSQI consists nineteen items which are scored from 0 (no sleep disturbance) to 3 (maximum sleep disturbance). The total PSQI score can range from 0 to 21 the higher the score, the lower the sleep quality. The total PSQI score is interpreted as follows: 0–5: High sleep quality; 6–10: Moderate sleep quality; 11–15: Relatively poor sleep quality; and 16–21: Poor sleep quality.[19] Izadi *et al*. reported a Cronbach's alpha of 0.80 for the scale.[20]

Intervention

Initially, we referred to the study setting and created a list of the names of all male nursing students who had enrolled in the physical training course. Then, we interviewed students on the phone to determine eligible ones. Students who met the inclusion criteria were asked to attend an opening session held in the conference hall of the study setting, where they were randomly allocated to one of the three groups and were asked to complete the demographic questionnaire and PSQI. Students in the aerobic and the anaerobic groups were required to attend a sport hall in the event and the odd weekdays, respectively. Aerobic and anaerobic exercise sessions were offered by the third researcher in thirty sessions held in 10 consecutive weeks, i.e., three sessions a week. Each session consisted of three parts, namely, warming up exercise (including a 6-min jogging followed by a 4-min stretching exercise), aerobic or anaerobic exercise, and cooling down exercise (including a 4-min jogging and a 5-min stretching exercise). Moreover, they were asked to do their activities of daily living and avoid any other regular exercise program during the study.

Aerobic exercise for students in the aerobic group comprised slow and fast running as well as jogging in a track and field gym. In the first session, students were required to do the scheduled aerobic exercise up to 50% of their maximal oxygen consumption (VO_2 max) for 20 min. The intensity and the duration of aerobic exercise were gradually increased during the program according to the

overload principle so much so that in the eighth and the 9th weeks of the program, the duration of aerobic exercise was 38 min while VO_2 max was 70%[21] [Table 1].

The first session of the anaerobic exercise program included of three 30-m sprints as well as a 60-m and a 100-m sprint with a VO_2 max of 95%. The intensity and the duration were gradually increased based on the overload principle so much so that in the eighth and the 9th weeks, each session consisted of eleven 30-m, six 60-m, and two 100-m sprints with a VO_2 max of <100%[22] [Table 1].

It is noteworthy that VO_2 max is calculated through dividing maximum heart rate by resting heart rate and multiplying the result by 15. Maximum heart rate is also calculated through subtracting age from the fixed value of 220.[23] At the end of the intervention, students in all groups were asked to attend the same conference hall to recomplete PSQI.

Ethical considerations

This study was part of a Master's thesis in exercise physiology at Kerman Islamic Azad University, Kerman, Iran. The study was approved and granted by the aforementioned university (grant code: 9305.10821410922003) and registered in the Iranian Registry of Clinical Trials (registration code: IRCT2017011526858N5). We adhered to the ethical principles of medical research reported in the Declaration of Helsinki.[24] The research objective was explained to all participants, and their written informed consents were secured. They were assured of their right to refuse participation and to voluntarily withdraw from the study. Moreover, they were informed that the intervention would not be harmful to them and their data would be managed confidentially.

Data analysis

Data analysis was done through the SPSS software version 13 (SPSS, Inc. Chicago, Illinois, USA). The Kolmogorov–Smirnov test was conducted to test the assumption of normality. The measures of descriptive statistics (such as mean, standard deviation, and absolute and relative

Table 1: The aerobic and anaerobic exercise programs

Weeks	Number of repeats	Anaerobic		Aerobic	
		Distance (m)	VO_{2max} (%)	Duration (min)	VO_{2max} (%)
1st	3	30	≈95	20	≈50
	2	60			
	1	100			
2nd	3	30	≈95	22	≈50
	2	60			
	1	100			
3rd	5	30	≈100	24	≈55
	3	60			
	1	100			
4th	5	30	≈100	26	≈55
	3	60			
	1	100			
5th	7	30	<100	28	≈60
	4	60			
	1	100			
6th	7	30	<100	30	≈60
	4	60			
	1	100			
7th	9	30	<100	32	≈65
	5	60			
	1	100			
8th	9	30	<100	34	≈65
	5	60			
	1	100			
9th	11	30	<100	36	≈70
	6	60			
	2	100			
10th	11	30	<100	38	≈70
	6	60			
	2	100			

frequencies) were employed for data description and presentation. The Chi-square test and the one-way analysis of variance were run to compare the groups regarding students' marital status, age, weight, body mass index, and PSQI scores. Moreover, the Tukey's *post hoc* test was performed for pairwise between-group comparisons.

Results

This study was made on 90 students. During the study, three students left the study (one from the aerobic and two from the anaerobic groups) and respectively 29, 28, and 30 students from the aerobic, anaerobic, and control groups completed the study [Figure 1]. Students aged 18–25, with a mean of 20.83 ± 1.80. No significant difference was observed among the groups respecting students' age, weight, body mass index, and marital status [$P > 0.05$; Table 2].

The results of the one-way analysis of variance illustrated that the groups did not differ significantly from each other at baseline regarding the mean score of PSQI ($P = 0.98$). After the intervention, PSQI mean score in both the aerobic and the anaerobic exercise groups significantly decreased ($P < 0.001$) while it significantly increased in the control group ($P = 0.02$). Consequently, the difference among the groups regarding the posttest mean score of PSQI was statistically significant [$P = 0.008$; Table 3]. The Tukey's *post hoc* test indicated that mean PSQI score in the control group was significantly higher than both the aerobic ($P = 0.04$) and the anaerobic ($P = 0.007$) groups, while the difference between the aerobic and the anaerobic groups was not statistically significant ($P = 0.66$).

Discussion

Findings indicated that both types of aerobic and anaerobic exercise significantly improved sleep quality. The amount of sleep quality improvement in the anaerobic group was greater than the aerobic group though the between-group difference was not statistically significant. Various studies reported the positive effects

Table 2: Comparison of personal characteristics in three groups[a]

Variables	Group			P^b
	Aerobic	Anaerobic	Control	
Age (year)	21.13 ± 1.88	21.00 ± 2.01	20.36 ± 1.42	0.17
Weight (kg)	66.54 ± 6.27	66.12 ± 7.34	65.66 ± 7.1	0.81
Body mass index	21.07 ± 2.26	22.02 ± 2.02	22.08 ± 2.28	0.14
Marital status				
Single	26 (86.6)	18 (60)	22 (73.3)	0.24
Married	4 (13.4)	12 (40)	8 (26.7)	

[a]Values are expressed as *n* (%) or mean±SD, [b]Analysis of variance was performed for age, weight, body mass index while the Chi-square test was performed for marital status. SD: Standard deviation

Table 3: The mean scores of sleep quality in the aerobic, anaerobic, and control groups before and after the intervention[a]

Sleep quality	Group			P^b
	Aerobic	Anaerobic	Control	
Before	4.06 ± 3.62	4.56 ± 4.93	4.50 ± 4.01	0.98
After	2.30 ± 2.96	1.96 ± 3.60	4.66 ± 4.16	0.008
P^c	<0.001	<0.001	0.023	

[a]Values are presented as mean±SD, [b]Analysis of variance was performed, [c]Paired-sample *t*-test was performed. SD: Standard deviation

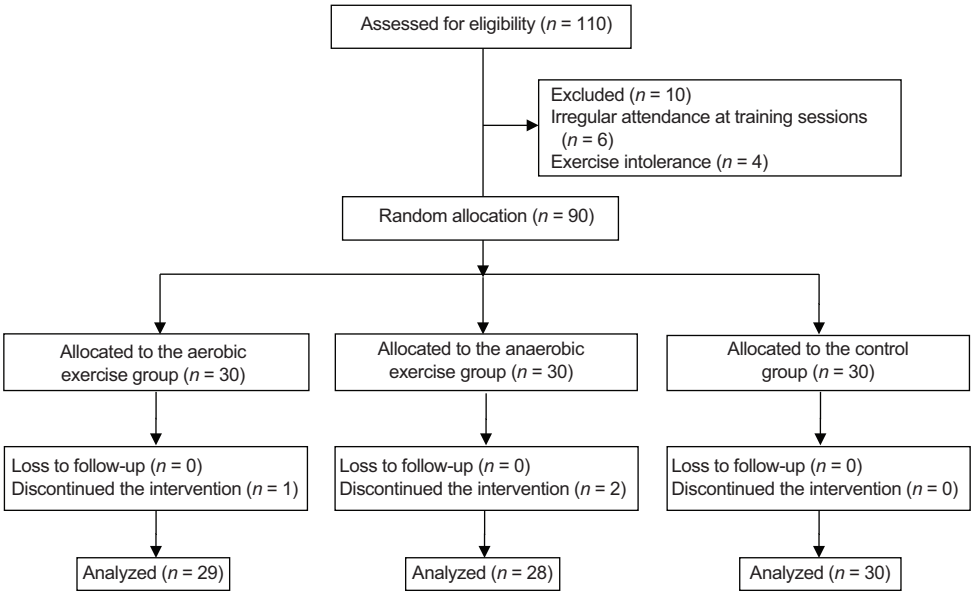

Figure 1: The flow diagram of the study

of exercise on sleep quality; however, to the best of our knowledge, none of the previous studies compared the effects of aerobic and anaerobic exercise on sleep quality.

In agreement with the findings of the present study, Tartibian and Abdollah Zadeh reported the positive effects of exercise on sleep quality among physically active young men.[25] Other studies also found that exercise improves sleep quality through promoting mental health, alleviating anxiety,[26] stimulating the anterior hypothalamus, changing core body temperature,[27] and regulating cytokines.[28] Similarly, Ilahi *et al*. found that exercise was directly correlated with sleep quality and satisfaction.[29] Most of these studies were conducted on patient populations while our sample consisted of healthy young students, denoting that exercise can improve sleep quality among both healthy individuals and patient populations. However, previous studies mainly focused on the general effects of exercise on sleep quality while the present study compared the effects of aerobic and anaerobic exercise on sleep quality.

Contrary to our findings, some studies reported the insignificant or the negative effects of exercise on sleep quality. For example, Izadi *et al*. and Irwin *et al*. found that not only aerobic exercise does not improve sleep quality, but also exercise-induced fatigue can reduce sleep quality.[20,30] Montgomery also reported the ineffectiveness of exercise in improving sleep quality.[30] These conflicting findings may be due to the fact that these studies were done on elderly people while our study was made on young students.[31] Besides, Buman *et al*. found that among different types of exercise, only mild exercise significantly improved sleep quality.[32] The contradiction between our findings and theirs may be due to the differences in the interventions and the samples of the studies.

One of the study limitations was that due to time constraints, we could not include in the study the students with poor sleep quality. Furthermore, our sample consisted only of male students. Future studies are recommended to evaluate the effects of different types of exercise on sleep quality among students with poor sleep quality as well as students of both genders.

Conclusion

Doing exercise, either aerobic or anaerobic, positively affects sleep quality among male nonathlete students. Encouraging young people to do aerobic and anaerobic exercise can improve their sleep quality and health. Thus, the physical training course for students needs to include both types of aerobic and anaerobic exercise. Moreover, adequate sporting facilities need to be provided for students.

Acknowledgments

The authors appreciate the help and support of Kerman and Zahedan Islamic Azad Universities, Kemran and Zahedan, Iran, as well as the participation of students in the study.

Financial support and sponsorship

This paper extracted from a Master's thesis in exercise physiology which was conducted in Kerman Islamic Azad University, Kerman, Iran. The grant code was 10821410922003.

Conflicts of interest

There are no conflicts of interest.

References

1. Ranjbaran M. Prevalence of poor sleep quality in college students of Iran: Systematic review and Meta-analysis. Razi J Med Sci 2016;23:1-7. [In Persian].
2. Lashkaripour K, Bakhshani N, Mafi S. Sleep quality assessment of medicine students and physician (medical) assistants. Interdiscip J Contemp Res Bus 2012;4:443-50.
3. Emkani M, Khanjani N. Sleep quality and its related factors in intercity bus drivers. J Mil Med 2012;14:137-41.
4. Mohammadi-Farrokhran E, Mokhayeri Y, Tavakkol Z, Mansouri A. Relationship between quality of sleep and mental health among students living in dormitories. Knowl Health 2012;7:112-7.
5. Ghanei R, Hemmati Maslakpak M, Rezaei K, Baghi V, Makki B. Nursing students quality of sleep in dormitories of Urmia university of medical sciences. J Urmia Nurs Midwifery Fac 2011;15:277-82. [In Persian].
6. Wolfson AR. Adolescents and emerging adults' sleep patterns: New developments. J Adolesc Health 2010;46:97-9.
7. Byrd K, Gelaye B, Tadessea MG, Williams MA, Lemma S, Berhanec Y, *et al.* Sleep disturbances and common mental disorders in college students. Health Behav Policy Rev 2014;1:229-37.
8. Lund HG, Reider BD, Whiting AB, Prichard JR. Sleep patterns and predictors of disturbed sleep in a large population of college students. J Adolesc Health 2010;46:124-32.
9. Angelone AM, Mattei A, Sbarbati M, Di Orio F. Prevalence and correlates for self-reported sleep problems among nursing students. J Prev Med Hyg 2011;52:201-8.
10. Alimirzaei R, Azizzadeh FM, Abazari F, Mohammadalizadeh S, Haghdoost A. Sleep Quality and some Associated Factors in Kerman Students of Nursing and Midwifery. Koomesh 2016;17:733-8. [In Persian].
11. Leopoldino AA, Avelar NC, Passos GB Jr., Santana NÁ Jr., Teixeira VP Jr., de Lima VP, *et al.* Effect of pilates on sleep quality and quality of life of sedentary population. J Bodyw Mov Ther 2013;17:5-10.
12. Seyfoorian M, Nikbakht M, Doostan M, Fathi MH. Influence of aerobic and anaerobic exercise on the reproductive hormones, cortisol and prolactin in male. Med Sci J 2011;10:546-53.
13. Passos GS, Poyares D, Santana MG, D'Aurea CV, Youngstedt SD, Tufik S, *et al.* Effects of moderate aerobic

exercise training on chronic primary insomnia. Sleep Med 2011;12:1018-27.
14. Yang PY, Ho KH, Chen HC, Chien MY. Exercise training improves sleep quality in middle-aged and older adults with sleep problems: A systematic review. J Physiother 2012;58:157-63.
15. Kredlow MA, Capozzoli MC, Hearon BA, Calkins AW, Otto MW. The effects of physical activity on sleep: A meta-analytic review. J Behav Med 2015;38:427-49.
16. Ghasemnian A, Kordi M, Ghaeini A, Ghorbanian B, Hedayati M. Changes of plasma visfatin and insulin resistance in overweight and obese non-athlete adolescents following an eight-week-endurance rope training. J Zanjan Univ Med Sci 2014;22:11-21. [In Persian].
17. Soltani SR, Aghamohammadian SH, Ghanaei CA. Effect of exercise on general health, quality of sleep and quality of life in ferdowsi University of Mashhad students. J Qazvin Univ Med Sci 2013;17:9-46. [In Persian].
18. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The pittsburgh sleep quality index: A new instrument for psychiatric practice and research. Psychiatry Res 1989;28:193-213.
19. Arab Z, Shariati A, Bahrami H, Asayesh H, Vakili MA. The effect of acupressure on sleep quality in patients undergoing hemodialysis. J Urmia Nurs Midwifery Fac 2012;10:237-45. [In Persian].
20. Izadi F, Adib Hajbagheri M, Kafaei M. Determining disturbing factors of sleep quality among hospitalized elderly patients in Kashan hospitals, Iran 2009. J Shahid Sadoughi Univ Med Sci 2013;20:688-98.
21. Khedri G, Mogharnasi M. Interaction effect of 8-week aerobic exercise and omega-3 fatty acid supplementation on plasma adiponectin concentration. Zahedan J Res Med Sci 2013;15:36-41.
22. Finaud J, Lac G, Filaire E. Oxidative stress: Relationship with exercise and training. Sports Med 2006;36:327-58.
23. Uth N, Sørensen H, Overgaard K, Pedersen PK. Estimation of VO2 max from the ratio between HRmax and HRrest – The heart rate ratio method. Eur J Appl Physiol 2004;91:111-5.
24. World Medical Association. World medical association declaration of Helsinki: Ethical principles for medical research involving human subjects. JAMA 2013;310:2191-4.
25. Tartibian B, Abdollah Zadeh N. Comparison of respiratory parameters and sleep quality in active and none active young men: Relationship between respiratory parameters and sleep quality. Razi J Med Sci 2014;20:30-9. [In Persian].
26. ZubiaVeqar ME. Sleep quality improvement and exercise: A Review. Int J Sci Res Publ 2012;2:1-8.
27. Escames G, Ozturk G, Baño-Otálora B, Pozo MJ, Madrid JA, Reiter RJ, *et al.* Exercise and melatonin in humans: Reciprocal benefits. J Pineal Res 2012;52:1-1.
28. Sprod LK, Palesh OG, Janelsins MC, Peppone LJ, Heckler CE, Adams MJ, *et al.* Exercise, sleep quality, and mediators of sleep in breast and prostate cancer patients receiving radiation therapy. Community Oncol 2010;7:463-71.
29. Ilahi A, Ansari A, Zulkifle M, Mufti M. Association of exercise, sleep habits, dietary habits, bathing and house status in the genesis of central nervous system disorders. Hamdard Med 2012;55:33-8.
30. Irwin MR, Olmstead R, Motivala SJ. Improving sleep quality in older adults with moderate sleep complaints: A randomized controlled trial of tai chi chih. Sleep 2008;31:1001-8.
31. Montgomery P, Dennis JA. Physical exercise for sleep problems in adults aged 60+. The Cochrane Libr 2002;1:1-14.
32. Buman MP, Phillips BA, Youngstedt SD, Kline CE, Hirshkowitz M. Does nighttime exercise really disturb sleep? Results from the 2013 national sleep foundation sleep in America poll. Sleep Med 2014;15:755-61.