EFFECT OF AEROBIC TRAINING ON QUALITY OF SLEEP AND FUNCTIONAL CAPACITY AMONG SEDENTARY YOUNG ADULTS

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Abstract

Background: Students are exposed to a range of stress-causing circumstances during their time in college. By voluntarily changing their sleeping patterns, students learn to manage the myriad elements that contribute to their stress. Research has shown that being physically active can increase a person's happiness with their sleep quality. **Aim:** to assess the impact of an eight-week aerobic exercise program on sleep quality and functional capacity. **Results:** This study depicted a marked disparity in the quality of sleep among sedentary young adults engaged in regular physical activity by achieving better scores denoting healthier sleep quality after engaging in moderate aerobic physical activity for 8 weeks, 5 times/week for the duration of at least 30 minutes per day, performed more than 4 hours before bedtime. **Conclusion:** Upon the outcomes of the current academic work, there is a crystal-clear impact of regular physical activity on the quality of sleep among young adults.

Keywords: Aerobic Training; Quality of sleep; Sedentary young adults.

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1. INTRODUCTION

Exercise and sleep are inversely correlated. In other words, improving your exercise regimen may help you sleep better, while having enough sleep may encourage higher levels of physical activity during the day. Students frequently experience inadequate sleep, which has negative implications for their health and behaviours. Studying the links between sedentary behaviours and physical exercise and sleep could uncover various strategies for promoting high-quality sleep (1,2).

When it is simple to fall asleep and wake up, when sleep is continuous, and when sleep lasts a sufficient amount of time, good sleep quality is considered. According to empirical data, physical activity has been linked to adults' sleep quality in addition to being regularly connected with a variety of favourable physical and mental health effects (3.4,5).

"Physical exercise has been proven to be associated with longer sleep duration and better sleep quality sleep; more than 3.5 hours of physical activity/week had more favourable measures of sleep quality," says a study by **Foti, et al.** (2011) (6). **Delisle et al.** (2010) (7) also discovered that among 822 Florida high school students, those who engaged in vigorous physical activity for at least 15 minutes five or more times per week had longer average sleep durations than those who engaged in such activity for at least 15 minutes just once per week or less. According to the study's findings, students who exercised for more than 60 minutes every day for the prior seven days had a better likelihood of getting enough sleep than those who did not exercise for longer than 60 minutes on any one day.

By searching electronic databases for articles published between January 2013 and March 2017, Brett A. **Dolezal, et al.** (2017) (8) reported that twenty-nine research found that exercise enhanced sleep quality or duration. Studies were considered if they included both an exercise intervention that adhered to the recommendations of the American College of Sports Medicine and either objective or subjective assessments of sleep (ACSM). The 30 minutes of moderate-intensity physical activity recommended by the ACSM/AHA should be performed five days a week. According to HHS

recommendations, one should engage in 150 minutes of moderate physical activity each week, which is best achieved by doing 30 minutes of activity five days a week.

Although a sizable body of literature has examined the connection between exercise and sleep, there aren't any in-depth analyses or conclusive findings about how exercise programs affect sleep. It is obvious that further research is required, especially given the differences in these results between different age groups, study populations, exercise intervention types, and physiological underpinnings of how exercise may affect sleep. The current study's objectives are to evaluate young individuals' levels of physical activity and to look at how it may affect their sleep quality.

2. METHODOLOGY

An experimental, before-and-after, quantitative design was adopted in the current academic work. Using a lottery system, 60 participants were randomly sub-categorized into two groups: A & B. A control group and an experimental group, respectively. The "before" data set is gathered for both, and the "after" data set is measured for both; both groups are comparable in all respects other than the status of the independent variable.

The study took place between August 2017 and January 2018 and participants were chosen from Cairo University's Faculty of Physical Therapy. The study used a handy sample of 60 students who were randomly assigned to the experimental group and control group. Adults must be between the ages of 18 and 25 and lead sedentary lifestyles, which include little to no regular physical activity. Among the factors for exclusion are: young individuals with sleep disorders including insomnia or obstructive sleep apnea who also take sleep aids or drugs for night-time urination as well as those with pulmonary and chronic cardiovascular diseases.

- **Tools and Instruments:**

The Pittsburgh Sleep Quality Index (PSQI), which was previously adopted in a study by **Knutson, Ph.D., et al.** (9), of the Department of Health Studies, University of Chicago in 2006 to describe the stability of the PSQI among an adult population, came to the conclusion that it is a stable measure of sleep quality (10.11).

cardiopulmonary exercise test unit to measure maximum oxygen consumption.

- **Procedure:**

All participants were guided to avoid strenuous activity at least 48 hours before the testing day, no meal was allowed at least two hours prior to testing, and data were collected at baseline and following the intervention study's conclusion. Participants who qualified for the study were given copies of the Pittsburgh Sleep Quality questionnaires and scheduled for cardiopulmonary exercise testing. The measurements and questionnaire collection were done at Cairo University's College of Physical Therapy. It took about ten to fifteen minutes to complete the interview. For eight weeks, subjects participated in a moderate aerobic exercise routine three times per week for a minimum of 45 minutes per session, which also included warm-up and cool-down periods. The workout was done more than four hours before going to bed. whereas subjects in group B were advised to avoid any unusual activities for eight weeks.

- **Data Collection:**

The Pittsburgh Sleep Quality Index (PSQI), a self-report survey, rates respondents' sleep quality using a series of questions. It takes five to ten minutes to complete and separates "poor" from "great" sleep quality by measuring seven different components made up of nineteen unique items. The elements are the following: sleep index, sleep latency (how long it takes to fall asleep), sleep duration, habitual sleep efficiency (how much of the time spent in bed is spent asleep), sleep disruptions, use of sleeping aids, and daytime dysfunction. Every entry is evaluated on a scale from 0 to 3.

To determine the overall PSQI score, the combined scores from the seven components are summed up to provide a value ranging from 0 to 21. A score of five or more indicates poor sleep quality, whereas a score of five or less indicates healthier sleep quality.

At the beginning of the trial and eight weeks later, all cases had a maximal cardiovascular activity test using a Zan 100 flow handy II medical gadget attached to an open spirometry system. To evaluate functional capacity and maximal heart rate, software that ran under Windows 95 through Windows NT was utilized. The test phase started with an increase in workload at a rate of 25 watts per minute for 8 to 11 minutes. Cases was guided to cycle until they became too exhausted. Three minutes were given to unload the bike as a cool-down, and then another seven minutes were given to recover while monitoring the ECG, BP, and HR and looking for any post-exercise abnormalities. At the conclusion of the test, maximal heart rates (HR max) and oxygen consumption (Vo2 max) were measured.

- **Training procedures**

The study's cases in the aerobic training group went through a 6-week program of aerobic exercise; the training load began at 50% of each case's maximum heart rate during the exercise test. For eight weeks straight, the individuals engaged in aerobic activity for three periods each week. Each

session began with a 10-minute warm-up (top-to-bottom motions), followed by 30 minutes of fundamental cardiovascular exercises (10 minutes of cycling, 15 minutes of treadmill walking, and 5 minutes of mat work), followed by a 15-minute cool-down. Every two weeks, the level of exercise intensity was raised by 5% of the starting heart rate. Participants in the control group (B) were told to continue exercising at their usual rate for the whole six-week period.

- **Data analysis and statistical design:**

Data were submitted as mean ± SD. The features of the two groups of cases were compared using an unpaired t-test. MANOVA was used to assess effects for VO2 max, HR max, sleep index, sleep latency, and sleep duration within and across groups. Data analysis was done using the statistical package for social sciences computer program (*version 20 for Windows; SPSS Inc., Chicago, Illinois, USA*). P equal to or less than 0.05 was regarded as significant.

- **ETHICAL CONSIDERATIONS:**

The current academic work complies with the values set forth in the Helsinki Declaration (Br Med J 1964; ii: 177). No. P.T.REC/012/003662 was approved by the faculty's research ethics committee for physical therapy at Cairo University. The study's participants gave written declarations allowing the publication of anonymous data and the use of their information.

3. RESULTS

- **General characteristics of the subjects:**

The mean ± SD of the age of patients in groups A and B were 20.6 ± 1.5 and 20.9 ± 1.8 years respectively. The mean ± SD of BMI of patients in groups A and B were 25 ± 3.8 and 24.4 ± 3.6 kg/m² respectively, there was no marked disparity between the two groups in the mean age and BMI ($p > 0.05$), as highlighted in table (1)

Table (1): Descriptive statistics and t-test for comparing the mean age and BMI between groups

	Group A	Group B	t- value	p-value
Age (years)	20.6 ± 1.5	20.9 ± 1.8	-0.615	0.541
BMI (kg/m²)	25 ± 3.8	24.4 ± 3.6	0.688	0.494

Data were observed as mean ± standard deviation p-value: probability value

- **Normality test:**

Data were investigated for normality assumption, homogeneity of variance, and the presence of extreme scores. Shapiro-Wilk and Kolmogorov-Smirnov tests for normality showed that all measured variables are normally distributed.

Pre-study between groups: no marked disparity was noticed in the pre-study mean values of all measured variables between the two groups ($P > 0.05$), as highlighted in Table 2.

- **Post-study between groups:**

The mean ± SD of VO2 max for subjects in groups A and B post-study were 36.3 ± 3.6 and 31.4 ± 4.4 mL/kg/min respectively, and of HR max were 183.7 ± 15.8 and 175.2 ± 15.7 beat/min respectively.

The mean ± SD of sleep index for subjects in groups A and B post-study were 3 ± 0.67 and 7.5 ± 0.86 respectively, sleep latency was 16 ± 1 and 36.4 ± 2 respectively and sleep duration was 6.7 ± 0.79 and 6.1 ± 0.86 hours respectively. There was a noticeable disparity in post-study mean values of all measured variables between the two groups ($P<0.05$) in favor of group B, as reflected in Table 2.

- **Pre and post-study within groups:**

A crystal-clear disparity is observed between pre- and post-study mean values of all measured variables in group A. In group B a marked disparity was observed only in sleep latency and sleep duration, as reflected in Table 2.

4. DISCUSSION

The current academic work reflected a marked disparity in the sleep index among sedentary young adults engaged in eight-week aerobic training by achieving better scores denoting healthier sleep quality (before 7.7±1.1 & after 3.0±0.67), which was strongly supported by a systemic review conducted by **Brett A. Dolezal, et al** (8) published in 2017 stating that twenty-nine studies reached a conclusion that exercise improved sleep quality or duration after electronic databases were investigated for academic work published between January 2013 and March 2017.

The results of the current study are also consistent with a meta-analytic review by **Kredlow et al.** (2015) (12) analyses, which showed that exercise has a positive impact on total sleep time, sleep onset latency, sleep efficiency, a moderately positive impact on wake time after sleep onset, a small positive impact on REM sleep, and a moderately positive impact on sleep quality.

Moreover, scores of sleep latency showed a dramatic decrease in group (A) who engaged in physical activity (before 37.5±1& after 16±1) in comparison to group(B) (before 37.3 ± 1.1& after 36.4 ± 2), and this finding was supported by **Youngstedt, et al.** (1997) (13) that showed exercise decreased sleep onset latency (SOL).

Furthermore, the duration of sleep among the cases in group A showed some increase (before 5.7±0.86 & after 6.7±0.79) supported by **Delisle, et al.** (2010) (7) assuring that the average sleep duration among 822 Florida high school students was greater among those who took part in physical activity five or more time/week than those who engaged once/week or less.

Table (2): Comparison between pre- and post-study mean values of measured variables between and within groups.

Measured variables	Pre-study Mean ±SD	Post-study Mean ±SD	% of change	P value
VO2 max (mL/kg/min)				
Group A	32.3 ± 4	36.3 ± 3.6	12.4%	0.001*
Group B	31.9 ± 3.4	31.4 ± 4.4	-1.6%	0.365
(P-value)	0.722	0.001*		
HR max (beat/min)				
Group A	174.4 ± 13.7	183.7 ± 15.8	5.3%	0.001*
Group B	173.8 ± 14.6	175.2 ± 15.7	0.8%	0.562
(P-value)	0.878	0.041*		
Sleep index				
Group A	7.7 ± 1.1	3 ± 0.67	-61%	0.001*
Group B	7.6 ± 1	7.5 ± 0.86	-1.3%	0.588
(P-value)	0.623	0.001*		
Sleep latency				
Group A	37.5 ± 1	16 ± 1	-57.3%	0.001*
Group B	37.3 ± 1.1	36.4 ± 2	-2.4%	0.005*
(P-value)	0.492	0.001*		
Sleep duration (hours)				
Group A	5.7 ±0.86	6.7 ± 0.79	17.5%	0.001*
Group B	5.9 ±0.93	6.1 ± 0.86	3.4%	0.024*
(P-value)	0.519	0.009*		

SD: standard deviation **p-value:** probability value ***:** significant

While a study by **Foti, et al.** (6) recommended different criteria, including those cases engage in 15 or more minutes of vigorous physical activity and 3.5 hours of physical activity/week, a study by **Myllymäki, et al.** (2006) (14) supported the criteria of exercise of moderate aerobic physical activity, stating that intense physical activity is not advised and showing results that there was a greater proportion of non-exercisers (15,16,17).

In addition, **Youngstedt, et al.** (1997) (13) stated in a study that exercise performed 4-8 hours before bedtime and exercise of shorter duration than 2 hours showed better results, contradicting **Foti, et al.'s** (2011) (6) statement of 3.5 hours of physical activity/week. Whereas, on the other hand, the exercise of more than 2 hours of duration performed more than 8 hours and less than 4 hours before bedtime increased SOL, and showed a crystal-clear decrease in REM, resulting in an overall decline in sleep quality; supporting our exercise criteria of at least 30 minutes per day conducted more than 4 hours before bedtime (18,19,20).

In scientific studies, light exercise was more frequently used as a physiotherapy technique to enhance sleep quality. It is a good idea to talk about how physical intensity and length affect the quality of sleep. A cross-sectional study revealed that neither the length nor the intensity of PA was related to the quantity or quality of sleep (21).

It has been strongly indicated that older persons with moderate sleep difficulties benefit from frequent moderate-intensity exercise (22). The results shown above suggest that physical intensity may be connected to sleep quality, although additional research work is needed to confirm this (23).

In the current study; eight weeks of aerobic training showed a significant improvement in Vo2 max (36.3±3.6 ml/min/kg) compared to the control group (31.4±4.4 ml/min/kg) achieved during maximal exercise testing , according to our hypothesis students who demonstrate better

functional capacity experienced better sleep quality, the similar result obtained in the study of **Ezati et al.'s** (2017) (24) who declared that cases in the aerobic group achieved a marked improve in the score of sleep quality ($p < 0.001$ and $p < 0.0001$, respectively) and its components (except for sleep duration after 4 weeks intervention).

Given that physical intensity is commonly recognized, this paper reveals that moderate physical activity improves sleep quality in age groups in healthy populations. The statistics that are now available, however, do not really support gender interaction when engaging in physical activity. Few scientific studies have specifically examined how long physical activity lasts for moderate activity; a topic that has not yet been fully studied in academic studies (25-28).

LIMITATIONS:

This study was limited by extrinsic factors such as holidays, exams, and class schedules.

5. CONCLUSION

Regular and frequently unnoticed contributors to health and behaviours include inadequate sleep. Pupils learn about a range of stress-producing situations and develop coping mechanisms by voluntarily changing their sleeping patterns. Yet, the outcomes of the current academic work indicate that young individuals who exercise for at least 30 minutes of moderate aerobic activity three times a week are more likely to sleep well, offering yet another benefit of physical activity. Within the scope of the academic work, a substantial disparity between individuals who engaged in physical activity and those who did not was discovered. This variance was accompanied by improvements in scores for the number of minutes needed to fall asleep and sleep hours, thus indicating an overall.

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