



## THE DIFFERENCE OF SLEEP QUALITY BEFORE AND AFTER SKIPPING EXERCISE IN MEDICAL STUDENTS OF DIPONEGORO UNIVERSITY

Julsyawiah Novthalia<sup>1</sup>, Buwono Puruhito<sup>2</sup>, Dodik Pramono<sup>3</sup>, Endang Kumaidah<sup>2</sup>

<sup>1</sup>Undergraduate of Medical Student, Faculty of Medicine, Diponegoro University

<sup>2</sup>The Lecturer Science of Physiology, Faculty of Medicine, Diponegoro University

<sup>3</sup>The Lecturer Science of Public Health, Faculty of Medicine, Diponegoro University

Jl. Prof. H. Soedarto, SH, Tembalang-Semarang 50275, Tel. (024) 76928010

\*Corresponding Author: Julsyawiah Novthalia. Email: [julsyawiah@yahoo.com](mailto:julsyawiah@yahoo.com)

### ABSTRACT

**Background :** The many tasks that put upon the medical students require them to have a good sleep quality. Medical students generally have poor sleep quality. One way to improve sleep quality is to perform effective aerobic physical activities such as skipping. **Aim :** To explore the difference in sleep quality before and after skipping exercise in Medical Student of Diponegoro University. **Methods :** This study was a quasi-experimental with pre-test and post-test non-equivalent group. The samples were students of Faculty of Medicine, Diponegoro University (n = 48) aged 18-22 years who met the inclusion criteria. The sample was divided into 2 groups: control and treatment groups, each consisting of 24 students. Sleep quality score was measured using the Pittsburgh Sleep Quality Index (PSQI). The normality test was performed using the Shapiro-Wilk test. Hypothesis testing of sleep quality score before and after skipping exercise in the control group was performed using the Wilcoxon test, while in the treatment group using the paired t-test. The difference in sleep quality score between control and treatment groups was performed using the Mann-Whitney test. **Results :** The pre-test PSQI score in the control group is  $6.88 \pm 1.872$  while in the treatment group is  $7.63 \pm 1.996$ . The results of the statistical test showed that the difference is not significant ( $p > 0.05$ ). The post-test PSQI score in the control group was  $7.92 \pm 2.888$  while in the treatment group was  $4.58 \pm 1.886$ . The results of the statistical test showed that the difference is significant ( $p < 0.05$ ). In the control group, there is a slight increase in PSQI score which is not significant ( $p > 0.05$ ), while in the treatment group there is a significant decrease in PSQI score ( $p < 0.05$ ). **Conclusion :** There is a significant difference in the sleep quality score between control and treatment groups; the sleep quality of the treatment group is better than the control group.

**Key Words :** Sleep quality, Skipping exercise, Pittsburgh Sleep Quality Index (PSQI)

### INTRODUCTION

Sleep is a necessity of every human being. Sleep is defined as an unconscious state in which a person can still be awakened by giving sensory or other stimuli.<sup>1</sup> The need for adequate sleep is determined by several factors including the

number of sleep hours (sleep quantity) and the depth of sleep (sleep quality).<sup>2</sup>

Sleep quality is one's satisfaction of its sleep.<sup>3</sup> The lack of sleep quality can decrease physical performance, cognitive function, social function, mental condition, and even death.<sup>4</sup> Poor sleep quality is a



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health problem that is often experienced by students, especially medical students. Based on the previous study conducted on medical students at the University of Botucatu, Brazil, from a total of 372 study subjects, 147 students (39.5%) experienced poor sleep quality.<sup>5</sup>

The sleep quality can be improved in various ways. One way to improve sleep quality is to perform aerobic and anaerobic physical exercises.<sup>6</sup> One of the aerobic exercises that are easy, inexpensive, and can be performed by ages is skipping exercise. Not only that, skipping exercise is very flexible because it only requires simple equipment. Considering that, skipping exercise can be a suitable alternative physical exercise for medical students with hectic schedules routine.

A prior study suggested the influence of Zumba fitness, which is one of the aerobic physical exercises, to improve sleep quality in sophomore students of the Faculty of Medicine, Unisba.<sup>7</sup> Other studies suggested the effect of aerobic exercise on improving sleep quality in students of the Physiotherapy Program at the Faculty of Medicine, Udayana University<sup>8</sup> and the effect of aerobic and anaerobic exercise on sleep quality in students of Islamic Zahedan Azad University Iran.<sup>6</sup> However, there is no

study on the effect of skipping exercise on sleep quality. It becomes the author interest to conduct a study on the differences in sleep quality before and after skipping exercise in students of Faculty of Medicine, Diponegoro University.

## **METHODS**

This study was conducted in the Faculty of Medicine, Diponegoro University, Semarang, Central Java, in May-June 2019. This study was a quasi-experimental with pre-test and post-test non-equivalent group. The samples were selected by purposive sampling based on predetermined criteria. In determining the study sample, the author used a matched subject design, which is an experiment that uses two groups of samples that had been matched subject-by-subject before the treatment was carried out. The variables which had been known to affect the experimental results were matched. There were 48 students of Faculty of Medicine, Diponegoro University who meet the inclusion criteria and there were no exclusion criteria.

The sample was divided into 2 groups: the control group that did not get any intervention and the treatment group that underwent skipping exercises 3 times a



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week for 6 weeks. The sleep quality assessment was carried out using the Pittsburgh Sleep Quality Index (PSQI) questionnaire.

The normality test was done using the Shapiro-Wilk test. Hypothesis testing between sleep quality score before and after skipping exercise in the control group was performed using the Wilcoxon test while in the treatment group using the paired t-test. The differences in sleep quality score between the control and treatment groups were performed using the Mann-Whitney test.

## RESULTS

**Table 1.** The PSQI score in the control and treatment groups.

Time of Measurement	Group		p
	Control (n=24)	Treatment (n=24)	
	Mean±SD; Median Min-Max	Mean±SD; Median Min-Max	
Pretest	6,88±1,872; 6 (2-10)	7,63±1,996; 8 (3-11)	0,127*
Posttest	7,92±2,888; 7 (4-14)	4,58±1,886; 4,5 (2-8)	0,000*
P	0,219 <sup>¶</sup>	0,000 <sup>§</sup>	

\*Mann-Whitney test

<sup>¶</sup>Wilcoxon test

<sup>§</sup>paired t-test

Based on table 1, it was demonstrated that the PSQI score during pre-test in the control group ( $6.88 \pm 1.872$ ) is higher than the treatment group ( $7.63 \pm 1.996$ ). The result of the statistical test showed that this difference is not significant ( $p > 0.05$ ). The PSQI score during post-test in the control group ( $7.92 \pm 2.888$ ) was higher than the treatment group ( $4.58 \pm 1.886$ ). The result of the statistical test showed that this difference is significant ( $p < 0.05$ ). Table 1 also showed a slight increase in the PSQI score which is not significant ( $p > 0.05$ ), while in the treatment group there is a significant decrease in PSQI score ( $p < 0.05$ ).

## DISCUSSION

The results showed that there is a change in sleep quality in the treatment group that underwent skipping exercise for 6 weeks and there was no change in sleep quality in the control group. In this study, there is an increase in sleep quality score after skipping exercise for 6 weeks. This is consistent with the hypothesis that physical exercise such as skipping can reduce stress hormones such as cortisol and increase endorphins. The cortisol hormone affects the central nervous system which can change the electrical waves in the limbic system and hippocampus and affect the



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sleep cycle.<sup>9</sup> The increase in cortisol hormone will disturb the sleep cycle, decrease the Slow Wave Sleep (SWS), shorten sleep time, and cause insomnia, so the decrease in cortisol hormone which is influenced by physical exercise such as skipping will improve sleep quality.<sup>9</sup>

In addition to cortisol, endorphins also contribute to improving sleep quality induced by physical exercise. Endorphins are hormones produced by the anterior pituitary gland that act as pain relievers through the binding of opioid receptors by beta-endorphins which will inhibit the release of pain and help improve sleep quality.<sup>9</sup>

The consistent movement of the arm muscles during skipping requires absorption of branched-chain amino acids. There is a competition between branched-chain amino acids and tryptophan, which is a precursor of serotonin. The decrease in the amount of branched-chain amino acids through the muscles during aerobic physical exercise will increase the amount of tryptophan that passes through the Blood-Brain Barrier (BBB) and therefore increase the serotonin in the brain.<sup>10</sup> Serotonin acts as a precursor of melatonin. In the pineal gland, serotonin is synthesized into melatonin. Melatonin function to regulate the body's cyclic

rhythm and cause drowsiness which in turn cause sleep.<sup>10</sup>

During successive jumps in skipping exercises, an increase in body temperature will occur. An increase in temperature either active (physical activity) or passive (hot shower/sauna) can increase sleep depth through increased Slow Wave Sleep (SWS). An increase in body temperature can result in elevation of the preoptic area or the anterior hypothalamus temperature associated with body thermoregulation.<sup>11</sup> When there is an increase in temperature induced by exercise, the temperature regulating mechanism will reduce body temperature by releasing the heat through vasodilation of peripheral blood vessels. A decrease in temperature due to this thermoregulatory mechanism will initiate sleep and improve sleep quality.<sup>12</sup>

## **CONCLUSION AND SUGGESTION**

### **Conclusion**

The results showed that there is a significant difference in the sleep quality score between the control group and the treatment group, the sleep quality score of the treatment group is lower than the control group and therefore the sleep quality of the treatment group was better than the control group.



## Suggestion

Future studies controlling the skipping exercises to ensure subject compliance and other factors that might affect sleep disorders are needed. Also, more objective study parameters such as electroencephalography and hormones related to sleep functions such as melatonin, cortisol, etc need to be considered.

## REFERENCES

1. A. Guyton JH. *Guytn Dan Hall Buku Ajar Fisiologi Kedokteran*. Jakarta: EGC; 2014.
2. E. Lanywati. *Insomnia Gangguan Sulit Tidur*. Yogyakarta: Kanisius; 2001.
3. Hidayat AA. *Pengantar Kebutuhan Dasar Manusia*. Jakarta: Salemba Medika; 2006.
4. Ambarawati F. *Konsep Kebutuhan Dasar Manusia*. Yogyakarta: Dua Satria Offset; 2014.
5. Corrêa C de C, Oliveira FK de, Pizzamiglio DS, Ortolan EVP, Weber SAT. Sleep quality in medical students: a comparison across the various phases of the medical course. *J Bras Pneumol*. 2017;43(4):285-289. doi:10.1590/s1806-37562016000000178
6. Kianian T, Navidia A, Aghamohamadi F, Saber S. Comparing the Effects of Aerobic and Anaerobic Exercise on Sleep Quality among Male Nonathlete Students. 2017:168-173. doi:10.4103/nms.nms
7. Anggraeni E, Sutadipura N, Kharisma Y. Pengaruh Zumba Fitness terhadap Kualitas Tidur Mahasiswi Tingkat II Fakultas Kedokteran Unisba Tahun Akademik 2016 – 2017 Effect of Zumba Fitness to Sleep Quality in Second Year Female Students Faculty of Medicine Unisba in Academic Year 2016 – 2017. 2017;1(22):30-36.
8. Malini MM, Silakarma ID, Sundari LPR. Latihan Senam Aerobik Meningkatkan Kualitas Tidur pada Mahasiswa Program Studi Fisioterapi Fakultas Kedokteran Universitas Udayana. 2014;89.
9. Buman MP, King AC. Exercise as a Treatment to Enhance Sleep. 2010. doi:10.1177/1559827610375532.
10. Heijnen S, Hommel B, Kibele A, Colzato LS. Neuromodulation of Aerobic Exercise — A Review. 2016;6(January):1-6. doi:10.3389/fpsyg.2015.01890



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11. ZubiaVeqar, EjazHussain M. Sleep quality Improvement and exercise. *Int J Sci Res Publ.* 2012;2(8):1-8.  
<http://www.ncbi.nlm.nih.gov/pubmed/17387231>.
12. Chennaoui M, Arnal PJ, Sauvet F, Léger D. Sleep and exercise: A reciprocal issue? *Sleep Med Rev.* 2015;20:59-72.  
doi:10.1016/j.smr.2014.06.008