

# The Effect of Mat Pilates Exercise on Sleep Quality of Obese Young Adults

*by* Erna Setiawati

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Maria Devina Putri Elvariani, Rahmi Isma Asmara Putri,  
Erna Setiawati, Hexanto Muhartomo

## THE EFFECT OF MAT PILATES EXERCISE ON SLEEP QUALITY OF OBESE YOUNG ADULTS

Maria Devina Putri Elvariani<sup>1\*</sup>, Rahmi Isma Asmara Putri<sup>2</sup>, Erna Setiawati<sup>2</sup>, Hexanto Muhartomo<sup>3</sup>

<sup>1</sup>Undergraduate Program, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

<sup>2</sup>Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

<sup>3</sup>Department of Neurology, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

\* Corresponding Author: E-mail: [devputri@students.undip.ac.id](mailto:devputri@students.undip.ac.id)

### ABSTRACT

**Background:** Obesity currently becomes one of the world's problems with the prevalence in Indonesia is 21,8%.that can decrease a person's quality of sleep in 40% of obese patients. Pilates exercise was found to improve sleep quality in obese patients. Pilates exercises are easy to do because they do not need instructor but also safe to do because they don't involve jumping and running so they avoid trauma. Mat Pilates exercise is basic exercises that are done on the floor on a mat with simpler movements. **Objective:** To analyze sleep quality in obese young adults before doing Mat Pilates exercise and to compare changes in sleep quality for obese young adults before and after doing Mat Pilates exercise. **Methods:** This study used a quasi-experimental design applying one group pre-posttest. Samples were taken by purposive sampling with a total of 36 people who met the inclusion and exclusion criteria. The measurement of sleep quality used the Pittsburgh Sleep Quality Index (PSQI) questionnaire. Data analysis was tested for normality by using the Shapiro-Wilk test and the effect of Mat Pilates exercise on sleep quality in the treatment group using the Wilcoxon test. The difference is significant if  $p < 0.05$ . **Results:** The average sleep quality index for young adults before participating in the Mat Pilates exercise was  $8.22 \pm 1.87$ , while the average sleep quality index for young adults after participating in the Mat Pilates exercise was  $4.33 \pm 0.77$ . The statistical test results showed that there was a significant difference ( $p = < 0.001$ ). **Conclusion:** There is an improvement in the mean value of sleep quality after doing Mat Pilates exercise.

**Keywords:** Mat Pilates exercise, obesity, PSQI, sleep quality.

### INTRODUCTION

Obesity is a pathological condition caused by the excessive accumulation of adipose tissue. A person with a Body Mass Index (BMI) over 27 kg/m<sup>2</sup> is considered to be obese. World Health Organization (WHO) is currently declared obesity as a global epidemic. Basic Health Research data (2018) shows that the prevalence of Indonesia's obese population aged more than 18 years continues to increase from 14,8% to 21,8%. [1, 2]

Obesity becomes one of the factors that accelerates the onset of cardiovascular disease, Obstructive Sleep Apnea (OSA), Type 2 Diabetes, Nonalcoholic steatohepatitis (NASH), osteoarthritis, and malignant disease. Obesity can also affect a person's quality of life, one of which is sleep quality. This is in line with research conducted by Antczak, et al. which states that there is an effect of obesity on sleep quality as high as 40% that is caused by respiratory distress during sleep or often called sleep apnea. [3] Sleep quality is characterized by a person's satisfaction with sleep starting with how a person prepares his sleep patterns at night such as sleep depth, the ability to maintain sleep, and the ease of falling asleep without medical help. Narrowing of

the upper airway muscles in obese patients occurs due to the accumulation of excessive adipose tissue. This accumulation of tissue causes dysfunction below the diaphragm and within the chest wall which can compress the lungs during sleep, leading to apnea and hypoxia. Fat tissue on the neck and tongue will affect the airway diameter and allow for early closure while the muscle tissue relaxes at sleep. This condition will cause obese patients to experience a decrease in sleep quality. [4] Poor sleep quality not only causes physical disturbances but can also result in a person's cognitive decline. If left untreated and occurring for many years, then complications are very likely to occur such as heart attacks, strokes, to psychological problems such as depression or other emotional disorders. [5]

Poor sleep quality due to airway obstruction can be improved by exercising or physical activity. Exercise is one of the ways that it is economical, easy to do, and has few side effects so it is safe to do. [6] Pilates exercise training can improve the quality of sleep in obese patients both physically and mentally. Pilates exercises are safe for everyone because they do not involve jumping and running so



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they avoid trauma. The Pilates movements do not require a lot of repetitions, by doing exercise fully and precisely yields a significant result. This exercise requires good respiratory coordination. This will indirectly train the respiratory muscles by stretching the muscles and make the muscle contractions increase so that it can affect the strength of the respiratory muscles and respiratory pressure. Pilates Mat exercise has a principle related to breathing, in which the respiratory method used is the "lateral breathing" method that prevents over-expansion of the abdominal area during the inspiration process. Mat Pilates breathing techniques are focused on the chest and muscles in the ribs so that it will increase the strength of the respiratory muscles. The lateral breathing method aims to make the ribs and chest cavity expand lateral expansion so that it will give more space for the lungs to expand. There are two types of Pilates exercises, namely Mat Pilates and Apparatus Pilates. Mat Pilates exercise is basic exercises that are done on the floor on a mat so that it is easier to do Mat Pilates anywhere and anytime and uses simpler movements. [7, 8, 9, 10] Research conducted by Trisnowiyanto B. also stated that Mat Pilates exercise also improve the flexibility in women aged 20-50 years. As far as the researchers know, research on the influence of Mat Pilates exercise on sleep quality has not been done in obese young adults who tend to have poor sleep quality. Through this study, it is expected to know the comparison of sleep quality between obese young adults who do Mat Pilates and those who do not do Mat Pilates exercises.

## METHODS

This study used a quasi-experimental design applying one group pretest-posttest. The research was conducted online from August to September 2020 by using the Zoom application. Research subjects were obtained from various regions in Semarang and outside Semarang. Research respondents were taken by considering the inclusion and exclusion criteria including young adults aged 18 to 23 years, Body Mass Index > 27 kg/m<sup>2</sup>, PSQI score > 5, not consuming coffee within 24 hours, DASS-21 score < 10, willingness to participate in the study, do not have a history or are not suffering from cardiovascular disease, do not have a history of spinal surgery and abnormalities (fractures, dislocations, and spondylosis), are not active

smokers, and can stand or walk. Based on these criteria, this study found a total of 36 respondents. The research subjects were divided into 2 groups, namely the control group and the treatment group who participated in the Mat Pilates exercise. The independent variable of this study was the Mat Pilates exercise guided by a coach. The exercise was done 3 times a week for 4 weeks with a total duration of approximately 50 minutes per session. The dependent variable is sleep quality as measured using the Pittsburgh Sleep Quality Index (PSQI) questionnaire. The confounding variable in this study is physical activity. In this study, subjects who have met the inclusion and exclusion criteria will sign an informed consent as a sign of willingness to participate in the study. After participating in the Mat Pilates exercise for 4 weeks, the research subjects were asked to fill out a PSQI questionnaire which would then be tabulated, coded, and analyzed. The data distribution was tested for normality using the Shapiro-Wilk test. Hypothesis testing of the effect of Mat Pilates exercise on sleep quality in the treatment group was carried out using the Wilcoxon test. Hypothesis testing to determine differences in PSQI scores post-test control and treatment groups was carried out using the Mann-Whitney test. The difference is significant if  $p < 0.05$ .

## RESULTS

### Characteristics of Research Subjects

Table 1. General descriptions of research subjects

Variable	Group		p
	Control	Treatment	
Age	20.44 ± 0.98	20.83 ± 0.86	0.328 <sup>‡</sup>
BMI	28.51 ± 2.18	30.46 ± 3.20	0.076 <sup>‡</sup>
<b>Physical Activity</b>			
Less	18 (100%)	14 (77.8%)	0.052 <sup>‡</sup>
Enough	0 (0%)	4 (22.2%)	
DASS-21	7.00 ± 1.94	7.67 ± 2.28	0.100 <sup>‡</sup>
PSQI Pre	8.22 ± 1.87	9.44 ± 2.26	0.085 <sup>§</sup>

Notes: \* Significant ( $p < 0.05$ ); <sup>‡</sup> Mann Whitney; <sup>‡</sup> Chi square; <sup>§</sup> Independent

As shown in table 1, it can be seen that based on age, BMI, physical activity, DASS-21, and pretest PSQI scores, all data did not find any significant differences between the control and treatment groups with  $p > 0.05$ .

**Descriptive Analysis**

Based on table 2, it can be found that the average PSQI pretest score of the treatment and control group is classified as poor sleep quality (PSQI > 5) in subjects with a BMI of > 27 kg/m<sup>2</sup>. The average PSQI post-test score of the treatment group was smaller than the control group, indicating there was an improvement in sleep quality in the treatment group after taking the Mat Pilates exercise.

From the results of this study, the Shapiro-Wilk normality test was carried out because the number of samples was less than 50, and the data obtained from the Body Mass Index (BMI) of the treatment and control groups were not normally distributed ( $p < 0.05$ ), the post-test PSQI score of the treatment group was not normally distributed ( $p < 0.05$ ), while the pre-test PSQI score data and the control group post-test PSQI score was normally distributed ( $p > 0.05$ ).

**Table 2.** Descriptive analysis table and normality test of research data

Variable (n=36)	Mean	Median	SD	Min	Max	Sig.
<b>BMI</b>						
Treatment	28.5067	27.7100	2.17574	27.03	35.75	0.000*
Control	30.4578	29.1950	3.20460	27.02	36.50	0.035*
<b>PSQI pre</b>						
Treatment	8.22	8	1.87	6	12	0.121*
Control	9.44	9.5	2.26	6	13	0.114*
<b>PSQI post</b>						
Treatment	4.33	4.5	0.77	3	5	0.001*
Control	8.17	8.5	2.57	3	11	0.064*

\* Shapiro-Wilk Normality Test

**Hypothesis testing****Table 3.** Comparison table in PSQI pre-test, post-test, and delta

PSQI	Group		p
	Treatment	Control	
Pre-test	8.22 ± 1.87	9.44 ± 2.26	0.085 <sup>§</sup>
Post test	4.33 ± 0.77	8.17 ± 2.57	<0.001 <sup>‡*</sup>
p	<0.001 <sup>‡*</sup>	0.035 <sup>§*</sup>	
Delta	-3.89 ± 1.32	-1.28 ± 2.37	<0.001 <sup>‡*</sup>

Notes: \* Significant ( $p < 0.05$ ); <sup>§</sup> Independent t; <sup>‡</sup> Mann Whitney; <sup>§</sup> Paired t; <sup>†</sup> Wilcoxon

Based on the Wilcoxon test, it can be concluded that there is a significant difference in the pre-test and post-test PSQI scores in the treatment group with  $p = 0.001$  ( $p < 0.05$ ). Based on the paired t-test, it can be concluded that there is a significant difference between the pre-test and post-test PSQI scores of the control group with  $p = 0.035$  ( $p < 0.05$ ). Based on the unpaired t-test and the Mann-Whitney test, it can be concluded that there is no significant difference in the pre-test PSQI scores of the control and treatment groups with  $p = 0.085$  ( $p > 0.05$ ), but it was found a significant difference in the PSQI scores of the post-test control and treatment group with  $p = 0.001$  ( $p < 0.05$ ).

**Table 4.** Hypothetical test of the influence of physical activity

Variable	Group		p
	Treatment	Control	
<b>Physical Activity</b>			
Less	18 (100%)	14 (77.8%)	0.052 <sup>‡</sup>
Enough	0 (0%)	4 (22.2%)	

<sup>‡</sup> Chi-square

Based on the results of data analysis with the chi-square test obtained a significance value of 0.052. Based on this value because the  $p > 0.05$  can be concluded that physical activity is not a contributing factor in this study.





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## DISCUSSION

### Sleep quality in obese young adults before doing Mat Pilates exercise

Sleep quality is defined as a person's satisfaction with sleep, including both quantitative and qualitative aspects of sleep such as sleep duration, sleep latency, the frequency of awakenings, and subjective aspects such as sleep quality.[11] In obese patients (BMI > 27 kg/m<sup>2</sup>) tends to have poor sleep quality due to the accumulation of excessive adipose tissue in the upper airway, increased abdominal circumference which will reduce lung volume capacity leading to hypoxia, weakened of respiratory muscles, and decreased fatigue resistance in the chest wall which can interfere with respiratory efforts during sleep.[12]

Research by Sulistiyani states that obese people increased risk of developing sleep apnea so that they often stop breathing for a moment during sleep and cause sleep quality to be disturbed, and the 19-29 years old and young adults are a group that spends more of their time in productive activities. They tend to wake up early for activities and sleep late at night because of various tasks that will affect sleep quality.[3] Research by Bataha shows that there are differences in obese and non-obese adolescents on sleep quality at SMP Negeri 8 Manado where 26 respondents (86,7%) of 30 respondents had poor sleep quality.[4] Based on the statistical analysis conducted in this study, it can be observed that the control and treatment groups with a BMI > 27 kg/m<sup>2</sup> and 18 to 23 years of age before Mat Pilates exercise had poor sleep quality (PSQI > 5). This shows that obese young adults tend to experience a decrease in sleep quality, according to the theory and research results previously mentioned.

### Sleep quality of obese young adults before and after doing Mat Pilates exercise

Poor sleep quality in obese young adults due to narrowing of the upper airway can be improved by doing exercises.[6] One of the exercises that can be done is the Mat Pilates exercise which requires good respiratory coordination. Mat Pilates exercise can train the respiratory muscles through stretching the muscles so that it can affect the respiratory muscle strength, respiratory pressure, and expand the lateral expansion to provide more room for the lungs to expand.[13]

Based on the results of the statistical analysis carried out in this study, there was a significant difference in sleep quality as measured by the PSQI questionnaire before and after doing Mat Pilates exercise 3 times a week for 4 weeks which was marked by a decrease in the number of PSQI scores to less than 5. The PSQI questionnaire components that experienced an improvement in the treatment group were fewer complaints of dyspnea during sleep and fewer complaints of coughing or snoring during sleep. Meanwhile, the control group also found a significant difference in the pre-test and post-test PSQI scores, but the post-test PSQI score was still classified as poor sleep quality, namely PSQI score > 5. This could be due to the higher pre-test PSQI score in the control group compared to the treatment so that it is possible to obtain a significant difference in the pre-test and post-test PSQI scores of the control group even though the post-test mean PSQI score is still classified as poor (PSQI score > 5). The components of the PSQI questionnaire for dyspnea during sleep and complaints of coughing or snoring were not found in the control group. The results of the statistical analysis also showed a significant difference in the results of the post-test PSQI scores between the control group and the experimental group. The results of this study illustrate that Mat Pilates exercise can help to improve sleep quality as evidenced by the post-test mean PSQI score of the treatment group < 5 or the quality of sleep is good. This is in line with the research of Vincent, et al.[6], which states that muscular endurance exercise increases antioxidants and oxidative properties in the respiratory muscles, thereby decreasing lipid peroxidation and increasing fatigue resistance which will activate the upper airway. Sangam, et al.[8], states that Pilates is effective in increasing respiratory muscle strength and mobility of the thorax and abdomen. Pilates can improve the performance of the respiratory muscles.

The limitation of this research is the Mat Pilates exercise which is carried out online due to the Covid-19 pandemic conditions which require social distancing so that supervision by gymnastics coaches is not as good as if it is carried out offline. The implementation of online exercise also requires an adequate internet network for all parties who play a role in the research so that information during exercise can be conveyed properly.



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### CONCLUSIONS

Based on the results of the research and analysis that has been done, it can be concluded that there are improvements in sleep quality in obese young adults before and after doing Mat Pilates exercise.

### Ethical Approval

Ethical clearance was obtained with the approval and consideration of the Health Research Ethics Commission, Faculty of Medicine, Diponegoro University with ethical clearance number No. 107 / EC / KEPK / FK-UNDIP / VI / 2020.

### Conflicts of Interest

There is no conflict of interest related to the materials, methods, and findings in this study.

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### Author Contributions

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