

## CORRELATION BETWEEN SLEEP QUALITY AND BODY MASS INDEX IN ADOLESCENTS IN DENPASAR

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### ABSTRACT

Obesity is a pathological condition under which extra fat is accumulated from the body's required needs. Complications such as hypertension, dyslipidemia, diabetes, fatty liver disease and psychosocial problems can occur in a person who is overweight and obese in adolescence. Sleep quality represents satisfaction with the sleep experience by integrating sleep initiation aspect, managing sleep time, meeting sleep needs, and feeling refreshed when waking up. One of the factors that can lead to overweight and obesity is poor sleep quality. This research attempts to establish the association between sleep quality and body mass index in adolescents in Denpasar. This research was a cross-sectional analytical study using the Pittsburg Sleep Quality Index questionnaire to determine the quality of sleep and measurement of the body mass index of 280 high school students in Denpasar. Somers'D correlation test results showed no relationship ( $p = 0.108$ ) between sleep quality and body mass index in adolescents. There is no correlation between sleep quality and body mass index in adolescents in Denpasar. Further studies are needed related to other factors that affect an adolescent's body mass index.

**Key Words:** *Sleep Quality; Overweight; Obesity; PSQI; Teenager*

### INTRODUCTION

Overweight and obesity are pathological conditions where excess fat accumulation from the body's needs for the body to function normally<sup>1</sup>. Overweight and obesity can occur in all age groups, including adolescents. The prevalence of overweight and obesity among adolescents aged 13-18 years in Indonesia is still high, according to a report on the Baseline Health Research results in 2013. In adolescents aged 13-15 years in Indonesia, the prevalence of overweight and obesity is 10.8%, consisting of 8.3% overweight and 2.5% obesity. In adolescents aged 16-18 years in Indonesia, the prevalence of overweight and obesity is 7.3%, consisting of 5.7% overweight and 1.6% obesity. In Bali, the prevalence of obesity and obesity among adolescents aged 13-15 years and 16-18 years is higher than the national prevalence. The incidence of obesity and obesity in adolescents aged 16-18 years in Indonesia keeps rising from 1.4% in 2007 to 7.3% in 2013.<sup>2</sup> Overweight and obesity in adolescent can affect nearly all organ systems and often have serious consequences, including hypertension, dyslipidemia, insulin resistance or diabetes, fatty liver disease, and psychosocial complications.<sup>3</sup> Recent literature shows that poor sleep quality is also a risk factor that can lead to overweight and obesity in adolescents<sup>4,5</sup>.

Sleep quality is a person's satisfaction with sleep experience by integrating sleep initiation, maintaining sleep time, sleeping quantity, and feeling refreshed when waking up<sup>6</sup>. The prevalence of people dissatisfied with their sleep ranges from 8% to 18.55%.<sup>7</sup> Poor sleep quality can occur in adolescents because it is influenced by several factors such as biological factors, psychosocial and environmental factors, and other factors such as disease and drugs<sup>8</sup>. Previous findings have found that increased food intake, poor eating patterns, and obesity are correlated with reduced sleep length, poor sleep efficiency, and later sleep times<sup>4</sup>. There are only a few studies that have been conducted in Indonesia on the relationship between sleep quality and body mass index in adolescents, especially in Denpasar. This is very important to understand in order for adolescents to measure their standard of sleep to keep their body mass index normal.

### METHODS

Cross-sectional observation is used as the main method on this research. Permissions to conduct the study and contact the sampled schools were granted by Medical Faculty of Udayana University/Sanglah Hospital Denpasar with ethical clearance number 121/UN14.2.2.VII.14/LP/2020.

An explanation of the procedures and benefits of the study was conducted on all respondents before the study began. This study involved 280 students aged 16-19 years in four public high schools in Denpasar during January-February 2020.

Multistage random sampling was used to select the sample. Using a random number generator, four of the eight public high schools in Denpasar were first selected. Within each school, two classes (from grade 10 and 11) were randomly selected, from which all students were invited to take part. The sample had fulfilled the inclusion criteria in which are registered as students from public high schools in Denpasar in the 2019-2020 academic year and agree to be the sample of the research by filling inform consent. Written informed consent was obtained from 150 participants and guardians of participants in the study, 130 participants were untraceable or had refused to continue to cooperate in the study.

The student questionnaires included questions on the following: grade, class, gender, and age. Data on sleep quality were collected using Pittsburgh Quality Scale Index (PSQI) questionnaire. The body mass index (BMI) measurement of the research sample was conducted by measuring the body weight using an electronic scale and body height using microtoise. The sleep quality measurement results were 0-5 for good sleep quality, and 6-21 for poor sleep quality.

Anthropometric body measurements were analyzed by the WHO Anthro Plus software version 1.0.4. BMI derived was categorized by using Z score tables of WHO-BMI for age standards for children and between 5 and 19 years. Data were analyzed by Statistical Package for the Social Sciences (SPSS) software version 25. Somers'D correlation test was used to determine the association between sleep quality as the independent variable and the body mass index as the dependent variable.

## RESULTS

Based on [Table 1](#), 61 male participants and 89 female participants were included. Most of participants were 17 years old (50.7%). The majority of participants had a normal body mass index, including 113 (75.3%) participants. In this study, the number and proportion of participants who were overweight and obese were 25 participants (16.7%), composed of 16 participants who were overweight and 9 participants who were obese. Most participants, including 92 participants (61.3%), had low quality of sleep. The number and percentage of participants who had good sleep quality in this study were 58 participants (38.7%).

Table 1. Subject characteristics of adolescents in Denpasar

Characteristics	Number of subjects (n)	Percentages (%)
Sex		
Male	61	40,7
Female	89	59,3
Age		
16 y.o	47	31,3
17 y.o	76	50,7
18 y.o	26	17,3
19 y.o	1	0,7
Body Mass Index		
Severe thinness	5	3,3
Thinness	7	4,7
Normal	113	75,3
Overweight	16	10,7
Obese	9	6,0
Sleep Quality		
Good	58	38,7
Poor	92	61,3

Based on the results of the Somers'D correlation test to the variable sleep quality with body mass index in [Table 2](#), a significance value (p-value) of 0.108 was obtained so that the value was above the  $\alpha$  (0.05) value. This shows that the data obtained has insignificant results. The value of the strength of

the correlation coefficient (r) of the two variables cannot be interpreted because there is no relationship between these variables. Based on the Somers'D correlation test results, it is known that there is no significant relationship between sleep quality and body mass index in adolescents.

Table 2. Somers'D correlation test results on sleep quality with body mass index

Variables	Significance	Correlation Coefficient R
Sleep Quality	0.108	-0.131
Body Mass Index		

The cross-tabulation between sleep quality and body mass index in [Table 3](#) shows that most participants have a normal body mass index either with good or poor sleep quality.

Table 3. Cross tabulation between sleep quality and body mass index

		Body Mass Index					Total
		Severe thinness	Thinness	Normal	Overweight	Obese	
Sleep Quality	Good	4	0	45	7	2	58
	Poor	1	7	68	9	7	92
	Total	5	7	113	16	9	150

## DISCUSSION

The final result of this study is based on bivariate analysis using Somers'D correlation test. The study had found that there is no relationship between sleep quality and body mass index (p-value = 0.108). The results of this research were similar to a case-controlled study conducted in elementary school children in Yogyakarta which found no relationship between sleep quality and BMI<sup>9</sup>. Other previous studies that examined sleep duration, one of the components in the PSQI questionnaire, also found a similar finding. A longitudinal study on adolescents aged 12-18 years in USA and a case-control study from four junior high schools in Yogyakarta stated that there was no significant relationship between sleep duration and obesity<sup>10,11</sup>. The National Sleep Foundation recommendation for an appropriate sleep duration in adolescents is 8 to 10 hours of sleep duration<sup>12</sup>. The study shown that sleep duration has a greater effect on BMI than other PSQI components. The previous study that was conducted in the United States found that one-third of the participants had a BMI  $\geq$  25. Self-reported height and weight was used to calculate BMI<sup>13</sup>. This is in contrast to this research which used direct measurements of body weight and height to assess BMI, wherein this study 113 (75.3%) participants had a normal BMI.

The study conducted in Manado with children aged 13-15 years stated that there is a relationship in sleep quality in obese and non-obese adolescents, where obese adolescents have poor sleep quality<sup>14</sup>. A different age range could be one reason why the results are not significant. The participants included in this study were aged 16-19 years old. The difference in research locations can also affect the results. A cross-sectional study in Malaysia found that one-third of the adolescents (32.6%) were overweight or obese<sup>15</sup>. However, a cross-sectional study in southern Karnataka has results similar to this study. It was found that most of the children aged between 5 and 19 years have normal BMI (70.4%)<sup>16</sup>. Another cross-sectional study was in Denpasar also had a similar result in that most of the students had a normal BMI (54.6%)<sup>17</sup>.

Although this research did not have any measures of diet, physical activity, parental weight status, socio-economic background, psychological well-being of participants, previous research has found that all of these factors can increase the risk of being overweight and obese. A case-control study conducted in Yogyakarta indicates that the factors that are significantly associated with and become a risk factor for obesity in adolescents are inactive physical activity; energy intake; fat; carbohydrate;

frequency of fast food, breakfast intake, and whose mothers or fathers with obese status<sup>18</sup>. Another cross-sectional study also found that adolescents who had longer sedentary behavior (22 hours/week) increasing the risk of raising the body mass index. The results of the experiment shown that adolescents who come from middle or low socioeconomic backgrounds have a higher risk of obesity<sup>19</sup>. Stress and depression also have been linked to obesity. A cross-sectional study in Pekanbaru found a significant relationship between depression and stress with obesity<sup>20</sup>. It was found that adolescents who experience depression have a 70% higher risk of becoming obese<sup>21</sup>. When human bodies are under stress, there is an increase in cortisol levels by the adrenal glands. High levels of the hormone cortisol will stimulate the body to release the insulin, leptin, and the neuropeptide Y system (NPY) which will make the brain arouse hunger so that there is a desire to eat and will increase the body mass index<sup>22</sup>.

The study found that the body mass index in adolescents can be influenced by diet, physical activity, parental weight status, socio-economic background, and psychological well-being including stress and depression.

### LIMITATION

This study has potential limitation. This study does not control other confounding variables such as diet, physical activity, parental weight status, socio-economic background, psychological well-being of participants, which may lead to bias.

### CONCLUSION

In conclusion, this research showed that there was no significant relationship between sleep quality and body mass index. Further studies are needed related to other factors that affect an adolescent's body mass index.

### CONFLICTS OF INTEREST

The author states that there is no conflict of interest.

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