



## The relationship of smoking habits to sleep quality and the risk of hypertension in adolescents in Banjar Adat Pande, Bangli District

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### ABSTRACT

**Background:** Adolescence is a period of transition and search for identity, which makes adolescents often follow trends that affect society and the environment. One of the adolescent behaviors caused by environmental exposure is smoking. Repeated smoking behavior will become a habit that can affect sleep quality and the risk of hypertension. This study aimed to determine the relationship between smoking habits and sleep quality with the risk of hypertension in adolescents.

**Methods:** This study used a cross-sectional study design. The sample is determined by purposive sampling. The number of study participants was 52 adolescents. Smoking habits were measured using the Brinkman Index questionnaire, a Sphygmomanometer

to measure blood pressure, and the Pittsburgh Quality Index Questionnaire (PSQI) to measure adolescent sleep quality. Computer software analyzed data using a chi-square test to determine the relationship between smoking habits to sleep quality and the risk of hypertension in adolescents.

**Results:** The chi-square test of smoking habits and adolescent sleep quality was shown with a  $p$ -value of 0.008. The chi-square test results of smoking habits with risk of hypertension in adolescents were indicated by a  $p$ -value of <0.001.

**Conclusion:** There was a significant positive relationship between smoking habits to sleep quality and the risk of hypertension in adolescents.

**Keywords:** adolescent, risk of hypertension; sleep quality; smoking habits.

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### INTRODUCTION

The adolescent phase is when the transition from childhood to the next stage becomes adulthood. In this phase, adolescents will experience emotional, physical, mental, and functional changes in behavior, attitudes, and social, and will also begin to face problems.<sup>1</sup> Within ten years, the Central Bureau of Statistics 2010 until 2020, released the results of the population census that it is known that the population of Indonesia in 2020 will reach 270.20 million people, with the percentage of the productive age population (15-64 years) reaching 70.72%. This percentage shows that the number of teenagers is quite a lot and will be the forerunner to continue the next age group.

The adolescent phase is synonymous with seeking self-identity or a child's identity. The search for self-identity affects the behavior of adolescents, who tend to follow existing trends and are influenced by their surroundings. One of these behaviors is smoking, which is currently seen as a regular habit by Indonesians.<sup>2</sup> Smoking is one of the habits encountered in everyday life. This lifestyle is considered an attractive health problem; at least, it

is considered a risk factor for non-communicable diseases. Based on data from the Central Statistics Agency (BPS) shows that the percentage of smoking in the population aged  $\geq 15$  years in 2020 was 28.69%, but in 2021 it increased by 28.96%. The smoking rate in 2021 at the age of 25-29 ranks fifth (32.32%), at the age of 20-24 ranks tenth (26.97%), while the age of 15-19 years ranks 12th (9.98%).<sup>3</sup>

Bustan's research (2000) shows that heavy smokers started their habit in their teens, and almost no heavy smokers started smoking as adults; because of that, adolescence is often considered a critical period that determines whether we will become smokers.<sup>4</sup> Smoking habits will affect a person's body, including teenagers. According to the National Sleep Foundation, the sleep quality of Indonesian adolescents ranges from 6 hours 46 minutes to 7 hours 25 minutes. To reach this time, Indonesian teenagers usually start sleeping but wake up late.<sup>5</sup> The content of cigarettes, namely nicotine, is the main reason a person can have difficulty getting to sleep, it is difficult to wake up in the morning, and it can also cause nightmares to affect the quality of sleep.<sup>6</sup> The researchers also found that every cigarette smoked decreased the

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amount of sleep time by 1 to 2 minutes.<sup>7</sup>

The relationship between active smoking and sleep disorders is well established. Active smoking status has been associated with shorter sleep duration and increased difficulty sleeping, along with other sleep disorders. It is thought that nicotine influences sleep through stimulation of cholinergic neurons in the basal forebrain, resulting in physiological arousal, but this has not been proven in all studies. Research shows that releasing these wakefulness-enhancing neurotransmitters offsets inhibitory input from the body's sleep-enhancing systems, resulting in physiological changes and pre-sleep awakenings, such as heart rate and blood increase pressure respiratory rate. Although most studies investigating nicotine and sleep have focused on smoking, exposure to other nicotines may also affect sleep.<sup>8</sup>

Besides affecting sleep quality, cigarette consumption also affects blood pressure, which can increase the risk of hypertension. The heart will be forced to work harder, pushing blood pressure.<sup>9</sup> The nicotine found in cigarettes can cause an increase in heart rate.<sup>10</sup> Smoking can cause hypertension, namely increased blood pressure due to the chemicals contained in tobacco.<sup>11</sup> Continuous hypertension will disrupt blood flow in the kidneys, heart, and brain. Hypertension will increase the incidence of kidney failure, atherosclerosis, coronary heart disease, and stroke. Meanwhile, when a person experiences hypotension, it will cause a person to feel dizzy, weak, and tired, nausea, chest pain and shortness of breath, nausea, and irregular heartbeat.<sup>12</sup> Research conducted by Angga (2021) found a significant relationship between smoking duration and an increase in systolic and diastolic blood pressure, with a *p*-value of 0.019 for systolic blood pressure and a *p*-value of 0.013 for diastolic blood pressure.<sup>13</sup>

However, some studies have concluded that smoking has no impact on hypertension or that the chronic effect of smoking on BP is minor. Another review found that smoking produces acute hypertension due to sympathetic nerve activation. Still, the long-term impact is unclear because quitting smoking does not substantially decrease BP. However, the effect of tobacco on BP needs to be re-evaluated as the current evidence is contradictory.<sup>14</sup>

Based on the problems, the presentation of the results of preliminary studies, and the lack of research on the relationship of smoking habits to sleep quality and the risk of hypertension in adolescents in Indonesia, this study was conducted to determine the correlation between smoking habits to sleep quality and the risk of hypertension in adolescents.

## METHODS

### Research design

This research was an observational study with a cross-sectional study design. The sampling method used in this research is non-probability sampling in the form of purposive sampling. The target population is all adolescents in the Pande Traditional Banjar, Cempaga Village, Bangli District. This research was conducted in June 2022.

### Population and sample

The affordable population is adolescents aged 18-23 years in Banjar Adat Pande, Cempaga Village, Bangli District, and has met the inclusion, exclusion, and dropout criteria. The sample included in this study was 52 adolescents who met the inclusion and exclusion criteria. The selection criteria for this study were male subjects aged 18-23 years who were willing from start to finish to participate in the study. Have smoked for at least one year, in good general condition, results of vital signs within normal limits. Adolescents can understand questions related to the Brinkman Index and PSQI questionnaires. Exclusion criteria in this study were refusing to be a respondent, having a heart and lung disease history, and taking drugs that affect both heart and lungs and their functions. The dropout criterion is when the sample withdraws during the research and suddenly falls ill or is injured for some reason.

The number of adolescents in Banjar Adat Pande, Cempaga Village, Bangli District is less than 100 people, namely 52 people, so the entire population is used as a research sample that meets the inclusion, exclusion, and dropout criteria.

### Research instrument

Smoking habits were measured using the Brinkman Index questionnaire. The smoking degree is grouped based on the Brinkman index and categorized into light, moderate, and severe smoking degrees. Categorization is calculated by multiplying the duration of smoking (in years) by the number of cigarettes smoked daily. The results of the multiplication are classified into mild (1-199 points), medium (200-599 points), and heavy degrees (>600 points).<sup>16</sup> A sphygmomanometer is used to measure blood pressure. There were five categories of blood pressure; normal (<120/80mmHg), prehypertension (120-139/80-89mmHg), and hypertension ( $\geq$ 140/90 mmHg). This hypertension was divided into two stages (stage 1 = BP 140-159/90-99 mmHg and stage 2 = BP $\geq$ 160/100 mmHg).<sup>17</sup> Pittsburgh Quality Index Questionnaire (PSQI) to measure adolescent sleep

quality. It is a 19-item test and consists of seven components: (1) subjective sleep quality, (2) sleep latency, (3) sleep duration, (4) sleep efficiency, (5) sleep disturbance, (6) sleeping medication use, and (7) daytime dysfunction. Each component is scored from 0 to 3, and the total score ranges from 0 to 21, with a lower score (<5) indicating good sleep quality. The PSQI has adequate internal consistency (Cronbach alpha = 0.73).<sup>18</sup>

### Data analysis

The data obtained were then analyzed using the SPSS computer application. Descriptive statistics are to describe age, gender, and occupation and describe the interpretation of the results of smoking habits, sleep quality, and hypertension. Chi-square analysis analyzed the relationship between the independent variable (i.e., smoking habits) and the dependent variable (i.e., sleep quality and hypertension). The relationship between smoking habits, sleep quality, and hypertension is assigned a value of 0.05. The relationship between variables is considered significant if a significance value or *p*-value <0.05 is obtained.

## RESULTS

### Characteristics of Respondents

In this study, the respondents were adolescents in Banjar Adat Pande, Cempaga Village, Bangli District, Bangli Regency, with a sampling technique

using total sampling. Out of 62 adolescents aged 18-23, five respondents did not meet the inclusion and exclusion criteria, so 57 adolescents participated in this study. Table 1 showed that the dominant research respondents were in the age group of 22-23 years, namely 30 people (45.6%).

### Hypothesis testing

Table 2 shows that most respondents with light smoking habits have good sleep quality scores; as many as 23 respondents (40.4%), and respondents with moderate smoking habits mostly had poor sleep quality scores 11 respondents (19.3%). After testing the chi-square correlation analysis, it was found that there was a relationship between smoking habits and sleep quality in adolescents after obtaining a *p*-value of 0.008 (*p*<0.05).

Table 3 shows that respondents with a light smoking habit have a regular stage, with 19 respondents (33.3%) and hypertension risk category in the prehypertension stage, with 24 respondents (42.1%). Hypertension stadium I stage has two respondents (3.5%). In the type of moderate smoking habits, most were in the risk category for hypertension with prehypertension conditions, with as many as seven respondents (12.3%), and hypertension stadium I, where there are five respondents (8.8%). After the chi-square correlation analysis test was carried out, the results showed a relationship between smoking habits and blood pressure in adolescents after obtaining a *p*-value of 0.000 (*p* <0.05).

## DISCUSSION

The characteristics of respondents based on age in this study showed that most respondents were in the 22-23-year age group, namely 26 respondents. Some studies have found that the period at which a

**Table 1. Characteristics of Respondents.**

Characteristics of Respondents	Frequency (f)	Percentage (%)
Age Group		
22-23	26	45.6
20-21	21	36.9
18-19	10	17.5
Total	57	100

**Table 2. Cross Table of Smoking Habits on Sleep Quality.**

Smoking Habits	Sleep Quality				Total		<i>p</i> -value
	Good		Bad		f	%	
	f	%	f	%			
Light Smoker	23	40.4	22	38.6	45	78.9	0.008
Moderate Smoker	1	1.8	11	19.3	12	21.1	
Total	24	42.1	33	57.9	57	100	

**Table 3. Cross Table of Smoking Habits on Hypertension Risk.**

Smoking Habits	Blood Pressure						Total		<i>p</i> -value
	Normal		Pre Hypertension		Hypertension Stadium I		n	%	
	f	%	f	%	f	%			
Light Smoker	19	33.3	24	42.1	2	3.5	45	78.9	<0.001
Moderate Smoker	0	0	7	12.3	5	8.8	12	21.1	
Total	19	33.3	31	54.4	7	12.3	57	100	

person smokes for the first time starts at the age of 11-13 years due to solid curiosity; the influence of the social environment, such as modeling (parents, family, and peers) is one of the determinants in starting smoking behavior. After trying the first cigarette, the teenager becomes addicted to smoking. The prevalence of smoking will also increase with age.<sup>5</sup>

Age greatly influences smoking behavior because respondents over 16 years are more daring to smoke. After all, they feel they have reached adulthood and have the right to do whatever they want, including smoking. Oskamp's (1984) opinion in Hamdani R (2019) states that after trying cigarettes for the first time, a person becomes addicted to tobacco for reasons such as habit, reducing anxiety, and gaining acceptance.<sup>15</sup> In this study, it was found that the age group of 22-23 years was the largest group with a total of 26 respondents, which following the research by Sawitri et al. 2020, which states that the age of 20-24 years is the age of students with the maturity to make their own pleasure decisions.<sup>19</sup>

The results of the cross-table of smoking habits on sleep quality show the category of light smoking habits with a variety of good sleep quality, with as many as 23 respondents. Many factors can influence this, one of which is that many teenagers follow their friends, experimenting, wanting to feel/curious and lonely, looking stylish, a symbol of maturity, as a stress reliever, and the last is imitating parents.<sup>20</sup> Smoking behavior in adolescents generally increases over time according to the stage of development and often results in nicotine dependence.<sup>21</sup> Smoking behavior, namely curiosity or simply following friends, can cause adolescents to fall into the category of light smokers, where the number of light smokers consumed in a year is 1-199 per year. Sleep time among adolescents/students aged 14-17 years sleep duration is 8-10 hours/day. Each respondent's smoking behavior can vary, while adolescents are still in trial and error. Besides that, the condition of the body, which is still a teenager, and the activities of adolescents still classified as active can affect the quality of adolescent sleep. Physical activity can improve the quality of a person's sleep, whereas high physical activity can cause fatigue, which affects the quality of a person's sleep. The more tired a person is, the more rest they need to maintain the energy balance that has been released.<sup>22</sup> People who have done activities and reach fatigue, then that person will be able to sleep faster because the slow wave sleep (NREM) stage is shortened.

Twenty-two respondents had light smoking habits with poor sleep quality. Following Supit's research (2018) shows that smoking is closely related to a decrease in the quality of sleep of respondents

which is characterized by sleep disturbances experienced by respondents such as waking up in the middle of the night/early morning, feeling cold and hot, nightmares and other sleep disturbances. The results of this study indicate that smoking is closely related to the reduced sleep quality of respondents, characterized by sleep disturbances experienced by respondents, such as waking up in the middle of the night/early.<sup>23</sup> Julianto's 2015 research, non-smokers have poor sleep quality because of sleep disturbances, gadget use, stress, illness, noise, and the overall sleep quality score indicates sleep quality problems.<sup>24</sup>

It was found that 11 respondents had moderate smoking habits with poor sleep quality. In line with research conducted by Sulistiyani in 2012, where smoking behavior can also cause sleep problems, this is related to the nicotine contained in cigarettes which is a brain stimulant.<sup>25</sup> Besides that, the brain that has been addicted to the effects of nicotine will cause sleep disturbances at night when going to sleep. In line with research conducted by Julianto in 2015 concerning the relationship between smoking habits and sleep quality in students of SMAN 2 Ungaran, the results of respondents with poor sleep quality were respondents who had smoking habits in the heavy category.<sup>24</sup> The results of this study are also the same as those of a study conducted by Vaora et al. in 2014 concerning the relationship between smoking habits and disrupted adolescent sleep patterns. A moderately heavy smoker has a 9.375 times greater risk of experiencing insomnia compared to a light smoker.<sup>5</sup>

Based on Hakim (2020) shows that there is a relationship between active smoking and sleep pattern disturbances (insomnia) in students of the Faculty of Agriculture, Tribhuwana Tungadewi University, Malang. In the research conducted by Hakim in 2020, the results of sleep disturbance in students who smoked using the Spearman rank correlation test obtained a correlation coefficient ( $r$ ) of 0.799, indicating a parallel (positive) similar correlation with a good correlation level. The  $p$ -value is  $0.000 < \alpha$  (0.05), so there is a relationship between active smokers and sleep pattern disturbances (insomnia).<sup>26</sup> A study by Diana et al. (2021) stated that apart from having more difficulty sleeping, you can also be awakened by a strong desire to smoke after sleeping for about two hours. After smoking, it will be difficult to sleep again because of the stimulating effect of nicotine. During sleep, this process will repeat. Meanwhile, in the advanced stages, smokers experience sleep quality disturbances triggered by nicotine addiction's "charging" effect. From recording brain waves in the sleep laboratory, it was found that smokers have

more light sleep than deep sleep, especially in the early hours. As a result, this study found that the number of people who reported feeling unrefreshed or still sleepy when they woke up in smokers was four times that of non-smokers.<sup>27</sup>

The results of the cross table between smoking habits and blood pressure show that in the category of light smoking habits in the category of average blood pressure values, there are 19 respondents (33.3%). In the stage of prehypertension blood pressure, there are 23 respondents (40.4%), and in the category of hypertension stage I, there were as many as one respondent (1.8%). Furthermore, respondents with the moderate smoking habits category with prehypertension value category eight respondents (14%), and with stage I hypertension category, there were six respondents (10.5%). Spearman's rank hypothesis test results obtained a *p*-value of 0.000 (*p* < 0.05). There is a relationship between smoking habits and blood pressure in adolescents with a correlation coefficient (R) of 0.548 which states that the strength of the relationship between smoking habits and the risk of hypertension is a strong correlation. So it can be concluded that a positive and significant relationship exists between smoking habits and the risk of hypertension in adolescents aged 18-23 years.

This study found the highest systolic blood pressure, namely 140 mmHg; in theory, it was stated that normal systolic blood pressure was 120 mmHg. While the highest diastolic blood pressure is 100 mmHg, in view, it says that normal diastolic blood pressure is 80 mmHg. These results are in line with research conducted by Setyanda et al. 2015 in men aged 35-65 years in the city of Padang which stated that there was a relationship between smoking habits and hypertension (*p*=0.003), which was influenced by smoking duration (*p*=0.017) and type of cigarette (*p*=0.017).<sup>11</sup> This research is also in line with research conducted by Angga (2021), which says that there is a significant relationship between smoking duration and increased blood pressure, which means that the more prolonged smoking habits are maintained, the higher the risk of suffering from hypertension.<sup>13</sup>

Kurnia and Malinti, in 2020, in their research entitled The Relationship between Coffee Consumption and Smoking Habits and Blood Pressure in Adult Men, stated that there was a significant relationship between the number of cigarettes per day on blood pressure as evidenced by a *p*-value of 0.039.<sup>28</sup>

The research conducted by Narayana and Sudhana in 2013 on residents aged 25 years and over who live in the Pekutatan I Health Center

working area found that the respondents with smoking habits were all male. Respondents who had smoking habits tended to suffer from hypertension compared to respondents who were not smoking, in his research stated that the longer and the greater the number of cigarettes smoked, the more at risk a person is for developing hypertension.<sup>9</sup> The genuine factor states that smoking can cause high blood pressure. Smoking can cause hypertension due to tobacco's chemicals, which can damage the inner lining of the artery walls, making the arteries more susceptible to plaque buildup (atherosclerosis).<sup>29</sup>

Cigarette ingredients that can cause hypertension include nicotine, tar, and carbon monoxide. Nicotine that enters the body will result in the release of adrenaline, which will cause blood vessels to experience vasoconstriction so that blood pressure will increase. Tar contained in cigarettes affects blood pressure by increasing the pump activity of the heart pump. At the same time, carbon monoxide (CO) will bind to hemoglobin and thicken the blood so that high pressure is needed to meet the body's metabolic needs. Someone who has been an active smoker for a long time has an increased risk of developing hypertension. Carbon monoxide from inhaled cigarette smoke will cause blood vessels to be less elastic, increasing blood pressure. Compounded by the effects of nicotine which makes blood vessels experience vasoconstriction, which will make the heart work harder and increase blood pressure.<sup>15</sup> The impact of smoking will indeed be felt 10-20 years after use. Cigarettes also have a dose-response effect, meaning that the younger you start smoking, the more difficult it is to quit smoking, and the longer a person will have a smoking habit, causes the greater risk of suffering from hypertension.<sup>12</sup>

This research has several limitations that need to be considered. First, This study uses a cross-sectional research design, so the results must be evaluated carefully and require future research. Second, this study only included male samples, so the results cannot be generalized to all genders. Third, the study's sample size is small for this survey, which needs to be higher for future studies.

## CONCLUSION

Based on the study results, it can be concluded that there was a significant relationship between smoking habits to sleep quality and the risk of hypertension in adolescents. This study shows that the moderate smoking habit category mostly has poor sleep quality values, and the intermediate smoking habit category mostly has an increased risk of hypertension.

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## CONFLICT OF INTEREST

This study does not have any conflict of interest.

## ETHICAL CONSIDERATION

The authors obtained informed consent that the sample had been approved before conducting the study.

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## AUTHOR CONTRIBUTION

IAPP conceived the study design, collected and analyzed the data, and drafted the manuscript; IGASWN, IARWM, and LDRP interpreted the data analysis and drafted the manuscript.

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