

# A Survey of Knowledge and Practices of Balinese Culture Sleep Hygiene Modification among Health Faculty Students at Hindu Indonesia University

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## ABSTRACT

**Background:** Sleep disorders were reported among 15–35% of adolescents and adults' population. Around 27% of college students potentially experience at least one sleep disorder. Poor sleep quality is one of the negative impacts of sleep disorders. Sleep hygiene or good sleeping habits are essential to get good sleep quality. Balinese culture has its own rules on sleeping habits related to sleep hygiene. Good knowledge and practices of Balinese culture sleep hygiene modification are expected to improve sleep quality.

**Methods:** The study design of this research is cross sectional descriptive observational study using total sampling as the sampling method, which included all Health Faculty students at Hindu Indonesia University who met the inclusion criteria. Data was collected through a survey by distributing offline questionnaires from April to May 2023. The questionnaires used in this research modified Sleep Beliefs Scale (SBS) and Sleep Hygiene Index (SHI) questionnaires by adding sleep hygiene perspectives according to Balinese culture and customs. Validity and reliability tests were applied to the questionnaires before the survey (Pearson Correlation shows sig. < 0.05 and reliability analysis showed Cronbach Alpha > 0.60). Data collected in this research were analyzed using crosstab tabulation.

**Results:** Thirty-one students of the Health Faculty at Hindu Indonesia University met the inclusion criteria (20 females and 11 males aged

19 to 57 years). The result of this study regarding the knowledge and practices of Balinese culture sleep hygiene modification shows 16 students (51.6%) had both adequate knowledge and practices, 4 students (12.9%) had adequate knowledge but poor practices, 2 students (6.5%) had poor knowledge but good practices, and 9 students (29%) had both poor knowledge and practices.

**Conclusion:** Most of the Health Faculty students at Hindu Indonesia University had adequate knowledge and practices of Balinese culture sleep hygiene modification. Additionally, several students had adequate knowledge but poor practices and several students had poor knowledge but good practices, which indicates that adequate knowledge about Balinese culture sleep hygiene modification does not guarantee good practices.

**Keywords:** Balinese culture sleep hygiene modification, knowledge, practices

## INTRODUCTION

Sleep plays a vital role in healing and regeneration processes, regulates blood sugar levels by controlling the body's response to insulin, boosts the immune system to fight microbes, and supports growth, especially in children and adolescents.<sup>[1]</sup> Sleep disorders were reported among 15–35% of adolescents and adults population.<sup>[2]</sup> Around 27% of college students potentially experience at least one

sleep disorder.<sup>[3]</sup> Sleep disorders negatively impact sleep quality, which then affects daily activities.<sup>[4,5]</sup>

Research on sleep disorders and their impact on daily activities among college students has been done several times. Data from a survey in Australia 1986 and a study in the United States conducted in 2001 show that undergraduate students suffered from Delayed Sleep Phase Syndrome (DSPS)<sup>[6-8]</sup>. DSPS occurs because of delayed sleeping hours, which makes it difficult for a person to wake up at the desired time. The consequences are the disturbance of learning and drowsiness.<sup>[9]</sup> A study on Excessive Day Time Sleepiness (EDS) at University of Indonesia conducted among *Rumpun Ilmu Kesehatan (RIK)* students shows that 48.6% of respondents experienced EDS. As many as 74.8% of students had poor sleep quality, resulting in drowsiness in the morning.<sup>[10]</sup>

Healthy sleeping habits, known as sleep hygiene, are suggested to achieve a good quality of sleep by maximizing one's ability to fall asleep and stay asleep based on sleep hours' recommendation.<sup>[11]</sup> According to the Sleep Foundation, sleep hygiene components include having scheduled daily sleeping time (the same wake-up time every day), following routines that can promote sleep consistently, avoiding the use of electronic devices before bed, avoiding long naps, creating a comfortable sleeping environment, and pursuing a healthy lifestyle such as exercising regularly, not smoking, reducing alcohol and caffeine consumption, and not eating food before bedtime.<sup>[12]</sup>

Bali has sleeping rules that correlate with sleep hygiene in terms of sleep positions, sleep times, art activities, and particular food and drink consumption. Bali is divided into two main parts, the northern and southern parts. This concept is caused by mountains stretching from the east to the west of Bali.<sup>[13]</sup> Terms of direction are slightly different between the northern and southern parts of Bali. Bali has four main terms of direction: *Kaja*, *Kangin*, *Kauh*, and

*Kelod*. *Kaja* is the direction where the mountains are found, while *Kelod* is the direction where the sea is found. People who live on the northern side of Bali will equate the south as *Kaja* since the mountains are on the south side of the Northern Balinese people's position. In contrast, people who live on the southern side of Bali will equate the north as *Kaja* since the mountains are on the north side of the Southern Balinese people's position. The east is called *Kangin* and the west is called *Kauh* for northern and southern people of Bali. Balinese believe that sleeping positions should follow the terms of those directions explained. Balinese consider that they should put their heads inclined toward *Kaja* or *Kangin*<sup>[14]</sup> as *Kaja* is the direction of mountains and *Kangin* is the direction of sunrise, which are sacred for the head position.<sup>[15,16]</sup>

A study in Iran shows a correlation between the geographical direction of the body during sleep and the quality of sleep. The highest number of respondents who did not have sleeping difficulties was in the south-north sleeping position (head in the south and feet in the north).<sup>[17]</sup> Another study of the relationship between bed design and the earth's electromagnetic direction in Iran shows that people with a south-to-north sleep position had longer sleep durations.<sup>[18]</sup> Based on those studies, it is known that the best sleeping position is the head in the south and the feet in the north (south-north), which corresponds to the sleep position concept of the Balinese people, particularly in North Bali.

Balinese believe sleeping at 6:00 p.m. is not good since 6:00 p.m. is known as *Sandikala*. People in Bali believe that *Betara Kala* interferes with human activity during *Sandikala*<sup>[19]</sup>, so people who sleep at 6:00 p.m. are believed to be eaten by *Betara Kala*.<sup>[20]</sup> Sleep hygiene suggests that a good nap is no more than 3:00 p.m. with a maximum effective nap duration of 20 minutes to avoid difficulty sleeping at night.<sup>[21]</sup> The concept that sleeping at 6 p.m. is not good in Bali follows sleep hygiene

suggestions, although it is not explicitly stated that sleeping at 6 p.m. is not recommended according to sleep hygiene. In Balinese culture, it is also believed that it is not good to wake up exceeding the sunrise because we may lose precious time in the morning if we wake up late.<sup>[22]</sup> Waking up before sunrise positively regulates melatonin based on the body's circadian rhythms.<sup>[23]</sup>

Balinese culture is also inseparable from the arts of dancing, music, and painting. Balinese, in their daily activities, will always be connected with art and culture as part of the community in Bali. Dancing can suppress sleep problems such as difficulty sleeping, anxiety, and nightmares<sup>[24]</sup>, thus improving sleep quality. A study shows a relevant results on the influence of music in reducing stress by providing a calming sense through instrument practices.<sup>[25]</sup> Furthermore, drawing and coloring patterns were found to lower the level of anxiety.<sup>[26]</sup> Dancing, playing traditional musical instruments, and visual arts activities in Bali potentially impact reducing anxiety, depression, and stress. The positive impact of art activities' performance of Balinese people correlates with sleep hygiene because each individual can experience a calm feeling from the art activities.

Consumption habits of particular food and drink will positively or negatively affect sleep hygiene. Bali has typical dishes like *Lawar*, *Sate Lilit*, and *Serobotan*. Bali also has a traditional immune booster drink called *Loloh* and a traditional wine called *Tuak*. Consumption of fish-based foods in Bali, including *Sate Lilit Ikan*, *Sudang Lepet*, and *Pesan Ikan*, may improve sleep quality. Poor sleep quality was rarely found in communities that regularly consume mostly fish at least twice a week. Fish oil is a source of omega-3 fatty acids that regulate serotonin as a sleep-regulating hormone.<sup>[27]</sup> Omega-3 fatty acids also increase the production of melatonin at night, which plays an essential role in sleep.<sup>[28]</sup>

Balinese people often make a traditional drink that supports healthy sleep, for

example, *Loloh Cemcem*. The ingredients used to make it can reduce insomnia because it contains flavonoids. *Dadap* leaves used for making the *Loloh* also have a sedative effect that is good for sleeping.<sup>[29,30]</sup> Balinese people's habit that is inappropriate to sleep hygiene is frequent alcohol consumption. The activity of gathering together and chatting while drinking liquor in Bali is called *Metuakan*. Alcohol consumption in Bali was high in 2018.<sup>[31]</sup> Alcohol helps the body to feel warmer<sup>[32]</sup>, so alcoholic beverages are consumed in subtropical areas, especially when facing winter. Nevertheless, alcohol also has a considerable negative impact on sleep. There was a 9.3% decrease in sleep quality in low-end alcohol consumption. Low-end alcohol consumption is less than two single servings per day for men and less than one single serving for women. Single serving size for alcohol is 0.35 liter of beverage with a 5% alcohol content.<sup>[33]</sup>

For all the reasons above, it can be concluded that Balinese culture and customs correlate with sleep hygiene. College students in Bali need to know which culture is suitable or not for sleep hygiene in order to be able to sleep well. The knowledge and practices of Balinese culture sleep hygiene modification are expected to improve students' sleep quality so they can be physically and mentally healthy and productive. Based on that description, this study was conducted to explore the knowledge and practices of Balinese culture sleep hygiene modification among the Health Faculty students at Hindu Indonesia University (UNHI).

## MATERIALS AND METHODS

This study design adopts a cross-sectional descriptive observational study. The sampling method is total sampling with the inclusion criteria consisting of four limitations, including students who are still studying at the Health Faculty of Hindu Indonesia University (UNHI) during the period of the study, Balinese ethnicity students confirmed by their identity on the

Indonesian ID card who are considered to understand Balinese culture and customs, students who are willing to participate in the study, and students who are able to fill in the questionnaires independently. The exclusion criteria are students with severe disabilities that limit their ability to understand the contents of the questionnaires.

Research permission was submitted to the Hindu Indonesia University (UNHI) in advance. After the permission was issued, the researcher contacted the study subjects from each semester through the students' leaders. The purpose was to determine a proper schedule for filling in the questionnaires. Informed consent was attached to the questionnaires and given to the subjects before they filled the questionnaires. A survey to collect the data of this study was conducted from April to May 2023 by distributing offline questionnaires. Two questionnaires were used for the survey.

The first questionnaire is about sleep hygiene knowledge using the Sleep Beliefs Scale (SBS) modified by Balinese sleep hygiene perspective. The other questionnaire is about the implementation of sleep hygiene using Sleep Hygiene Index (SHI), which is also modified by Balinese sleep hygiene perspective. The first questionnaire consists of 20 statements about sleep hygiene knowledge and the other questionnaire consists of 16 statements about sleep hygiene practices.

On the first questionnaire, the respondents should consider each statement to have a positive, negative, or neutral effect on sleeping. If the answer is correct, the subjects will get 1 point, but if the answer is incorrect, the subjects will get 0 points. The higher the score, the better sleep hygiene knowledge is. The total highest score for the first questionnaire is 20. The other questionnaire has statements that are the opposite of the sleep hygiene recommendation. The subjects should consider if they never, seldom, sometimes, often, or always do the activity on the statements for the last month. The point for each statement is 0 when the subjects never do the activity, 1 when the subjects seldom do the activity, 2 when the subjects sometimes do the activity, 3 when the subjects often do the activity, and 4 when the subjects always do the activity. The higher the score, the poorer sleep hygiene practices are. The highest total score for the second questionnaire is 64. Validity and reliability tests were applied to the questionnaires before the survey (Pearson Correlation showed sig. < 0.05 and reliability analysis showed Cronbach Alpha > 0.60).

The expected result of this study was the prevalence of students with adequate knowledge and practices, adequate knowledge but poor practices, poor knowledge but good practices, and both poor knowledge and practices of Balinese culture sleep hygiene modification.

**Table 1: Knowledge questionnaire of Balinese culture sleep hygiene modification**

Number	Habits Related To Sleep	Effect	Positive	Neutral	Negative
1	Drinking alcohol in the evening				
2	<i>Metuakan</i> regularly ( <i>Metuakan</i> is when people gather while drinking liquor)				
3	Drinking coffee or other substances with caffeine after dinner				
4	Do Balinese art activities (e.g., dancing, playing traditional musical instruments, etc.)				
5	Doing intense physical exercise before going to bed				
6	Sleeping at 6 p.m.				
7	Taking a long nap during the day				
8	Using sleep medication regularly				
9	Smoking before falling asleep				
10	Going to bed 2 hours later than the habitual hour				
11	Going to bed with an empty stomach				
12	Using the bed for eating, calling on the phone, studying and other non-sleeping activities				
13	Routine consumption of Balinese fish-based foods				
14	Routine consumption of <i>Loloh</i>				

15	Studying or working intensely until late night			
16	Going to bed 2 hours earlier than the habitual hour			
17	Going to bed immediately after eating			
18	Being worried about the impossibility of getting enough sleep			
19	Recovering lost sleep by sleeping for a long time			
20	Wake up in the morning exceeding the time of sunrise			

Table 2: Practices questionnaire of Balinese culture sleep hygiene modification

0	1	2	3	4
Never	Seldom	Sometimes	Often	Always

Number	Habits	How Often					
1	I use alcohol, tobacco, or caffeine within 4 hours of going to bed	0	1	2	3	4	....
2	I join a gathering activity while drinking liquor ( <i>Metuakan</i> )	0	1	2	3	4	....
3	I exclude Balinese art activities (e.g. dancing, playing musical instruments, etc.) from my daily activities because they are unnecessary.	0	1	2	3	4	....
4	I exercise to the point of sweating within 1 hour of going to bed	0	1	2	3	4	....
5	I position myself asleep without paying attention to the concept of south to north direction according to the Balinese sleeping rules (head on the south and legs on the north)	0	1	2	3	4	....
6	I go to bed at different times from day to day	0	1	2	3	4	....
7	I get out of bed at different times from day to day	0	1	2	3	4	....
8	I think, plan, or worry when I am in bed	0	1	2	3	4	....
9	I go to bed feeling stressed, angry, upset, or nervous	0	1	2	3	4	....
10	I do something that may wake me up before bedtime (e.g. play video games, use the internet, or clean)	0	1	2	3	4	....
11	I do important work before bedtime (e.g. pay bills, schedule, or study)	0	1	2	3	4	....
12	I use my bed for things other than sleeping (e.g. watch television, read, eat, or study)	0	1	2	3	4	....
13	I wake up exceeding the sunrise	0	1	2	3	4	....
14	I stay in bed longer than I should two or three times a week	0	1	2	3	4	....
15	I'd rather eat other meat-based foods than fish-based foods.	0	1	2	3	4	....
16	I'd rather have a soft drink than a traditional Balinese drink ( <i>Loloh</i> ).	0	1	2	3	4	....

## STATISTICAL ANALYSIS

Descriptive statistics and cross tabulation using SPSS 26 were done to determine the prevalence of students based on their knowledge and practices of Balinese culture sleep hygiene modification.

## RESULT

There were 32 students of the Health Faculty at Hindu Indonesia University (UNHI) from the 2<sup>nd</sup>–6<sup>th</sup> semester, but only 31 students met the inclusion criteria. Samples were comprised of 20 females and 11 males aged 19 to 57 years. The data tabulation of this study had a normal distribution (sig. > 0.5) for the total score of all samples for both knowledge and practices of Balinese culture sleep hygiene modification. The data distribution was used as the cut-off point for determining the knowledge and practices of Balinese culture sleep hygiene modification categories. The two categories are "good/adequate" and "poor/bad" knowledge and practices. The score range for each category was determined by the average of the respondents' scores. The knowledge of

Balinese culture sleep hygiene modification is categorized as good/adequate knowledge if the respondent obtains a score  $\geq 12$  and a score  $< 12$  is categorized as poor knowledge. The practices of Balinese culture sleep hygiene modification are categorized as good if the respondent gets a score  $< 27$  and a score  $\geq 27$  is categorized as bad practices.

Based on the knowledge itself, 20 students (64.5%) had an adequate knowledge of Balinese culture sleep hygiene modification and 11 students (35.5%) had poor understanding of Balinese culture sleep hygiene modification. Based on the practices, 18 students (58.1%) had good practices of Balinese culture sleep hygiene modification, and 13 students (41.9%) had poor practices (**Table 3**).

Table 3: Data distribution separately between knowledge and practices of Balinese culture sleep hygiene modification

Knowledge	(n=31)	Percentage (%)
Poor	11	35,5
Adequate/good	20	64,5
Practices	(n=31)	Percentage (%)
Poor	13	41,9
Good	18	58,1

Data based on both knowledge and practices of sleep hygiene modification of Balinese culture obtain results: 9 students (29%) had both poor knowledge and practices, 4 students (12.9%) had adequate knowledge

but poor practices, 2 students (6.5%) had poor knowledge but with good practices, and there were 16 students (51.6%) with both good knowledge and practices (**Table 4**).

**Table 4: Data distribution based on both knowledge and practices of Balinese culture sleep hygiene modification**

Knowledge	Practices	(n=31)	Percentage (%)
Poor	Poor	9	29
Adequate/good	Poor	4	12.9
Poor	Good	2	6.5
Adequate/good	Good	16	51.6

According to the age of the students, which varies from 19 to 57 years old, the largest number of respondents with adequate knowledge and good practices of Balinese culture sleep hygiene modification were those aged 20, 21, 22, and 39 (2 students for each age group). In contrast, the largest number of respondents with poor knowledge and practices of Balinese culture sleep hygiene modification were those aged 21 (4 students) (**Table 5**).

**Table 5: Data distribution on knowledge and practices of Balinese culture sleep hygiene modification according to age**

Age	Knowledge	Practices	(n=31)	Age	Knowledge	Practices	(n=31)	Age	Knowledge	Practices	(n=31)
19	Poor	Poor	0	39	Poor	Poor	0	48	Poor	Poor	0
	Adequate/good	Poor	1		Adequate/good	Poor	0		Adequate/good	Poor	0
	Poor	Good	1		Poor	Good	0		Poor	Good	1
	Adequate/good	Good	0		Adequate/good	Good	2		Adequate/good	Good	0
20	Poor	Poor	3	40	Poor	Poor	0	49	Poor	Poor	0
	Adequate/good	Poor	0		Adequate/good	Poor	0		Adequate/good	Poor	0
	Poor	Good	0		Poor	Good	0		Poor	Good	0
	Adequate/good	Good	2		Adequate/good	Good	1		Adequate/good	Good	1
21	Poor	Poor	4	41	Poor	Poor	1	53	Poor	Poor	0
	Adequate/good	Poor	1		Adequate/good	Poor	0		Adequate/good	Poor	0
	Poor	Good	0		Poor	Good	0		Poor	Good	0
	Adequate/good	Good	2		Adequate/good	Good	0		Adequate/good	Good	1
22	Poor	Poor	0	44	Poor	Poor	0	55	Poor	Poor	0
	Adequate/good	Poor	1		Adequate/good	Poor	0		Adequate/good	Poor	0
	Poor	Good	0		Poor	Good	0		Poor	Good	0
	Adequate/good	Good	2		Adequate/good	Good	1		Adequate/good	Good	1
25	Poor	Poor	1	45	Poor	Poor	0	57	Poor	Poor	0
	Adequate/good	Poor	0		Adequate/good	Poor	1		Adequate/good	Poor	0
	Poor	Good	0		Poor	Good	0		Poor	Good	0
	Adequate/good	Good	0		Adequate/good	Good	0		Adequate/good	Good	1
37	Poor	Poor	0	46	Poor	Poor	0				
	Adequate/good	Poor	0		Adequate/good	Poor	0				
	Poor	Good	0		Poor	Good	0				
	Adequate/good	Good	1		Adequate/good	Good	1				

Data grouping based on the gender of the respondents shows that female students had better knowledge and practices of Balinese culture sleep hygiene modification than

male students (12 female students or 60% of the total female students, have good knowledge and practices) (**Table 6**).

**Table 6: Data distribution on knowledge and practices of Balinese culture sleep hygiene modification according to gender**

Gender	Knowledge	Practices	(n=20)	Percentage (%)
Female	Poor	Poor	4	20
	Adequate/good	Poor	3	15
	Poor	Good	1	5
	Adequate/good	Good	12	60
Gender	Knowledge	Practices	(n=11)	Percentage (%)
Male	Poor	Poor	5	45.45
	Adequate/good	Poor	1	9.09
	Poor	Good	1	9.09
	Adequate/good	Good	4	36.36

According to data from the knowledge questionnaire, female students had more incorrect answers on statements 1, 10, and 12 than male students whereas male students had more incorrect answers on statements 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, 14,

15, 16, 17, 18, 19, and 20. Overall, female students had more correct answers than male students on the knowledge questionnaire of Balinese culture sleep hygiene modification (**Table 7**).

**Table 7: Number of students with correct and incorrect answers per statement on the knowledge questionnaire of Balinese culture sleep hygiene modification according to gender**

Statements	Female (n = 20)		Percentage (%)		Male (n=11)			Percentage (%)	
	Correct	Incorrect	Correct	Incorrect	Statements	Correct	Incorrect	Correct	Incorrect
1	14	6	70	30	1	10	1	91	9
2	19	1	95	5	2	9	2	82	18
3	17	3	85	15	3	8	3	73	27
4	17	3	85	15	4	7	4	64	36
5	4	16	20	80	5	2	9	18	82
6	10	10	50	50	6	5	6	45	55
7	17	3	85	15	7	9	2	82	18
8	17	3	85	15	8	9	2	82	18
9	19	1	95	5	9	8	3	73	27
10	5	15	25	75	10	5	6	45	55
11	14	6	70	30	11	4	7	36	64
12	5	15	25	75	12	3	8	27	73
13	14	6	40	60	13	4	7	36	64
14	5	15	75	25	14	8	3	73	27
15	8	12	70	30	15	6	5	55	45
16	15	5	10	90	16	1	10	9	91
17	14	6	95	5	17	8	3	73	27
18	2	18	70	30	18	5	6	45	55
19	19	1	55	45	19	3	8	27	73
20	14	6	75	25	20	5	6	45	55

Following the practices questionnaire, the data mode for each statement based on how often students perform the activity on the statement shows significant differences between males and females in statements

13, 14, and 15, where female students tended to "seldom" do the activity mentioned. In contrast, male respondents tended to "often" do the activity on the statement (**Table 8**).

**Table 8: Data mode per statement on the practice's questionnaire of Balinese culture sleep hygiene modification**

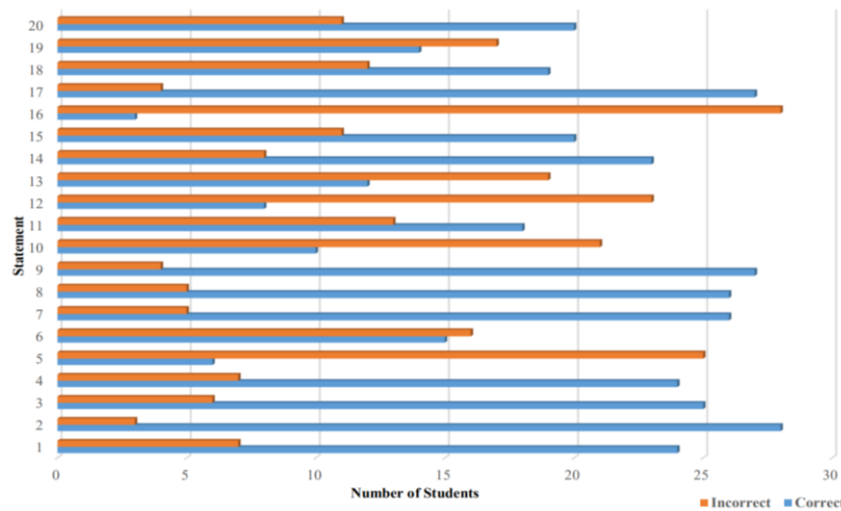
Statements	Mode for Each Statement (0 = Never, 1 = Seldom, 2 = Sometimes, 3 = Often, 4 = Always)	
	Female	Male
	1	0 (never)
2	0 (never)	1 (seldom)
3	2 (sometimes)	0 (never)
4	0 (never)	1 (seldom)
5	0 (never)	0 (never)
6	2 (sometimes)	1 (seldom)
7	2 (sometimes)	2 (sometimes)
8	2 (sometimes)	3 (often)
9	1 (seldom)	2 (sometimes)
10	3 (often)	2 (sometimes)
11	1 (seldom)	2 (sometimes)
12	3 (often)	3 (often)

13	1 (seldom)	3 (often)
14	1 (seldom)	3 (often)
15	1 (seldom)	3 (often)
16	2 (sometimes)	1 (seldom)

Additional data found in this study is that the statement with the most incorrect answers on the knowledge questionnaire of the Balinese culture sleep hygiene modification was statement 16: "Going to

bed 2 hours earlier than the habitual hour". Twenty-eight respondents had incorrect answers, while there were only three respondents who had correct answers (Figure 1).

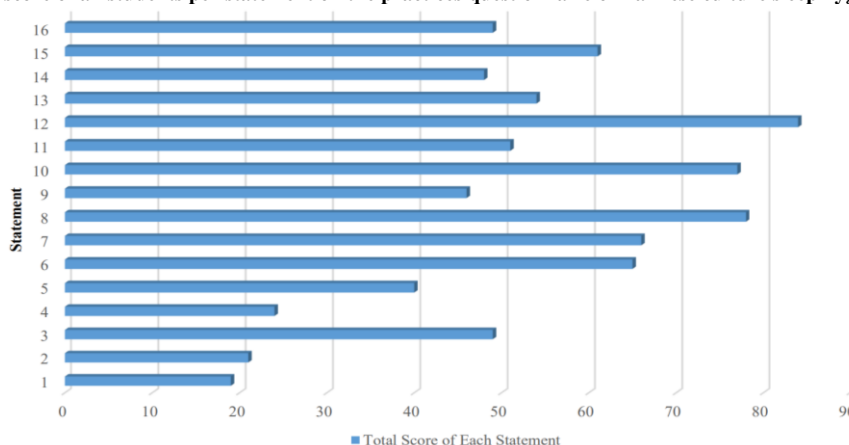
Figure 1: Number of students with correct and incorrect answers per statement on the knowledge questionnaire of Balinese culture sleep hygiene modification



Based on the total score of all students in each statement on the practices questionnaire of the Balinese culture sleep hygiene modification, statement 12, which is " I use my bed for things other than

sleeping (e.g. watch television, read, eat, or study)" had the highest score which means the activity on that statement was often done in the daily basis of students for the last month (Figure 2).

Figure 2: Total score of all students per statement on the practices questionnaire of Balinese culture sleep hygiene modification



## DISCUSSION

Nearly 65% of students had an adequate knowledge of Balinese culture sleep hygiene modification. It may happen due to

easy access to health information, including information related to sleep hygiene. Health information can be obtained through the Internet and social media. The Internet has



become a source of health information that is widely used by the public since it is easy to access, which increases people's motivation to search for health information on their own.<sup>[34]</sup>

Another reason that may lead to adequate sleep hygiene knowledge is that Balinese culture is inherent in the life of Hindu Indonesia University (UNHI) students and has become a common thing to discuss. People in Bali are attached to the culture and customs of Bali because they believe that those cultures and customs should be followed to maintain the harmony of life.<sup>[35]</sup> Around 60% of the students had good practices of sleep hygiene modification of Balinese culture, which also proves that Balinese culture and customs are inherent in Balinese people.

Data based on both knowledge and practices scores of Balinese culture sleep hygiene modification shows that more than 50% of students had adequate knowledge followed by good implementation of sleep hygiene. On the other hand, 20% of the students had poor knowledge but good practices or adequate knowledge but poor practices, which proves that good knowledge about Balinese culture sleep hygiene modification does not guarantee it will result in good implementation.<sup>[36,37]</sup> These findings are also supported by a study in 2013, which shows that many students had difficulty implementing sleep hygiene even though they understood it.<sup>[38]</sup> A good quality of sleep will not be achieved only with adequate sleep hygiene knowledge but requires good implementation of sleep hygiene daily.

Data distribution on knowledge and practices of Balinese culture sleep hygiene modification according to gender shows that knowledge and practices of sleep hygiene tended to be better in female students. This finding is supported by a study in 2017, which shows that women had better sleep hygiene knowledge than men.<sup>[39]</sup> However, there is no specific explanation of the possible cause of the difference. A study in 2016 found that men tended to have worse

sleep hygiene practices than women because of bad habits that men often do every day, such as smoking before bed and doing heavy work before bedtime.<sup>[40]</sup> A study in 2021 also found that women tended to pay more attention to their pre-sleep habits to get a good sleep.<sup>[41]</sup> However, a different study conducted in 2017 shows that the implementation of sleep hygiene in women was terrible due to unhealthy lifestyles of women, such as smoking, drinking liquor, and others.<sup>[39]</sup> It is considered that no data consistency shows the dominance of better sleep hygiene practices in either women or men. The comparison of better sleep hygiene implementation between women and men depends on the lifestyle and habits of communities in the area, not affected by gender differences.

Male students tended to wake up exceeding the sunrise, stayed in bed longer than usual, around 2-3 times a week, and preferred to consume other meat-based foods compared to fish-based foods, which caused the practices of Balinese culture sleep hygiene modifications in male students to be worse than female students. The tendency of men to wake up exceeding sunrise and to stay in bed more than usual, around 2-3 times a week, is associated with the patriarchal system in Bali. Even though women are unmarried, women are taught to get up early because they have to do household tasks like cooking, house cleaning, washing clothes, and others. Data obtained from a study conducted in 2016 at one of the districts in Bali shows that more than 50% of women woke up at 5 a.m. or earlier.<sup>[42]</sup> Wake up exceeding the sunrise and being in bed longer than usual are not in accordance with sleep hygiene because those will interfere with circadian rhythms as the internal time regulators of the entire body system, causing reduced rest time at night.<sup>[43]</sup>

In addition to this study, male students preferred to consume other meat-based foods than fish-based food. This finding can be attributed to the concept of masculinity in men who consider red meat-based foods

to be foods that reflect real men, assuming that the consumption of red meat can strengthen men's physical condition.<sup>[44]</sup> Tend to eat meat-based foods rather than fish-based foods is also not in accordance with sleep hygiene recommendations since in sleep hygiene, it is recommended to eat foods that can facilitate sleep. Fish consumption is good for sleep because the fish oil in seafood meat is a source of omega-3 fatty acids that regulate serotonin as a sleep-regulating hormone.<sup>[27]</sup>

Other data in this study is that the largest count of incorrect answers found on the knowledge questionnaire of Balinese culture sleep hygiene modification on the statement "Going to bed 2 hours earlier than the habitual hour". It is essential to understand that sleeping 2 hours earlier than the habitual hour will interfere with the following sleep pattern. An inconsistent sleep schedule will disturb our body's ability to produce melatonin, which has a prominent role in facilitating sleep. The Sleep Foundation strongly recommends a steady sleep schedule with a suitable sleep duration. The expected duration of sleep is 7–9 hours for adults.<sup>[45]</sup>

On the practices questionnaire of Balinese culture sleep hygiene modification, it is found that the statement "I use my bed for things other than sleeping (e.g. watch television, read, eat, or study)" is most frequently done by students on the last month. According to sleep hygiene, we should only use the bed as a place to rest to give the brain a signal to sleep. The brain will realize it is time to rest right after being in bed and after doing other routines before going to bed, like wearing pajamas and brushing our teeth. It is also recommended to avoid using electronic devices and exposure to lights when already in bed, to facilitate sleep. The influence of lights from lamps and electronics can trigger the production of melatonin hormone, which can lower the melatonin hormone levels as a sleep-accelerating hormone.<sup>[46]</sup>

The limitation of this study is the inclusion criteria used, which is Balinese ethnicity

students who are considered to understand Balinese culture and customs better. This limitation cannot fully guarantee that Balinese ethnicity students understand Balinese culture and customs well. It is still possible that Balinese ethnicity students do not understand Balinese culture if they lived outside Bali for an extended period or in a family exposed to modernization. On the other hand, those students who are not considered to be Balinese ethnicity may understand Balinese culture if they have lived in Bali since childhood or lived in an environment exposed to Balinese culture and engage with Balinese communities. Further study should be conducted with more precise limitations to avoid bias.

## **CONCLUSION**

Most of the Health Faculty students at Hindu Indonesia University (UNHI) had adequate knowledge and practices of Balinese culture sleep hygiene modification. On the other hand, several students had adequate knowledge but poor practices and several students had poor knowledge but good practices, which indicates that adequate knowledge about Balinese culture sleep hygiene modification does not guarantee good practices. Overall, there was still a gap in the knowledge and practices of Balinese culture sleep hygiene modification among Health Faculty students at Hindu Indonesia University (UNHI). Some concepts about sleep hygiene should be re-emphasized so that they can be understood and adequately implemented to get a good quality of sleep.

### ***Declaration by Authors***

**Ethical Approval:** This study has obtained ethical clearance issued by The Research Ethic Commission of Faculty of Medicine, Udayana University, Denpasar (EC no 564/UN14.2.2.VII.14/LT/ 2023).

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