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THE CORRELATION BETWEEN SLEEP QUALITY AND ACNE VULGARIS INCIDENCE IN MEDICAL STUDENTS OF UNIVERSITAS TARUMANAGARA

Helena Ivonne Cungse Adinegoro[1], Donatila Mano[2]*
[1]Faculty of Medicine, Universitas Tarumanagara, Jakarta, Indonesia
[2]Department of Microbiology, Universitas Tarumanagara, Jakarta, Indonesia

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Corresponding Author:
E-mail: dontalias@fk.untar.ac.id

ABSTRACT

Background: Acne vulgaris is still occurred among medical students worldwide, with a prevalence range of 34,38% to 97,9%. Acne vulgaris, which affects the pilosebaceous unit, is suspected to be related to sleep quality because it involves many hormones, including melatonin, which is associated to sleep. Melatonin can suppress androgens, which play a crucial role in Acne vulgaris pathogenesis. Besides, some studies said that melatonin has a role to suppress inflammation. Medical students also often experience poor sleep quality. Previous studies on the correlation between sleep quality and Acne vulgaris have shown varied results. **Objective:** This research was conducted to confirm the correlation between sleep quality and Acne vulgaris. **Methods:** A total of 195 medical students from Tarumanagara University classes of 2021 and 2022 participated in this study by answering the Pittsburgh Sleep Quality Index (PSQI) and Acne vulgaris questionnaires. Samples were taken using non-random consecutive sampling. This research used an analytical observational method with a cross-sectional design. **Results:** The study found that 92 respondents (47,2%) had good sleep quality, while 103 respondents had poor sleep quality (52,8%). A total of 123 respondents (63,15) experiences Acne vulgaris. Chi-square statistical analysis using SPSS software showed a significant correlation between sleep quality and Acne vulgaris (p-value <0,05; PRR = 1,261; 95% CI = 1,261-1,576). **Conclusion:** Poor sleep quality can increase the risk of developing Acne vulgaris.

INTRODUCTION

Sleep is a condition in which the body and mind rest. It occurs periodically with the eyes closed, making the body less sensitive to external stimuli.[1,2] According to the Center for Disease Control and Prevention (CDC) (2022), the recommended amount of sleep for individuals aged 18-60 years is seven hours or more each night, while the National Sleep Foundation (NSF) (2020) recommends between seven to nine hours of sleep per night for those who aged 18-64 years old.[3,4] This sleep duration is a part of the criteria for sleep quality, which is also included in the Pittsburgh Sleep Quality Index (PSQI) questionnaire.[5] Sleep quality itself is defined as an individual's satisfaction with their sleep habits.[6] Globally, Rao WW, et al. (2020) found that 52,7% of medical students experience poor sleep quality.[7]

Acne vulgaris is a chronic inflammatory condition affecting the pilosebaceous unit, characterized as a multifactorial and complex disease. This is due to its association with genetic factors, lifestyle, environmental influences, and the involvement of various hormones. Its forms and severity can be a non-inflammatory lesion, such as closed and open comedones, as well as inflammatory lesions, such as papules, pustules, nodule, or cysts. This condition is commonly experienced by adolescents and young adults.[8]

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Data from Global Burden of Disease (GBD) in 2019 reported that 3.52 million people aged 15-49 years old suffered from *Acne vulgaris*, out of a global incidence of 4.96 million cases.[9] A literature review conducted by Sachdeva M, et al. (2021) found that the prevalence of *Acne vulgaris* among medical students worldwide ranges from 34.38% to 97.9%.[10]

Moreover, *Acne vulgaris* is a significant concern due to its potential impact on the psychological well-being of affected persons. This was proven by Morshed ASM, et al. (2023) in Bangladesh, who found a significant association between *Acne vulgaris* and depression, anxiety, and stress, particularly among women. The psychological distress caused by *Acne vulgaris* also affects self-confidence and the overall quality of life of those affected.[11]

The components involved in the pathogenesis of *Acne vulgaris* include follicular epidermal hyperproliferation, sebum production, bacteria called *Propionibacterium acnes* (now *Cutibacterium acnes*), and the immune response to the inflammatory process.[8] An increase in sebum production is associated with androgen hormones. Androgen levels can be reduced by the presence of melatonin, a hormone related to sleep and circadian rhythms, suggesting a potential link between *Acne vulgaris* and sleep quality.[12–15] Previous studies have found mixed results, as seen in research by Annisa F, et al. (2021) and Silvia E, et al. (2020), both of which found a significant relationship between sleep quality and *Acne vulgaris*.[16,17] However, a study by Primawati, et al. (2022) found no such association.[18] Therefore, this research aims to clarify the correlation between sleep quality and *Acne vulgaris*. Additionally, this research, which using a larger samples, was conducted with the expectation that the results may contribute to efforts aimed at reducing the prevalence of *Acne vulgaris*.

METHODS

This research was an observational analytic method with a cross-sectional design, conducted at Universitas Tarumanagara in Jakarta, Indonesia, from January 2024 to February 2024. This research used a primary data, as the researchers directly collected data from the respondents. The study population consists of all medical students from Universitas Tarumanagara. The sample includes 195 students from the 2021 and 2022 of the medical students. Inclusion criteria for this research were students from the 2021 and 2022 of the medical students at Universitas Tarumanagara, who are willing to participate as respondents, complete the questionnaires, and meet the exclusion criteria. The exclusion criteria were those who unwilling to participate, use the acne medication, use the acne prevention products, undergo a treatment at a clinic, and take sleeping medication. Medical students who agreed to participate as respondents completed the Pittsburgh Sleep Quality Index (PSQI) and an *Acne vulgaris* questionnaire that was made by the researchers. The PSQI questionnaire was filled out by respondents to evaluate their sleep quality over the past month. The PSQI consisted of seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, the use of sleeping medication, and daytime dysfunction. Each component was scored according to the PSQI scoring system, with a total score >5 classified as poor sleep quality, and a total score <5 classified as good sleep quality. Meanwhile, the *Acne vulgaris* questionnaire was used to assess whether respondents had experienced symptoms of *Acne vulgaris* in the past month or not. Both questionnaires were distributed to the respondents via *Google forms*. Once the data were collected through *Google forms*, they were stored in *Microsoft Excel* format. The data were then input into a 26 version of SPSS software for processing and bivariate analysis using the Chi-square statistical test, with a significance level of p-value <0.05 and a 95% Confidence Interval (CI). This research was conducted after receiving an ethical approval letter from ethic committee of the Faculty of Medicine, Universitas Tarumanagara with ethical clearance No. 279/KEPK/FK UNTAR/XII/2023.

RESULTS

This study was conducted based on the sample size obtained, which involved 195 respondents as research subjects. These subjects were selected using a non-random consecutive sampling technique. Table 1 shows the sample characteristics, including age, gender, and body mass index distribution.

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Table 1. Sample characteristics

	Frequency (%)	Mean (SD)	Median (Min-Max)
Age		20.01 (1.43)	20.00
<20	66 (33.8)		(18-31)
20-25	127 (65.1)		
>25	2 (1.0)		
Gender			
Female	146 (74.9)		
Male	49 (25.1)		
Body Mass Index (BMI)		22.66 (4.11)	22.04 (15.22-37.89)
<23.00	109 (55.9)		
≥23.00	86 (44.1)		
Total	**195 (100)**		

Table 1 shows that the average age of the respondents was 20 years old, with the majority being female (74.9%). The mean body mass index (BMI) was 22.04 kg/m², which is within the normal range. The proportion of respondents with an underweight to normal (BMI <23.00 kg/m²) was higher compared to those with an overweight to obese (BMI ≥23.00 kg/m²).

Table 2. Proportion of sleep quality and *Acne vulgaris* incidence

	Frequency (n)	Percentage (%)
Sleep Quality		
Good	92	47.2
Poor	103	52.8
Acne vulgaris Incidence		
Yes	123	63.1
No	72	36.9
Total	**195**	**100**

Table 2 shows the proportion of sleep quality and the incidence of *Acne* vulgaris among respondents. It shows that more respondents had poor sleep quality (52.8%) compared to those with good quality (47.2%). Additionally, most respondents (63.1%) experienced *Acne vulgaris*.

Table 3. The correlation between sleep quality and *Acne vulgaris*

Sleep Quality	*Acne vulgaris*		Total	PRR	95% CI		*p-value*
	Yes	No			Lower	Upper	
Poor	72 (69.9%)	31 (30.1%)	92	1.261	1.009	1.576	0.037
Good	51 (55.4%)	41 (44.6%)	103				

Table 3 reveals the results of the data analysis in this research. As shown in Table 3, the research found a significant correlation between sleep quality and *Acne vulgaris*, with a p-value <0.05 (p-value = 0.037). This indicates that sleep quality has a meaningful impact on the likelihood of developing *Acne vulgaris*. The Prevalence Rate Ratio (PRR) of 1.261 means that those with poor sleep quality may have a 1.261 times higher risk of experiencing *Acne vulgaris*.

DISCUSSION

The findings of this research are consistent with the results of several previous studies, such as the research conducted by Annisa F, et al. (2021) on patients at Dr. Nur Afni's practice, M.Biomed, in Medan, which used 67 research samples.[16] Additionally, a significant correlation between sleep quality and *Acne vulgaris* was also found by Silvia E, et al. (2020) in a study involving 157 respondents at the General Faculty of Medicine, Universitas Malahayati.[17] However, a similar study conducted by Primawati I, et al. (2022) at the Faculty of Medicine, Universitas Baiturrahmah, found the opposite results. This contrast result may be attributed to differences in the study locations, which could affect the characteristics of the research subjects, as well as differences in sample size, as Primawati I, et al. included only 88 respondents.[18]

Human body can recognize external time and adjust to it through a specific protein found in retinal ganglion cells, known as melanopsin. Melanopsin acts as a receptor molecule for light. Whether it is dark or daylight, light serves as an input that is detected by melanopsin. This information is then transmitted to the suprachiasmatic nucleus (SCN) via the retino-hypothalamic tract. The pineal gland subsequently receives this signal to determine whether melatonin production should be increased or inhibited. Melatonin production can increase up to tenfold at night.[15]

Poor sleep quality can reduce melatonin production due to light exposure.[19] This hormone acts on its receptors, including MT1, MT2, MT3, and RZR/ROR receptors. These receptors are present in the skin, such as in melanocytes and keratinocytes. When melatonin binds to the MT1 and MT2 receptors, which are coupled with G-proteins, it activates signal transduction through the cAMP (cyclic adenosine monophosphate) pathway.[20,21] This series of pathways leads to specific effects, such as regulating testosterone synthesis and reducing androgen receptor expression.[13,22] Therefore, reduced melatonin production due to poor sleep quality can result in increased androgen hormones.

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Androgen hormones play a crucial role in the four factors involved in the pathogenesis of *Acne vulgaris*: epidermal follicular keratinocyte hyperproliferation, sebum production, *Cutibacterium acnes* bacteria, and the body's immune response to the resulting inflammation. Epidermal follicular keratinocyte hyperproliferation occurs due to an excess of new keratinocyte production compared to desquamation, leading to obstruction of the follicular ostium and accumulation of keratin, sebum, and bacteria, resulting in microcomedones.[8,23,24] Sebum production by sebocytes is influenced by androgen hormones, specifically in the forms of dihydrotestosterone (DHT) and testosterone. These androgen forms bind to their receptors on sebocytes and keratinocytes, interacting with DNA and stimulating sebocytes differentiation, which increases sebum production.[24,25] Additionally, DHT can stimulate follicular keratinocyte proliferation. Increased sebum production leads to an increased breakdown process, producing free fatty acids.[8] The accumulation of free fatty acids supports the colonization of *C. acnes*, which is then recognized by the innate immune system in keratinocytes through TLR-2 (toll-like receptor-2), TLR-4 (toll-like receptor-4), and NLRP-3 (NOD-like receptor family, pyrin domain containing 3). This recognition triggers immune cell activation and the release of pro-inflammatory cytokines such as TNF (tumor necrosis factor), IL-1 (interleukin-1), and IL-8. These pro-inflammatory cytokines recruit neutrophils, macrophages, and support Th1 (type-1 T helper) cell responses, leading to ongoing inflammation and damage to the sebaceous gland epithelial cells. The adaptive immune system can also respond by releasing pro-inflammatory cytokines.[26] When melatonin production decreases due to poor sleep quality, melatonin is less able to suppress androgen hormones, leading to the development of *Acne vulgaris*.

Additionally, melatonin can suppress inflammatory responses by inhibiting the activation of the NLRP-3 inflammasome and the NFκB (Nuclear Factor kappa B) pathway.[20] Research by Yaşar NF, et al. (2017) demonstrated that melatonin affects the levels of the pro-inflammatory cytokine IL-6.[27] Furthermore, a study by Cho JH, et al. (2021) found that melatonin can reduce other pro-inflammatory cytokines such as IL-1 and TNF.[28] Melatonin can enhance the expression of an anti-inflammatory cytokine, IL-10, showed by Chen S, et al. (2016). Therefore, reduced melatonin levels due to poor sleep quality result in an inability to suppress the inflammatory process.[29]

In this research, data that could potentially act as confounding variables were not obtained. These variables may also difficult to eliminate. Such data is needed to understand the relationship between sleep quality and *Acne vulgaris* in more detail.

CONCLUSION

The results of this research indicate that sleep quality is related to *Acne vulgaris*, with individuals experiencing poor sleep quality at a higher risk of developing *Acne vulgaris*. Therefore, it is recommended that participants and the public pay more attention to their sleep quality to decrease the *Acne vulgaris* prevalence. Future research could use a cohort study design to understand the temporal relationship between sleep quality and *Acne vulgaris* since this research was a cross-sectional study design. Future research could also conduct multivariate analysis, considering confounding variables to understand the relationship between sleep quality and *Acne vulgaris* in more detail, including which factors play a more significant role in the incidence of *Acne vulgaris*.

ETHICAL APPROVAL

Ethical Clearance was obtained with consideration by the Komite Etik Penelitian Kesehatan (KEPK) Fakultas Kedokteran Universitas Tarumanagara with ethical clearance No. 279/KEPK/FK UNTAR/XII/2023.

CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

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AUTHOR CONTRIBUTIONS

Conceptualization, methodology, data analysis, HICA and DM, data curation, HICA, writing–original draft preparation, writing–review and editing, HICA and DM, supervision, DM.

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