Sleep Quality and Skin Type as Factors Associated with the Incidence of Acne Vulgaris

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Article Info

Abstract

Acne vulgaris is a skin disease caused by chronic inflammation in the pilosebaceous unit, which produces sebum. The factors causing acne vulgaris are multifactorial and interact with each other. Medical students are a subgroup of society who are vulnerable to experiencing sleep disorders. Therefore, this study aims to explore the relationship between acne and sex, sleep quality, and skin type, especially in medical students. This research uses survey methods and analytical observation with a cross-sectional approach. The sampling technique is stratified random sampling. Validated questionnaires were used to assess sleep quality and skin type. Univariate analysis showed that of the 85 participants, the majority were female and aged 20. The prevalence of acne in this study was 52.9%. Most respondents had poor sleep quality (63.5%) and oily skin (69.4%). Based on bivariate analysis, acne vulgaris was significantly related to sleep quality (p=0.046) and skin type (p=0.025). Multivariate analysis showed that skin type had the most robust relationship with acne vulgaris (OR = 2.876; 95% CI = 1.077-7.685).

Introduction

Acne vulgaris is a skin disease caused by chronic inflammation of the pilosebaceous follicles, which produces sebum and is a self-limited disease (Eichenfield *et al.*, 2021; Sutaria *et al.*, 2023). The most common clinical manifestations are on the face with blackheads, pastures, papules, nodules, and cysts (Vasam *et al.*, 2023). However, they can be persistent and have dire consequences for a person's skin and psychology because they interfere with their appearance. The factors causing acne vulgaris are multifactorial and interact with each other. Several factors, such as age, hormonal imbalance, bacterial colonization, genetics, vitamin deficiencies, certain foods, impaired sebum production, and stress, influence the occurrence of the polysebaceous inflammatory process (Sachdeva *et al.*, 2021; Vasam *et al.*, 2023). Acne can appear in adolescence, generally between the ages of 15 and 17, and can continue until 30 years. The incidence and severity of acne affects approximately 85% of adolescents between 12 and 25 years of age and increases during adolescence and early adulthood (Lynn *et al.*, 2016; Ribeiro *et al.*, 2015; Wolkenstein *et al.*, 2018).

Sleep quality is a measurement that aims to measure how well a person sleeps by measuring sleepiness during sleep and what

is felt after waking up. Good quality sleep can provide various benefits for a person, such as improving mood, a healthy heart, regular blood sugar, improving mental function, maintaining the immune system, reducing stress, improving performance, and maintaining a healthy weight (Albqoor & Shaheen, 2021; Ramar *et al.*, 2021). On the other hand, poor sleep quality can have many negative impacts due to disturbed physiological and psychological balance, such as fatigue, dysfunction during the day, unstable mood, excessive sleepiness, feeling tired, cognitive disorders that can make people forget quickly, difficulty concentrating, increase the risk of heart disease, and trigger acne vulgaris (Jović *et al.*, 2017; Nelson *et al.*, 2022).

The mechanism by which acne occurs due to disturbances and lack of sleep is not fully understood, and research is still limited; however, an overall irregular endocrine system in the body is estimated to trigger the development of acne (A. Rao *et al.*, 2021; Schrom *et al.*, 2019; Zhu *et al.*, 2023). Sex hormones, especially androgens, play an essential role in the pathogenesis of acne and skin homeostasis, including forming comedones, increased oil production, disruption of the skin microbiome, and inflammation (Zhu *et al.*, 2023). The increase in androgen hormones, which have an impact on excessive sebum production, puts teenagers at puberty at risk of experiencing the peak of the acne epidemic. Nonetheless, previous studies stated that males with poor sleep quality instead experience a decrease in testosterone levels, which is the most common type of androgen (Lord *et al.*, 2014; Morssinkhof *et al.*, 2020). Therefore, disturbances and lack of sleep may not be directly correlated with the development of acne by affecting androgen levels; however, there are other factors, such as the hormone cortisol, which is more related to the inflammatory process, and sleep, which is a potential mechanism for the occurrence of acne (A. Rao *et al.*, 2021).

Medical students represent a subgroup of the general population who are vulnerable to experiencing poor sleep quality due to various possibilities, like greater academic demands, more extended study periods, frequent exams, and exam anxiety. All of these possibilities affect sleep disturbances, resulting in increased cortisol levels, which pose a risk of causing acne (Alotaibi *et al.*, 2020; Jahrami *et al.*, 2020; Mishra *et al.*, 2022; Okun *et al.*, 2023). Based on the results of 11 cross-sectional studies, the average prevalence of acne, especially among medical students with an average age of 21.3 years, was 57.2% (range 34%-98%) (Sachdeva *et al.*, 2021). The level of sebum production is also related to skin type. Based on the Baumann Skin Type Indicator (BSTI), dry or oily skin parameters are related to acne growth (Baumann, 2010; Hong *et al.*, 2020). Increased sebum production is often interpreted as oily skin. So skin type can be classified as a risk factor for acne vulgaris (Baumann *et al.*, 2014). Therefore, associations between sex, sleep quality, skin type, and acne in medical students require further investigation. This study aims to investigate the relationship between sleep quality and skin type with acne using a validated questionnaire assessment.

Method

This research is a study with a cross-sectional study approach. Data collection will only be done once for each respondent using a questionnaire. The sample in this study will use stratified random sampling, which will be carried out on all students of the Atma Jaya Faculty of Medicine and Health Sciences class of 2020, 2021, and 2022 from April to June 2023. Only students who meet the inclusion criteria are entitled to participate. The inclusion criteria in this study were active students of the Unika Atma Jaya undergraduate medical study program. The exclusion criteria were respondents who treated acne vulgaris at a clinic with a dermatologist or had taken medication for the last two weeks. This research has received approval from the Faculty of Medicine and Health Sciences ethics committee, Unika Atma Jaya, with number 23/05/KEP-FKIKUAJ/2023.

Univariate analysis describes the frequency distribution of respondents' characteristics. The questionnaire results are independent variables, and the acne The instruments used in this study were the Pittsburgh Sleep Quality Index (PSQI) questionnaire (Buysse *et al.*, 1989), BSTI (Baumann *et al.*, 2014), and offline acne observation using the classification of Lehmann *et al.*(Lehmann *et al.*, 2002). Respondent

characteristics consist of age and gender. The PSQI questionnaire consists of 19 questions with seven components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disorders, use of sleeping medication, and daytime dysfunction. Each is scored from 0 to 3, with a total score ranging from 0 to 21. Lower scores indicate good sleep quality (≤5). The BSTI questionnaire: oily vs dry consists of 11 questions with answer choices a, b, c, d, and e. The answer to this question consists of 1 point for choice a, 2 points for choice b, 3 points for choice c, 4 points for choice d, and 2.5 points for choice e. The total score will range from 11 to 44. A total score of 11 to 26 indicates dry skin and a 27 to 44 indicates oily skin. Acne vulgaris will be measured observationally using the classification based on Lehmann *et al.*, divided into three degrees: mild, moderate, and severe. Mild acne is seen with some comedones < 20, inflammatory lesions < 15, or total lesions < 30. Moderate acne is seen with comedones 20-100, inflammatory lesions (papulo-pustular) 15-50, or total lesions 30-125. Severe acne is seen by the number of cysts > 5, comedones < 100, inflammatory lesions > 50, or total lesions > 125. However, in this study, only measurements will be made of the presence or absence of acne vulgaris, so even mild acne is considered positive for acne. Observation results are

dependent variables. Then, the bivariate analysis will be used using the Chi-Square test if it meets the requirements (expected value is less than 5, maximum 20% of the number of cells), and if not, it will be carried out using the Fisher test. It will be said to be significant between two variables if the p-value is <0.05. A multivariate logistic regression test was carried out to determine the relationship between several independent variables that have the most significant influence on the dependent variable. Variables included in the multivariate analysis are variables with a significant value with p < 0.25 in the bivariate analysis.

Result And Discussion

The results of this study on 85 Unika Atma Jaya students showed that most respondents were female, with the majority of respondents aged 20 years. The prevalence of acne among medical students in this study is 52.9%. Most of the respondents had poor sleep quality (63.5%) and oily skin (69.4%). The demographic characteristics of respondents and a description of the factors that influence the incidence of acne vulgaris can be seen in Table 1.

In the current study, males (54.5%) reported a slightly higher prevalence of acne vulgaris compared to females (51.9%) but not

TABLE 1. Characteristics of Respondents

Variables	Frequency	
	Total (n)	**Percentage (%)**
Age (years)	Median (range): 20 (18-22)	
Gender		
Male	33	38.8
Female	52	61.2
Sleep quality		
Poor	54	63.5
Good	31	36.5
Skin type		
Oily	59	69.4
Dry	26	30.6
Acne vulgaris		
Positive	45	52,9
Negative	40	47,1

statistically significant (p> 0.05). This finding is similar to an earlier study in Indonesia that found gender was not significantly associated with acne, with 60.6 % of males reporting acne compared to 56.9% of females (Subagio *et al.*, 2021). These results also align with previous community-based research in China, where acne was higher in males than females in the late adolescent age category (Shen *et al.*, 2012). It is in contrast to what several other studies have stated acne was more common in females (Alanazi *et al.*, 2020; Chahoub *et al.*, 2023; Jaber *et al.*, 2020; Skroza *et al.*, 2018). Acne vulgaris is believed to be influenced by sebum production, which is influenced by androgens and estrogen. Androgen levels increase sebum production, while estrogen levels can reduce sebum production. Androgens and estrogens are produced in males and females; however, the evolvement of alteration in hormone levels that vary with age between the two sexes results in differences in the prevalence of acne in them (Ju *et al.*, 2017; Yang *et al.*, 2020). Androgen hormones such as testosterone and dihydrotestosterone are believed to be the main hormones that modulate development and physiology in males with testosterone levels in the circulation who have experienced puberty 15- to 20-fold more significant than those of females (Handelsman *et al.*, 2018). The increased risk of acne vulgaris in males may also be caused by higher sebum levels and their larger pore sizes. Meanwhile, the prevalence of acne vulgaris in females is higher in early adolescence because females experience puberty more quickly than males (Heng & Chew, 2020). However, the exact mechanism of this sex steroid hormone concerning the pathogenesis of acne is still unclear (Ju *et al.*, 2017)

Medical students are a subgroup of society vulnerable to poor sleep quality. It can be due to the demanding nature of medical school, such as high academic demands, extended studies, short sleep duration, frequent exams, anxiety regarding studies and results, lifestyle choices, and other factors (Jahrami *et al.*, 2020). The majority of respondents in this study need better sleep quality. The prevalence of poor sleep quality, especially among medical students, varies significantly between countries; however,

the main finding from various studies was that most medical students had self-reported poor sleep quality. A meta-analysis study found that the pooled prevalence of poor sleep quality from 57 studies with 25,735 medical students involved was 52.7%. In addition, it was found that the study area was significantly associated with the prevalence of poor sleep quality in medical students. The highest prevalence of poor sleep quality occurred in Europe (65.13%), followed by America (59.92%), Africa (54.54%), and Asia (47.44%) (W. W. Rao *et al.*, 2020).

In this study, the prevalence of poor sleep quality among undergraduate medical students was 63.5%, similar to the study conducted in Ethiopia, which was 62% (Wondie *et al.*, 2021). However, the result of the present study was higher than the study reported in Brazil (40%) and Nepal (38.2%)(Paudel *et al.*, 2022). On the other hand, our study was lower than the previous studies conducted at other medical faculties in Indonesia (Harlim & Gloria Stephanie, 2020; Primawati *et al.*, 2022). Possible causes of this variability are differences in sampling techniques, socio-culture, and study populations. Respondents with poor sleep quality were more likely to be positive for acne vulgaris. The results of bivariate analysis of sleep quality and the incidence of acne vulgaris using chi-square obtained a p-value of 0.046 (95% CI), showing a significant relationship between the two variables (Table 2). Respondents with poor sleep quality had a risk of experiencing acne vulgaris compared to those with good sleep quality. The significant relationship between poor sleep quality and acne is in line with previous research by (Annisa & Sulistiasari, 2021; Zhang *et al.*, 2023). Some studies also report an association with the severity of acne (Harlim & Gloria Stephanie, 2020; Schrom *et al.*, 2019). However, some studies state that although the incidence of acne vulgaris was more common in students with poor sleep quality, it is statistically unrelated to the incidence and severity of acne (Primawati *et al.*, 2022; Seran *et al.*, 2020). Disturbances and lack of sleep can significantly impact overall endocrinological regulation, which can indirectly trigger the development of acne by affecting androgen levels; however, the exact mechanism remains elusive (Zhu *et al.*,

2023). **S**everal hypotheses state that disturbed/ poor sleep quality is related to acne, including increased expression of corticotropin-releasing hormone (CRH), cortisol, and neuropeptide P, which affects the increasing sebum secreted by sebaceous glands (Okun *et al.*, 2023; A. Rao *et al.*, 2021; Soliman *et al.*, 2022; Zhang *et al.*, 2023).

The hypothalamic-pituitary-adrenal (HPA) is a physiological system whose activation is a consequence of the release of CRH from the hypothalamus, which stimulates the anterior pituitary to release adrenocorticotropic hormone (ACTH) and which then stimulates cortisol from the adrenal glands (Labad *et al.*, 2020). The results of several studies show increased HPA axis activity in people with poor sleep quality (van Dalfsen & Markus, 2018). An increase in CRH and cortisol, which are stress-related hormones, also mediate the activity of the sebaceous glands in the skin. This is evidenced by the robust expression of CRH observed in the sebaceous glands of skin

with acne compared to skin without (A. Rao *et al.*, 2021). The CRH promotes lipogenesis and enhances the expression of enzyme 3-β-hydroxysteroid dehydrogenase, which leads to an increase in testosterone in humans and may also interact with immune factors, causing the release of inflammatory mediators in acne (Bhat *et al.*, 2017; Cruz *et al.*, 2023). Substance P (SP), a neuropeptide released by nerve endings in the skin, is regulated by stress and is overexpressed in the nerves around the sebaceous glands in individuals with acne. The SP causes expansion of the sebaceous glands by stimulating the proliferation of sebaceous precursor cells and modulating sebocyte differentiation. In addition, SP can increase the regulation of various inflammatory factors and promote the expression of peroxisome proliferator-activated receptors-γ (PPAR-γ) on sebocytes to increase lipid synthesis (Cruz *et al.*, 2023; Jusuf *et al.*, 2021).

Respondents with oily skin were more likely to have acne vulgaris than dry skin and

TABLE 2. Bivariate Analysis of Factors Associated with Acne Vulgaris in Medical Student

	Acne Vulgaris				Odds Ratio	95 CI		P-value
	Positive		Negative			Lower	Upper	
	n	%	n	%				
Gender								
Male	18	54.5	15	45.5	1.111	0.463	2.665	0.813
Female	27	51.9	25	48.1				
Sleep quality								
Poor	33	61.1	21	38.9	2.488	1.005	6.159	0.046
Good	12	38.7	19	61.3				
Skin type								
Oily	36	61.0	23	39.0	2.957	1.129	7.741	0.025
Dry	9	34.6	17	65.4				

TABLE 3. Multivariate Analysis of Factors Associated with Acne Vulgaris among Medical Students

Category		Exp B (adjusted OR)	95% CI		P-value
			Lower	Upper	
Sleep quality	0,882	2,415	0,163	1,052	0,064
Skin type	1,057	2,876	1,077	7,685	0,035

have a significant relationship (Table 2). The results of this research are in line with those carried out by (Salsabila Samara *et al.*, 2023; Tamba & Jusuf, 2020; Wang *et al.*, 2016). Based on BSTI, one of the parameters for determining skin type is oily or dry skin. Oily skin is known for its high sebum production. Meanwhile, dry skin has a low level of sebum, so it cannot prevent water evaporation, which can disrupt the skin barrier on the skin (Baumann *et al.*, 2014). Increased sebum production is often interpreted as oily skin; thus, skin type can be classified as a risk factor for acne vulgaris (Tamba & Jusuf, 2020). The level of sebum production between individuals is different and varies greatly. Several factors have been proven to explain why some individuals have oilier skin than others. Males generally have higher sebum production. It is associated with higher testosterone, the most common type of androgen (Leung *et al.*, 2020). Increased sebum production is due to an increase in androgen hormones, which can result in inflammation and colonization of *Cutibacterium acnes* (*C. anes*) bacteria in hair follicles, increasing the risk of acne. Meanwhile, increased sebum production occurs during the ovulatory phase in females due to a secondary increase in progesterone levels (Endly & Miller, 2017; Hong *et al.*, 2020). More people experiencing oily skin in this study are also supported by the tropical climate in Indonesia, which tends to be humid, resulting in increased sebum production (Endly & Miller, 2017). The results of the bivariate analysis of all independent and dependent variables can be seen in Table 2.

The results of the multivariate analysis showed that skin type had the most robust relationship with acne vulgaris compared with sleep quality (Table 3). However, there are no studies comparing sleep quality and skin type, which have a more significant influence on acne vulgaris, so to our knowledge, the results of this study are the first. Skin type has a more dominant influence on acne than poor sleep quality because oily skin is a direct result of increased activity of the sebaceous glands, which produce sebum, compared to sleep quality, which indirectly affects hormonal regulation, ultimately affecting the sebaceous glands. Sebum alone or in coordination with others is an essential pathogenic factor in AV pathogenesis. Increased production and changes in the lipid profile of sebum play a role in the pathogenesis of acne by the formation of comedones, triggering inflammation through various pathways, as a source of nutrition and follicular microenvironment for *C. acnes*, and increasing the expression of the proinflammatory cytokine interleukin (IL)-1 which causes hyperkeratinization. The growth of *C. acnes,* in turn, will also stimulate the production of proinflammatory cytokines by sebocytes and other cells of the pilosebaceous unit and further increase sebum production. This excess sebum combines with clumps of keratin/keratinocytes that try to leave the follicle, ultimately clogging the pilosebaceous unit and causing inflammation (Del Rosso & Kircik, 2024; Leung *et al.*, 2020).

Additional studies are needed to explore other factors associated with the incidence of acne vulgaris, including its severity. Although there are limitations, the findings obtained contribute to providing information on risk factors that influence the incidence of acne vulgaris, especially in medical students. Education on acne prevention is necessary, especially regarding poor sleep quality, and those with oily skin are being advised to pay more attention to facial hygiene because they are at greater risk of experiencing it.

Conclusion

The prevalence of acne among medical students in this study was 52.9%. Poor sleep quality and oily skin are associated with acne vulgaris, with oily skin type playing a dominant role. Medical students need to pay more attention to sleep quality and facial cleanliness, especially if they have oily skin because they are prone to acne. Further studies comparing the severity of acne are needed to find out the risk factors that exist in more detail.

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