

THE RELATIONSHIP BETWEEN ACADEMIC STRESS AND SLEEP QUALITY WITH THE INCIDENCE OF ANEMIA IN ADOLESCENT GIRLS

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Abstract

Anemia among adolescent girls remains an unresolved health problem in Indonesia. Factors suspected to be associated with anemia include academic stress and sleep quality. The study aimed to determine the relationship between academic stress and sleep quality with anemia among 12th-grade female adolescents at Senior High School 1 Rendang, Karangasem Regency. This observational analytical study used quantitative methods and a cross-sectional design with a sample of 92 respondents obtained through total sampling techniques. The measurement tools used included the Educational Stress Scale for Adolescents (ESSA) questionnaire to assess academic stress levels, the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality, and hemoglobin levels. Data were analyzed using the Chi-Square test. The results showed that the highest proportion of respondents were in the moderate academic stress category (87.0%), followed by 48.9% with poor sleep quality, and the prevalence of anemia was recorded at 14.1%. Statistically, no relationship was found between academic stress and anemia ($p=0.819$), nor between sleep quality and anemia ($p=0.710$).

Keywords: Adolescent Girls, Anemia, Academic Stress, Sleep Quality.

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1. Introduction

Adolescent girls are a population at risk for health problems, particularly iron deficiency anemia. Anemia in this group represents a crucial global health challenge, given its impacts, which include decreased concentration in learning, lower productivity, reduced physical fitness, and an increased risk of anemia in later pregnancy [1].

WHO (2023) stated that as many as 30.5% of unmarried teenagers in the world suffer from anemia [2]. In Indonesia, based on the 2023 Indonesian Health Survey report, the prevalence of

anemia in adolescents aged 15-24 years was 15.5% [3].

A person's hemoglobin level is influenced by various factors, both internal and external. Internal factors include nutritional status, menstrual blood loss, and general health. External factors include iron intake, physical activity intensity, and psychological stress. Academic stress is a very common psychological factor in adolescent girls, due to high learning demands, exams, and the pressure to achieve. Prolonged stress can affect stomach acid production and iron absorption, as well as disrupt

appetite, which can impact nutrient intake, including iron [4].

The Indonesian Ministry of Health has determined that a person is said to be anemic if their hemoglobin level is less than 11 g/dL (pregnant women) or less than 12 g/dL (adolescents aged 12-14 years and non-pregnant women aged over 15 years) [5].

Academic stress can be understood as a condition where a student feels unable to cope with the various academic demands, so that these demands are perceived as a disruption. The sources that trigger academic stress in adolescents are very diverse [6].

Academic stress encompasses five main aspects. First, pressure from study, which is the pressure experienced by students. Second, workload, which is the burden of numerous academic assignments. Third, worry about grades, which involves anxiety about exam scores, assignment grades, and other forms of assessment. Fourth, self-expectation, which is students' expectations of achieving satisfactory results according to their desires. Fifth, despondency, which is students' feelings of lack of confidence in achieving planned goals [7].

Besides academic pressure, sleep quality is another factor that is often overlooked in the adolescent population. Teenagers' sleep patterns tend to be irregular due to heavy schoolwork, gadget use, and high social activity. Sleep disturbances can also trigger increased cortisol levels, which ultimately negatively impact hemoglobin levels [8].

Sleep quality is defined as an indicator that measures how well a person rests, encompassing various components such as sleep duration, sleep latency (the length of time it takes to fall asleep), frequency of nighttime awakenings, sleep efficiency, and feeling refreshed upon waking. According to research using the Pittsburgh Sleep Quality Index (PSQI), sleep quality is assessed using seven components: subjective assessment of sleep quality, time needed to fall asleep, sleep duration,

sleep effectiveness, sleep disturbances, use of sleep aids, and the impact of sleepiness on daytime activities [9].

Previous research conducted by Dwi in 2024 in Malang showed that anemia had an effect on the mental health of Gen Z teenagers [10]. Then, Rosidana's research in Pekanbaru in 2025 obtained results showing a relationship between sleep quality and the risk of anemia in adolescent girls [8]. Meanwhile, different results were obtained from the research conducted by Umi in 2023 in Konawe, where there was no significant relationship between sleep quality and the incidence of anemia [11].

Buleleng Regency is one of the areas in Bali Province with a large adolescent population. Data from Karangasem Regency indicates that the prevalence of anemia among female students remains at an alarming level. A total of 22.6% of female students at the high school and vocational school levels experience this condition. Furthermore, the effectiveness of iron supplementation programs remains suboptimal, with a compliance rate of iron supplementation tablets reaching only 18.75%, according to research at Junior High School 2 Selat. This situation certainly presents its own challenges in preventing anemia among adolescent girls. Data on the relationship between academic stress and sleep quality and hemoglobin levels in adolescent girls in this region is still limited, particularly at the high school level.

This study is the first to examine the relationship between academic stress and sleep quality and the incidence of anemia in adolescent girls at Senior High School 1 Rendang, Karangasem Regency, where previous similar studies have been conducted in areas with different socio-demographic characteristics. Furthermore, testing both variables in a single model on a population of adolescent girls and using standardized instruments, namely the ESSA to measure academic stress and the PSQI to assess sleep quality, makes this study more accurate than studies using

non-standardized measurement tools. Therefore, this study should provide additional empirical evidence that will enrich the understanding of the determinants of anemia in adolescent girls in areas with unique socio-demographic characteristics and serve as a basis for planning and strengthening anemia prevention and control programs at the senior high school level.

This study aims to determine the relationship between academic stress and sleep quality with the incidence of anemia in female adolescents in grade XII at Senior High School 1 Rendang, Karangasem Regency.

2. Research Methods

The research design was cross-sectional with a quantitative observational analytical method. Data collection was conducted at a specific point in time without any follow-up or repeated observations. This research was conducted at Senior High School 1 Rendang, Karangasem Regency, over four weeks in February 2026.

The population used was 111 female students in grade XII. The sampling technique used was total sampling from the population. The sample obtained was 92 respondents with an age range of 17-19 years based on the inclusion criteria, namely female students who were willing and present at the time of sample collection and who did not have any diseases (TB, worms, blood clotting disorders, cancer, HIV, or diseases that can cause anemia). The difference in the number of populations differed from the sample obtained during sampling because students were absent (sick and on leave).

The research instrument was a questionnaire containing questions to collect data on respondent characteristics including age, body mass index, academic stress level, sleep quality and anemia incidence. Then using the Educational Stress Scale for Adolescents/ESSA questionnaire to measure the level of academic stress consisting of 16 questions with a 5-level

Likert method, namely with a score of (1) strongly disagree, (2) disagree, (3) neutral, (4) agree and (5) strongly agree. and sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), an instrument divided into 19 items to assess seven sleep components. Sleep quality is categorized as poor if the total score obtained is more than 5.

The data collection technique was carried out using a standard questionnaire which was then filled out by respondents, followed by a hemoglobin level examination using a simple measuring tool (Easy Touch GCHb, a portable point-of-care device) by taking capillary blood samples from the fingertips. The collected data were then recorded and classified based on criteria established by the Indonesian Ministry of Health and WHO, then entered into a data collection format as material for processing and compiling into research master data.

Data analysis describes the distribution of each independent variable studied by looking at the percentage of the total data in the study through univariate analysis.

This research analysis was processed using the Chi-Square test. However, because there were cells with an expected frequency of less than 5 in the contingency table for academic stress and anemia (expected count = 1.7), the alternative Fisher's Exact Text test was used for this variable to ensure the validity of the results.

3. Results and Discussion

a. Characteristics

Respondent characteristics include age, BMI (Body Mass Index), Academic Stress, Sleep Quality, and Anemia Incidence.

Table 1. Frequency Distribution of Characteristics of Adolescent Girls

No	Characteristics	f	%
1	Age		
	17 Year	31	33,7
	18 Year	56	60,9
	19 Year	5	5,4

	Total	92	100
2	IMT		
	Normal	76	82,6
	Underweight	12	13
	Overweight	4	4,3
	Total	92	100
3	Academic Stress		
	Mild	12	13
	Moderate	80	87
	Total	92	100
4	Sleep Quality		
	Good	47	51,1
	Bad	45	48,9
	Total	92	100
5	Menstrual Cycle		
	Regular	49	53,3
	Irregular	43	46,7
	Total	92	100
6	Incident of Anemia		
	Anemia	13	14,1
	Not Anemic	79	85,9
	Total	92	100

Source: primary data

Table 1 shows that most of the participants were 18 years old, namely 56 respondents (60.9%), 76 respondents (82.6%) had a normal Body Mass Index, 80 respondents (87%) had moderate academic stress levels, 47 respondents (51.1%) had good sleep quality, 49 respondents (53.3%) had regular menstrual cycles, and 79 respondents (85.9%) were not anemic.

The research results found that 12 respondents (13%) had mild academic stress levels, and 80 respondents (87%) had moderate levels. This indicates that the academic stress experienced by adolescent girls is quite high, which can be triggered by various factors such as high academic grade demands, heavy homework loads, exams, and pressure from parents and the school environment.

Suci's (2024) previous research found that academic stress was quite high among students at an IT high school in Mataram [12]. Another study by Riris (2020) also found that 57.76% of female students experienced stress related to primary dysmenorrhea [13].

Regarding sleep quality, the study found that 51.1% of respondents were classified as having good sleep quality, while 48.9% were in the poor sleep quality category. This figure indicates that nearly half of respondents experience sleep quality issues. Sleep quality is often affected by the habit of sleeping late (staying up late), using gadgets before bed, a heavy schoolwork load, and busy social activities [14].

Research by Julitiana et al. (2025) in Medong Village, Pandeglang Regency, also found that poor sleep quality contributes to the high prevalence of anemia in adolescent girls, with environmental factors and irregular sleep patterns being the main factors. Another study by Rosdiana (2025) in Pekanbaru on female students reported statistical test results that proved a correlation between sleep quality and hemoglobin levels.

b. The Relationship between Academic Stress and Sleep Quality with the Incidence of Anemia

Table 2. Relationship between Academic Stress and Sleep Quality with Academic Events

Variable	Anemia		Total	P- value
	Not Anemic	Anemia		
Academic Stress				
Mild	10 (83,3%)	2 (16,7%)	12	0,819
Moderate	69 (86,3%)	11(13,7%)	80	
Sleep Quality				
Good	41 (87,2%)	6 (12,8%)	47	0,710
Bad	38 (84,4%)	7 (15,6%)	45	

Based on the chi-square test results in Table 2, the academic stress variable had a value of 0.819 and the sleep quality variable had a value of 0.710. To address the limitations of the small cell frequency in the academic stress variable, an alternative Fisher's

exact test was conducted, which showed a p-value of 0.874. All three values were above the significance threshold ($p=0.05$), so no relationship was found between the two variables and the incidence in adolescent girls.

The analysis revealed that in the group of respondents with mild academic stress, 83.3% did not experience anemia, 16.7% had mild anemia, and no respondents had moderate anemia. Meanwhile, in the group with moderate academic stress, the proportion of respondents who were not anemic reached 86.3%, and 13.8% had anemia.

The lack of a significant relationship detected in this study can be explained by several factors: the highly skewed distribution of respondents' stress levels, with 87.0% in the moderate stress category and only 13.0% in the mild stress category. This lack of data variation makes it difficult for statistical tests to detect significant differences. Furthermore, the respondents' adaptive coping mechanisms also play a role. Adolescents with good coping strategies tend to be better able to manage stress, thus minimizing its negative impact on physiological conditions.

The analysis results showed that in the group of respondents with good sleep quality, 87.2% were free from anemia and 12.7% were anemic. Meanwhile, in the group with poor sleep quality, 84.4% were free from anemia and 15.5% were anemic. Although the proportion of anemia appeared higher in the poor sleep quality group, the difference was not statistically significant ($p\text{-value}=0.819>0.05$), therefore it can be concluded that there was no significant relationship between sleep quality and the incidence of anemia at Senior High School 1 Rendang. This conclusion is in line with Umi's (2023) research on female adolescents at Senior High School 2 Wawotobi which also reported no relationship between sleep quality and the incidence of anemia ($p=0.102$).

There are at least three mechanisms linking poor sleep quality to anemia. First, poor sleep quality can trigger chronic inflammation that increases hepcidin production, thereby inhibiting iron absorption and the release of iron from the body's reserves. Second, sleep deprivation can disrupt the secretion of the hormone erythropoietin (EPO), which is involved in red blood cell formation (erythropoiesis). Third, sleep disturbances can also affect appetite and eating patterns, which ultimately impact iron intake [15].

This can be explained by several factors. First, the proportion of respondents with good and poor sleep quality was relatively balanced (51.1% vs. 48.9%), but the low incidence of anemia (14.2%) made the statistical test less sensitive in detecting significant differences. Second, the presence of confounding factors such as iron intake, nutritional status, and physical activity that were not controlled for in the bivariate analysis could have influenced the results. This is in line with Umi's (2023) research with a value ($p=0.102$), meaning no significant relationship was found. Third, insufficient sleep duration may not have lasted long enough or not been severe enough to have a significant impact on hemoglobin status, given that the body has quite good compensatory mechanisms.

4. Conclusion

The prevalence of anemia in this study was relatively low, at 14.1% of the 92 female adolescents studied, while the majority of respondents (82.6%) had normal nutritional status. Statistical analysis showed no significant relationship between academic stress and anemia ($p=0.819$), nor between sleep quality and anemia ($p=0.710$). Therefore, academic stress and sleep quality were not the primary determinants of anemia in this population.

Based on these conclusions, it can be assumed that the causal factors include an unequal distribution of stress levels (87.0% of respondents

experienced moderate academic stress), a low incidence of anemia which may be influenced by other protective factors such as good nutritional status and compliance with iron supplementation tablets, as well as the existence of adaptive coping mechanisms in respondents.

Although stress and sleep quality have not been proven as risk factors, the anemia prevention program at SMA Negeri 1 Rendang should not stop. Ensuring 100% of adolescent girls consistently consume iron supplements weekly, increasing education about iron sources, and implementing stress management programs for teachers and parents remain crucial in supporting adolescent girls' reproductive health. Furthermore, further research is recommended to use a prospective cohort design, increase the sample size, and control for confounding factors such as iron intake and physical activity to obtain a more comprehensive picture.

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