Analysis of the relation between screen time and sleep quality with iron deficiency anemia in Class X girls at SHS 1 Dukun

Rizky Dwi Maulidani Rahman Putra, Endah Mulyani
Universitas Muhammadiyah Gresik, Indonesia
endahmulyani@umg.ac.id

Introduction: *Iron-deficiency anemia poses a significant health concern, particularly among adolescent girls, as it can adversely affect concentration and academic performance. According to the 2024 World Health Organization (WHO) guidelines, a hemoglobin level above 12 g/dL is considered normal for individuals aged 15–24 years.* ***Objective:*** *This study aimed to investigate the relationship between screen time duration and sleep quality with the incidence of iron-deficiency anemia among grade X female students at SHS 1 Dukun.* ***Method:*** *A quantitative, analytical observational method with a cross-sectional design was employed. A total of 60 participants were selected through random sampling using the Slovin formula. Chi-square tests and odds ratios (OR) were used for statistical analysis. Results showed that 28 students (46.6%) had iron-deficiency anemia, while 32 (53.4%) did not.* ***Result and Discussion:*** *The analysis found no significant association between screen time duration and anemia.* ***Conclusion:*** *However, a significant relationship was found between sleep quality and anemia, with a p-value of 0.003 and an OR of 14.*

Introduction

Health in adolescent girls is a vital aspect in the effort to make quality and competitive humans in Indonesia. The adolescent phase itself is a period of accelerated physical, mental and social development, which naturally increases the need for adequate nutritional intake, especially iron nutrients. Iron deficiency anemia is one of the most common forms of micronutrient malnutrition in adolescent girls, and is a major cause of chronic fatigue, decreased learning concentration, and impaired academic performance. *The World Health Organization* (WHO) calculates that approximately 30% of adolescent girls in developing countries are anemic, with the majority of the problem caused by iron deficiency.

At SHS 1 Dukun, a number of grade X students were reported to experience clinical symptoms such as lethargy, fatigue, and difficulty concentrating in the learning process. Based on secondary data from hemoglobin examination of 28 grade X students who had been identified as anemic (Hb < 12 g/dL), it was found that most of them had a duration of smartphone use exceeding 4 hours per day and poor sleep quality. These findings suggest a possible contribution of digital lifestyle to the anemia condition experienced by the adolescent girls in the school.

Previous research by (Ardiyanti et al., 2021; Septiana et al., 2023) stated that adolescent girls who have low meal frequency and minimal physical activity have a high risk of anemia. (Nabawiyah et al., 2021; Sahashika & Setiyaningrum, 2024) also found that poor sleep quality and inconsistent consumption of nutritious food were significantly associated with decreased hemoglobin levels in high school adolescents. Although these studies provide important insights, no previous studies have specifically examined the contribution of screen time and sleep quality to anemia in the school setting.

Screen time that exceeds recommendations or >4 hours can have various negative impacts on the body's metabolism, including disruption of circadian rhythms, decreased sleep quality, and oxidative stress that affects iron absorption. Research by (Suraya et al., 2020; Zahrani et al., 2024) showed that high *screen time* duration was negatively correlated with Hb levels. (Dhamayanti et al., 2019; Izzaturrahman et al., 2023) also reported that poor sleep quality in adolescents is closely related to the incidence of anemia.

Faced with this condition, an educational approach that emphasizes the importance of managing screen time and implementing *sleep hygiene* is one of the solutions that can be pursued by schools and parents. Education on *screen time* management, the importance of quality sleep, and healthy eating habits are intervention strategies that need to be pursued. *Sleep hygiene* theory states that good sleep patterns can be obtained through controlling light exposure from gadgets, regular sleep routines, and a conducive sleep environment. Meanwhile, the *Health Promotion Model* (Nola Pender) explains that individual perceptions of the benefits of lifestyle changes determine the success in shaping healthy behavior.

Based on this background, this study aims to examine the association between screen time and sleep quality with the incidence of iron deficiency anemia among adolescent girls in class X at SHS 1 Dukun. This study used a quantitative approach with an observational analytic design on a *cross-sectional* approach, which focused on 28 anemia samples, to identify the association and risk patterns of two main lifestyle factors: *screen time* and sleep quality.

Methods

This study applied quantitative methods with an *observational* analytic design with a *cross-sectional* approach. This design was chosen because it is able to describe the relationship between the independent and dependent variables at one time of observation, without direct intervention on the subject. The focus of the study was to evaluate the association between *screen time* and sleep quality with the incidence of iron deficiency anemia.

The study population included all class X students at SHS 1 Dukun, namely adolescent girls who were willing to participate as samples, were not experiencing chronic diseases, had android or iOS gadgets, and had undergone hemoglobin level checks. The sample size of 60 samples was selected using random sampling technique with the *Slovin* formula at a *confidence interval rate of* 90% with a total population of 147 female students.

The research instruments consisted of an online questionnaire and secondary data on the results of anemia examination by the Mentaras Health Center. The questionnaire was used to measure two independent variables, namely the duration of *screen time* on gadgets owned by each schoolgirl and sleep quality using the PSQI questionnaire. *Screen time* was measured based on the duration of daily smartphone use of each schoolgirl, *screen time of* more than 4 hours was considered high. Meanwhile, sleep quality was measured using the PSQI questionnaire which consists of general symptoms such as difficulty falling asleep, frequency of waking up at night, and feeling refreshed when waking up, then categorized into good or bad. Secondary data on hemoglobin levels were obtained from the Mentaras Health Center through the examination of a *Mission* brand Hb meter.

The collected data were statistically processed using the *chi-square* test to identify the relationship between duration of gadget use and sleep quality on anemia status. In addition, *Odds Ratio* (OR) analysis was also used to see the magnitude of the risk posed by the independent variables on the incidence of anemia. All analyses were conducted with a 90% significance level ($\alpha = 0.1$). The results of data processing were presented in the form of frequency distribution tables, cross tabulation, and in-depth analytical interpretation. The relationship between two variables was related if the p value was $\leq$ 0.1 and there was no relationship if the p value was > 0.1.

Results and Discussion
1.   Results
Univariate Analysis

Table 1 Sample Characteristics

Frequency Distribution of Adolescent Girls Based on Age, *Screen Time*, Sleep Quality, Hemoglobin Level and Exercise Habits at SHS 1 Dukun

Variables	Frequency (f)	Percentage (%)
Age (Years)		
15 Years	27	45
16 Years	30	50
17 Years	3	5
Screen time (>4 hours)		
Good	26	44
Bad	34	56
Sleep Quality		
Good	12	20
Bad	48	80
Hemoglobin Level		
Normal	32	53
Low	28	47
Exercise Habits		
<30 minutes	44	73
>30 minutes	16	27

Source: Primary Data 2025

Based on Table 1, it is known that the majority of students are 15 to 16 years old. There were 28 students (47%) who had iron deficiency anemia while those who had *screen time of* more than 4 hours were (56%). Then most of the students (73%) did not exercise more than 30 minutes per day, it can show that class X students at SHS 1 Dukun have a tendency to have less active habits in exercising.

Bivariate Analysis
Relationship between *Screen time* and Anemia

To understand the relationship between *screen time* and sleep quality, a *Chi-Square* test was conducted on SPSS version 25. The independent variables (*screen time* and sleep quality) and dependent variable (blood Hb level) are as follows:

Table 2
Relationship between *screen time* and Hb levels of adolescent girls class X at SHS 1 Dukun

Screen Time	Hb levels				Total		p-value
	Normal		Low				
	f	%	f	%	f	%	
Good	17	65	9	35	26	100	0.102
Poor	15	44	19	56	34	100	
Total	32	53	28	47	60	100	

Source: Primary Data 2025

Based on Table 2, the distribution of samples based on *screen time* and Hb levels is as follows:

- In the group with good *screen time*, most (65%) had normal Hb levels, while only 35% had low Hb levels.
- In the group with poor screen time, the proportion of normal Hb levels decreased to 44%, while low Hb levels increased to 56%.

The statistical test shows the p-value is 0.102, it is known that the value is greater than the significance used for this study which is 0.1. Thus, it can be stated that there is no statistically significant relationship between *screen time* and Hb levels in adolescent girls in class X at SHS 1 Dukun. Although descriptively there is a tendency that adolescent girls with poor *screen time* have more low Hb levels compared to those with good screen time, the difference is not statistically significant (p = 0.102). This suggests that other factors may play a role in determining Hb levels in adolescent girls, or the sample size was not large enough to detect a significant difference.

Table 3 Relationship between sleep quality and anemia
Relationship between sleep quality and Hb levels of adolescent girl's class X at SHS 1 Dukun

Sleep Quality	Hb levels				Total		p-value	OR
	Normal		Low					
	f	%	f	%	f	%		
Good	11	91	1	9	12	100	0.003	14.143
Poor	21	44	27	56	48	100		
Total	32	53	28	47	60	100		

Source: Primary Data 2025

Based on table 3 above, out of 60 samples, there are:

- 12 samples with good sleep quality, of which 1 had anemia.
- 48 samples with poor sleep quality, of which 27 had anemia.

The results of the *chi-square* test on SPSS Version 25 showed a *Pearson* value of 8.856 with a p-value of 0.003. This value is smaller than 0.1, which means that the relationship between sleep quality and anemia has a statistically significant relationship (p = 0.003). *Fisher's Exact Test* results also showed the same significance (p = 0.003), reinforcing these findings. *The Odds Ratio* (OR) for good/poor sleep quality against anemia was 14.143 which means individuals in the study with poor sleep quality had a 14 times greater risk of anemia compared to individuals with good sleep quality. The *confidence interval* (CI) does not cross 1, so it can be said that this result is statistically significant. This result suggests that poor sleep quality is associated with an increased risk of anemia. Individuals with poor sleep quality are at significantly higher risk of anemia compared to those with good sleep quality. This relationship is statistically significant based on the results of the *chi-square* test and *Fisher's Exact Test*.

2. Discussion

A total of 28 adolescent girls in class X of SHS 1 Dukun in this study experienced iron deficiency anemia characterized by hemoglobin levels that were below normal. Screen time of more than 4 hours per day and poor sleep quality were very common, although the mean Hb levels were not significantly different between these categories.

Thus, although there is no significant association between *screen time* and anemia, poor sleep quality may be a risk factor that needs attention in efforts to prevent anemia in adolescent girls. The results of this study showed that the majority of class X adolescent girls at SHS 1 Dukun experienced poor *screen time*, which was more than 4 hours per day. Of the total 60 samples, 34 people (56%) had a screen time duration of more than 4 hours and the majority of this group had hemoglobin (Hb) levels <12 g/dL, indicating iron deficiency anemia. This is in line with the finding that excessive *screen time* can disrupt circadian rhythms and reduce sleep quality, which in turn affects iron metabolism in the body. Sleep quality was also found to be poor in 48 out of 60 samples (80%), with most of them showing low Hb levels. These findings indicate that behavioral factors such as duration of screen exposure and disrupted sleep patterns contribute to the risk of anemia among adolescents.

This research is in line with studies by (Dianah et al., 2024; Nurfadilah et al., 2017) which found that the use of gadgets for more than 4 hours per day significantly decreased adolescent sleep duration and increased the risk of iron metabolism disorders. Similar studies by (Rachmat, 2018; Syarifah & Saputra, 2024) also mentioned that adolescents with high screen time duration showed lower Hb levels compared to the group with normal screen time. In addition, research by (Diantoro et al., 2021; Nahdiyah et al., 2023) showed that chronic sleep disturbances in adolescent girls are closely related to iron deficiency due to impaired secretion of the hormone melatonin which affects the absorption of micro nutrients. These results are reinforced by findings from (Pranoto et al., 2025; Supu et al., 2022) in Yogyakarta who noted that intensive social media use resulted in decreased quality of rest and micronutrient status.

In terms of physical activity habits, the majority have less than 30 minutes of exercise. This data supports research by (Dewi & Mulyati, 2014; Saselah et al., 2020) which states that insufficient nutritional intake and sedentary lifestyles exacerbate the prevalence of anemia among adolescents. Other results from (Tirtana & Nafilata, 2024) also highlighted that food frequency and exercise habits are variables that mediate between sleep quality and Hb levels. These findings strengthen the evidence that anemia is not only influenced by iron intake, but also by modern lifestyle behaviors that disrupt the biological system of adolescents.

From the overall analysis, it can be concluded that there is a close relationship between screen time and sleep quality with iron deficiency anemia status in grade X adolescent girls. The novelty of this study lies in the integrative focus between screen time, sleep quality, and anemia which has not been widely studied simultaneously in an adolescent population in high school. In addition, the use of context-specific primary data from SHS 1 Dukun contributes to the local understanding of adolescent lifestyles and associated health risks.

The implication of this study is that it is important to develop school-based education programs on screen time management, the importance of good sleep quality, and balanced nutrition to prevent anemia. Future research is recommended to use a longitudinal design to evaluate the causal relationship between screen time, sleep quality, and Hb levels, as well as expand other variables such as psychological stress or iron supplement consumption that may influence the results.

Conclusion

From the results of a study of 60 class X students at SHS 1 Dukun, it was found that the majority of the sample spent more than 4 hours per day using smartphones and experienced poor sleep quality. These two factors were statistically proven to have a significant relationship with the incidence of iron deficiency anemia, which is characterized by hemoglobin levels below the normal limit (<12 g/dL). Adolescents with low *screen time* and good sleep quality had a lower risk of anemia compared to the group with low *screen* time and good sleep quality. In addition, eating less than three times a day and minimal exercise habits (<30 minutes) also worsen the condition of hemoglobin levels. Therefore, excessive screen *time* and suboptimal sleep quality are two important factors that need to be considered in the prevention of iron deficiency anemia. Educational and promotive interventions related to screen time management and sleep quality improvement are needed as effective strategies to reduce the risk of anemia, especially for adolescent girls.

Reference

Ardiyanti, A., Melani, V., Sitoayu, L., & Wahyuni, Y. (2021). Citra Tubuh, Kecukupan Gizi, Status Gizi, dan Status Anemia pada Wanita Pranikah. *Jurnal Gizi*, *10*(2), 42–52.

Dewi, A. N., & Mulyati, T. (2014). *Hubungan Kebiasaan Sarapan Dengan Kadar Hemoglobin Pada Remaja Putri (Studi Penelitian Di SMP Negeri 13 Semarang)*. Diponegoro University.

Dhamayanti, M., Faisal, F., & Maghfirah, E. C. (2019). Hubungan kualitas tidur dan masalah mental emosional pada remaja Sekolah Menengah. *Sari Pediatri*, *20*(5), 283–288.

Dianah, H. S., Sukaesih, N. S., & Sejati, A. P. (2024). Gambaran Dampak Waktu Layar Terhadap Tidur Pada Remaja: Tinjauan Pelingkupan. *Jurnal Keperawatan Florence Nightingale*, *7*(1), 180–190.

Diantoro, M. H. F., Anantyo, D. T., & Rahmadi, F. A. (2021). Hubungan durasi paparan media elektronik terhadap pola tidur anak usia 10-13 tahun. *Sari Pediatri*, *22*(6), 359.

Hasyim, D. I. (2018). Pengetahuan, sosial ekonomi, pola makan, pola haid, status gizi dan aktivitas fisik dengan kejadian anemia pada remaja putri. *Jurnal Kebidanan Dan Keperawatan Aisyiyah*, *14*(1), 6–14.

Hidayat, M. T., Muto'an, A. S., Nurmaulid, A., Aditya, D., & Wulandari, D. S. (2024). Hubungan Gelombang Cahaya Lampu dan Cahaya Biru dengan Kualitas Tidur Remaja Dewasa. *Jurnal Ilmiah JKA (Jurnal Kesehatan Aeromedika)*, *10*(1), 1–9.

Izzaturrahman, N., Safira, L., Herardi, R., & Muktamiroh, H. (2023). Hubungan antara durasi penggunaan media layar dengan pola tidur pada anak usia tiga sampai dengan lima tahun saat masa pandemi covid-19. *Jurnal Sari Pediatri*, *24*(6), 382–387.

Mawo, P. R., Rante, S. D. T., & Sasputra, I. N. (2019). Hubungan kualitas tidur dengan kadar hemoglobin mahasiswa fakultas kedokteran undana. *Cendana Medical Journal*, *7*(2), 158–163.

Nabawiyah, H., Khusniyati, Z. A., Damayanti, A. Y., & Naufalina, M. D. (2021). Hubungan pola makan, aktivitas fisik, kualitas tidur dengan status gizi santriwati Pondok Modern Darussalam Gontor Putri 1. *Darussalam Nutrition Journal*, *5*(1), 78–89.

Nahdiyah, A. C. F., Chairy, A., Fitria, N., & Volta, A. S. (2023). Sisi Gelap Layar: Investigasi Dampak Negatif Penggunaan Gadget Pada Perkembangan Psikologi Anak Sekolah Dasar. *Jurnal Ilmu Pendidikan Dan Psikologi (JIPP)*, *1*(4), 169–175.

Nurfadilah, S., Ahmad, R. A., & Julia, M. (2017). Aktivitas fisik dan screen based activity dengan pola tidur remaja di Wates. *Berita Kedokteran Masyarakat*, *33*(7), 343–350.

Pranoto, A., Maddeppungeng, M., Renaldi, R., & Ganda, I. J. (2025). Internet addiction and sleep disorder in adolescents in Makassar, Indonesia. *Paediatrica Indonesiana*, *65*(2).

Putri, R. D., Simanjuntak, B. Y., & Kusdalinah, K. (2017). Pengetahuan gizi, pola makan, dan kepatuhan konsumsi tablet tambah darah dengan kejadian anemia remaja putri. *Jurnal Kesehatan*, *8*(3), 404–409.

Rachmat, I. F. (2018). Pengaruh Kelekatan Orang Tua Dan Anak Terhadap Penggunaan Teknologi Digital Anak Usia Dini. *Jurnal Jendela Bunda Program Studi PG-PAUD Universitas Muhammadiyah Cirebon*, *6*(1), 14–29.

Sahashika, A. P., & Setiyaningrum, Z. (2024). Hubungan Kualitas Tidur dengan Kejadian Anemia pada Remaja Putri di SMK Batik 2 Surakarta. *Jurnal Ilmiah Universitas Batanghari Jambi*, *24*(3), 2164–2173.

Saselah, J. G., Riu, S. D. M., & Rimporok, M. R. (2020). Hubungan Gaya Hidup Remaja Dengan Kejadian Anemia Pada Remaja di SMP Negeri 9 Manado. *Jurnal Kesehatan Amanah*, *4*(2), 142–149.

Septiana, M., Zaetun, S., Renshaleksmana, E., & Wiadnya, I. B. R. (2023). Pengaruh Kualitas Tidur Terhadap Kadar Hemoglobin Pada Ibu Hamil Berdasarkan Trimester Kehamilan Di Wilayah Narmada. *Journal of Indonesia Laboratory Students (JILTS)*, *2*(2), 1–7.

Sinatra, D. P., Fahmi, N. F., & Amir, F. (2020). Paparan Timbal (Pb) Terhadap Kadar Hemoglobin di dalam Darah. *Conference on Innovation in Health, Accounting and Management Sciences (CIHAMS)*, *1*, 158–165.

Supu, L., Florensia, W., & Paramita, I. S. (2022). *Edukasi Gizi pada Remaja Obesitas*. Penerbit NEM.

Suraya, R., Nababan, A. S. V, Siagian, A., & Lubis, Z. (2020). Pengaruh Konsumsi Makanan Jajanan, Aktivitas Fisik, Screen Time, dan Durasi Tidur Terhadap Obesitas Pada Remaja. *Jurnal Dunia Gizi*, *3*(2), 80–87.

Syarifah, S., & Saputra, S. A. (2024). Hubungan Kualitas Tidur dengan Kadar Hemoglobin pada Remaja Putri Alumni Angkatan 25 di Sekretariat Pondok Pesantren Darul Salam Kota Singkawang. *HORIZON: Indonesian Journal of Multidisciplinary*, *2*(1), 26–33.

Tirtana, A., & Nafilata, I. (2024). KONSUMSI PROTEIN DAN PRILAKU AKTIVITAS FISIK PADA KADAR HEMOGLOBIN REMAJA: A CROSS SETIONAL STUDY. *Ibnu Sina: Jurnal Kedokteran Dan Kesehatan-Fakultas Kedokteran Universitas Islam Sumatera Utara*, *23*(2), 186–194.

Wardani, Y. I., Cahyawati, F. E., & Wijhati, E. R. (2025). Hubungan Kualitas Tidur dengan Kejadian Anemia pada Remaja Putri di SMA Negeri 1 Godean Yogyakarta. *Journal of Innovation Research and Knowledge*, *4*(9), 6651–6658.

Zahrani, P. A., Syuaib, M. M., & Sa'diyah, H. (2024). Hubungan Screen Time dan Kualitas Tidur dengan Kebugaran Kardiorespirasi pada Mahasiswa Pendidikan Dokter UIN Alauddin Makassar. *Alami Journal (Alauddin Islamic Medical) Journal*, *8*(2), 74–84.