Residence types and anemia determinants among female students at Universitas Negeri Semarang

Tempat tinggal dan faktor-faktor determinan anemia pada mahasiswi Universitas Negeri Semarang

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Abstract

The 2023 Indonesia Health Survey (IHS) data showed that the prevalence of anemia among adolescents aged 15–24 years in Indonesia is 15.5%, with a prevalence of 18% among adolescent girls, which, according to the WHO, is still considered a nutritional problem (>10%). Female university students aged 15–24 years are among the age groups at risk of developing anemia. This study aimed to investigate the association between residence type and factors influencing the risk of anemia among 105 female Universitas Negeri Semarang students. The study used quantitative cross-sectional methods, and the sample was determined using purposive sampling. The chi-square test results (p<0.05) showed a significant relationship between residence (p=0.001), food consumption (Fe p=0.000; protein p=0.000; vitamin C p=0.024), meal frequency (animal protein p=0.000; vegetable protein p= 0.000; vegetables p= 0.000; fruits p= 0.003), menstrual patterns (p=0.002), and knowledge about anemia (p=0.010) with the incidence of anemia. However, no significant association existed between dietary status and anemia (p=0.105) in female students of Universitas Negeri Semarang. The multivariate logistic regression test showed that residence type was the most dominant factor (OR=12.63). In conclusion, anemia prevention should focus on dietary patterns, knowledge, and living conditions as the main factors in the future.

Keywords: Adolescencents, anemia, dietary intake, residence type.

Abstrak

Data Survei Kesehatan Indonesia (SKI) Tahun 2023 menunjukkan prevalensi anemia pada remaja usia 15-24 tahun di Indonesia mencapai 15.5% dengan prevalensi pada remaja putri sebesar 18% dimana menurut WHO masih merupakan masalah gizi (>10%). Mahasiswi yang berada pada usia remaja 15-24 tahun menjadi salah satu usia yang beresiko mengalami anemia. Penelitian ini bertujuan unutk menganalisis hubungan tempat tinggal dan faktor-faktor yang mempengaruhi kejadian anemia pada 105 mahasiswi Universitas Negeri Semarang dengan metode kuantitatif cross-sectional dan teknik purposive sampling. Hasil uji *chi-square* (p<0,05) menunjukkan hubungan signifikan antara tempat tinggal (p=0,001), konsumsi makanan (Fe p=0,000; protein p=0,000; vitamin C p=0,024), frekuensi makan (protein hewani p=0,000; protein nabati p= 0,000; sayuran p= 0,000; buah-buahan p= 0,003), pola menstruasi (p=0,002), serta pengetahuan tentang anemia (p=0,010) dengan kejadian anemia. Namun, tidak ditemukan hubungan signifikan antara status gizi dan anemia (p=0,105) pada mahasiswi Universitas Negeri Semarang. Uji multivariat logistik regresi menunjukkan faktor tempat tinggal merupakan faktor yang paling dominan (OR=12,63). Kesimpulan, pencegahan anemia perlu difokuskan pada pola konsumsi, pengetahuan, dan kondisi tempat tinggal sebagai faktor utama kedepannya.

Kata Kunci: Anemia, konsumsi pangan, remaja, tipe tempat tinggal

Introduction

Anemia is characterized by lower-than-normal hemoglobin levels in the blood. The main causes of anemia are chronic bleeding and nutritional deficiency (Kusudaryati & Prananingrum, 2018). Female students are particularly vulnerable to anemia because of their growth stage and increased dietary requirements (Istawati, 2022). They are a group of late adolescents who easily undergo lifestyle modifications due to busy schedules, often consuming junk food and lacking rest (Rusman, 2018). This transition period is often overlooked, causing health problems, such as anemia (Harahap & Damayanty, 2023).

Anemia remains a global health problem. Based on WHO Nutritional Anemia (2021), the global prevalence of anemia in children aged 6–59 months is 39.8%, while in women of childbearing age (15–49 years), it is 29.9%. In Indonesia, the incidence of anemia in adolescents aged 15–24 years decreased from 26.8% in 2018 (Riskesdas, 2018) to 15.5% in 2023 (Indonesia Health Survey, IHS). Nonetheless, this number is still considered a nutritional problem (>10%) regarding anemia, according to the WHO. The city of Semarang, as part of Central Java Province, has experienced an increase in the incidence of anemia, from 17.4% in 2019 to 29% in 2023 (Dinas Kesehatan Kota Semarang, 2023).

Previous studies have shown that factors affecting anemia in female students include unbalanced nutritional intake, irregular diet, non-breakfast habits, low consumption of vegetables and fruits, and high consumption of fast food (Harahap & Damayanty, 2023). Other variables that lead to anemia include menstruation patterns, dietary conditions, understanding of anemia, and chronic disorders (Rusman, 2018). Abnormal menstrual patterns can cause significant blood loss, which increases the risk of anemia (Yunarsih & Antono, 2017). Nutritional status is also closely related to hemoglobin levels in the blood (Lutfitasari, 2021), while a lack of knowledge about anemia increases the risk of anemia, even if understanding is otherwise good (Harahap, 2018). Chronic diseases, such as kidney disorders and diabetes, also contribute to anemia due to inflammation that inhibits the production of red blood cells (Hadiyanto et al., 2018).

Previous studies regarding the prevalence of anemia among female students in several universities in Semarang City vary significantly, ranging from 36.36% to 71.8% according to different studies (Ambarwati & Pangesti, 2017; Sholichah, 2021; Suhariyati et al., 2020). Other research has also shown that female students who live at home have a 3.53 times greater chance of not experiencing anemia than those who live in boarding houses (Ersila & Prafitri, 2018), as students living in boarding houses tend to have a less nutritious diet than those who live with their families (Rusman, 2018).

This study is novel as it is the first to investigate anemia among female students aged 18–24 at Universitas Negeri Semarang, simultaneously examining five factors: residence, diet, menstrual patterns, nutritional status, and anemia knowledge. This study aimed to determine the relationship between residence and factors that affect the incidence of anemia, especially in female students, who are still considered normal, so that they are often neglected and not handled properly. This study hypothesizes that there is a significant relationship between residence type, dietary intake, menstrual patterns, nutritional status, and knowledge of anemia and the incidence of anemia among female students at Universitas Negeri Semarang.

Methods

This study employed a quantitative observational method with a cross-sectional design conducted at Universitas Negeri Semarang, Semarang City, Central Java, from November 2024 to April 2025. The target population comprised female students aged 18-24 years enrolled at Universitas Negeri Semarang. A purposive sampling technique was used, with inclusion and exclusion criteria implemented to identify eligible participants. The inclusion criteria were as follows: 1) female students of Universitas Negeri Semarang aged 18-24 years; 2) students willing to participate as research subjects; and 3) students willing to complete an offline questionnaire. The exclusion criteria were as follows: 1) female students with a history of chronic disease; 2) female students not present during data collection; and 3) students unable to complete the questionnaire. The sample size, determined using the Lemeshow formula, consisted of 105 female adolescents.

$$n = \frac{z^2 p\,(1-p)}{d^2}$$

Notes:
n = total samble
Z = Z score with 95% confidence interval = 1,96
ά = Alpha (0,10) or sampling error = 10%
p = Maximum estimation = 50% = 0,5
d = Error level

In this study, the independent variables comprised residence type, food consumption, nutritional status, menstrual patterns, and knowledge of anemia, with the incidence of anemia among female students serving as the dependent variable. Data were collected through observations, questionnaires, and interviews, with all respondents participating voluntarily after providing informed consent. Hemoglobin levels, used to determine the incidence of anemia in female students at Universitas Negeri Semarang, were measured using a calibrated Easy Touch GCHb device. Hemoglobin level measurements were recorded and used to determine anemia status based on the World Health Organization (WHO) standard for non-pregnant women aged >15 years, defined as a hemoglobin level <12 g/dL. Four validated questionnaires were utilized: (1) a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) to assess food consumption; (2) a residence questionnaire to gather information on student residence type (boarding house, dormitory, or house); (3) a menstrual pattern questionnaire to collect data on cycles, duration, blood volume, and associated symptoms; and (4) a knowledge of anemia questionnaire to assess understanding of the definition, causes, symptoms, prevention, and iron sources related to anemia. All questionnaires have established validity and reliability.

Univariate analysis was performed to describe the distribution of respondents, with findings presented as frequency distribution tables and graphs and interpreted descriptively. This analysis was conducted for each independent variable: residence type, food consumption, menstrual patterns, nutritional status, and knowledge of anemia. Bivariate analysis using the chi-square test was employed to examine the relationships between independent and dependent variables. Where the assumption of the chi-square test was violated (more than 20% of expected cell counts were less than 5), an alternative statistical test was applied. The relationships between variables were considered statistically significant at p ≤ 0.05.

Multivariate analysis, specifically logistic regression, was conducted to examine the simultaneous effects of multiple independent variables on the likelihood of anemia. This method allowed for the control of potential confounding factors and identification of the most significant predictors of the outcome. Results are presented as odds ratios (OR), where an OR greater than 1 indicates increased odds of anemia associated with the variable and an OR less than 1 indicates decreased odds.

This study was conducted in accordance with the ethical guidelines and received ethical approval (No. 536/KEPK/FK/KLE/2024).

Result and Discussion

Respondent Characteristics

This study describes the frequency distribution of residence relationships and the factors that affect the incidence of anemia in each study respondent, namely, female UNNES students of vulnerable ages (18–24 years).

Table 1. Distribution of research subject characteristics

Category	n	%
Incidence of Anemia		
No Anemia	36	34.3
Anemia	69	65.5
Residence Tyoe		
Not staying on a boarding house	24	22.9
Living on a boarding house	81	77.1
Consumption of Meals		
Fe Intake		
Less	64	61.0
Adequate	41	39.0
Protein Intake		
Less	51	48.6
Adequate	54	51.4
Vitamin C Intake		
Less	45	42.9
Adequate	60	57.1
Frequency of Consumption of Animal Protein		
Less	54	51.4
Good	51	48.6
Frequency of Consumption of Vegetable Protein		
Less	53	50.5
Good	52	49.5

Frequency of Vegetable Consumption		
Less	61	58.1
Good	44	41.9
Frequency of Fruit Consumption		
Less	34	32.4
Good	71	67.6
Menstrual Patterns		
Abnormal	54	51.4
Normal	51	48.6
Nutritional Status		
Underweight	27	25.7
Normal	53	20.5
Overweight	13	12.4
Obesity	12	11.4
Knowledge about Anemia		
Less	15	14.3
Enough	48	45.7
Good	42	40.0

Table 1 shows that most of the respondents (65.5%) had anemia and lived in a boarding house (77.1%). In terms of food consumption, 61.0% of respondents had low iron (Fe) intake, and more than 50% had adequate protein (51.4%) and vitamin C (57.1%) intakes. Based on the frequency of eating, 54 (51.4%) respondents had low animal protein consumption, 53 (50.5%) had low vegetable protein consumption, and 61 (58.1%) had low vegetable consumption frequency, but 71 (67.6%) had good fruit consumption frequency. Regarding nutritional status, 53 (50.5%) respondents had a normal nutritional status. In addition, abnormal menstrual patterns were observed in 54 (51.4%) respondents. The level of knowledge about anemia showed that 48 (45.7%) respondents were in the adequate category.

The Relationship between Residence and the Incidence of Anemia in Female Students of Universitas Negeri Semarang

Table 2. The relationship of residence to the prevelance of anemia in female students of Universitas Negeri Semarang

Residence	Anemia Status				Total		p-value	PR
	No Anemia		Anemia					
	n	%	n	%	n	%		
Not staying on a boarding house	15	62.5	9	37.5	24	100		
Living on a boarding house	21	25.9	60	74.1	81	100	0.001*	4.762
Total	36	34,3	69	65,7	105	100		

*Description: *significant if p-value <0.05; PR (prevalence ratio); n (total respondents).*

Table 2 shows a significant relationship between residence and anemia in female students at Universitas Negeri Semarang. Based on the statistical test, a PR of 4.762 was obtained (CI 95% 1.815-12.499), which means that compared to female students who do not live in a boarding house or at home, students who live in boarding houses have a 4.762 times higher risk of developing anemia. This study's findings are consistent with those of Ersila and Prafitri (2018), who reported a significant relationship between residence and anemia among students of the Diploma in Midwifery Study Program at STIKES Muhammadiyah Pekajangan (p = 0.027). The place where students live—whether with parents or in boarding houses—appears to influence parenting styles and their impact on students' well-being. Similarly, Mulyani and Sadrina (2021) found that students living with their parents tend to achieve higher academically than those living in dormitories or boarding houses. Living at home provides not only educational guidance but also better monitoring of nutritional needs compared to boarding house residents (Akib & Sumarmi, 2017).

This aligns with the findings that students living in boarding houses often have lower nutritional knowledge and face more nutritional problems than those living with their families (Purwandari, 2018). This may be due to selective eating habits aimed at maintaining a slim body or a higher tendency to consume fast food, which is typically calorie-dense but low in essential nutrients, such as fiber, vitamins, calcium, and folate. Such dietary patterns can contribute to various nutritional issues and negatively affect the health of adolescents (Ersila & Prafitri, 2018).

The Relationship between Food Consumption and the Incidence of Anemia in Female Students of Universitas Negeri Semarang

Table 3. The relationship between food consumption and the prevalence of anemia in female students of Universitas Negeri Semarang

Dietary Pattern	Anemia Status				Total		P-value	PR
	No Anemia		Anemia					
	n	%	n	%	n	%		
Fe Intake								
Less	6	9.4	58	90.6	64	100	<0.001*	0.038
Adequate	30	73.3	11	26.8	41	100		
Protein Intake								
Less	1	2.0	50	98.0	51	100	<0.001*	0.011
Adequate	35	18.5	19	35.2	54	100		
Vitamin C Intake							0.024*	0.374
Less	10	22.2	35	77.8	45	100		
Adequate	26	43.3	34	39.4	60	100		
Frequency of Animal Protein							<0.001*	0.066
Less	5	9.3	49	90.7	54	100		
Good	31	60.8	20	39.2	51	100		
Frequency of Vegetable Protein							<0.0011*	0.094
Less	6	11.3	47	88.7	53	100		
Good	30	57.7	22	42.3	52	100		
Vegetable Frequency							<0.001*	0.026
Less	4	6.6	57	93.4	61	100		
Good	32	72.7	12	27.3	44	100		
Fruit Frequency							0.003*	0.222
Less	5	14.7	29	85.3	34	100		
Good	31	43.7	40	56.3	71	100		

*Description: *significant if p-value <0.05; PR (prevalence ratio); n (total respondents)*

The results of this study indicated a significant association between iron (Fe) intake and anemia incidence among female students at Universitas Negeri Semarang (p = 0.000; Table 3). The prevalence ratio (PR = 0.038; 95% CI: 0.013–0.113) suggested that inadequate Fe intake elevated the risk of anemia; however, this factor did not demonstrate statistical significance as a protective factor. These findings are consistent with those of Saputri & Noerfitri (2022), who reported a significant association between Fe intake and anemia in new students of STIKes Mitra, underscoring the critical role of iron in hemoglobin formation. Conversely, Mulyanah and Rini (2023) found no relationship between Fe intake and anemia among nutrition students at the Aceh Ministry of Health Polytechnic (p = 0.629), potentially attributable to confounding factors such as chronic disease and consumption of non-heme iron sources, compounded by dietary habits such as tea consumption, which inhibits iron absorption (Budianto & Fadhilah, 2022; Saputri & Noerfitri, 2022).

Protein intake was also significantly associated with anemia, with low protein consumption correlating with a higher risk of anemia (p = 0.000), although PR values did not indicate it as a significant protective factor. This result aligns with those of Annisa et al. (2024) and Thamrin & Masnilawati (2021), who demonstrated strong associations between low protein intake and anemia. Mulyani & Sadrina (2021) further elucidated that protein deficiency impairs iron transport and absorption, leading to reduced hemoglobin levels. Despite adequate protein intake among some respondents, anemia persisted, likely due to concurrent low iron and vitamin C consumption and the intake of tannin-containing beverages, such as tea and coffee, which impede nutrient absorption.

Vitamin C intake and the frequency of vegetable and fruit consumption were significantly associated with anemia incidence (p = 0.024, 0.000, and 0.003, respectively). Although not statistically significant as protective factors

based on PR values, inadequate intake increased the risk of anemia. Vitamin C enhances iron absorption by reducing ferric iron to the more absorbable ferrous form, particularly in acidic conditions (Kusudaryati & Prananingrum, 2018). These findings are consistent with those of Alfiah and Dainy (2023), who identified a significant relationship between vitamin C intake and anemia among adolescent girls. However, this study revealed a low frequency of fruit consumption and selective vegetable intake among respondents, limiting their vitamin C intake. Furthermore, dietary habits characterized by low diversity and a preference for snacks over nutrient-rich foods, including the avoidance of animal protein sources such as liver and red meat, contribute to insufficient iron and vitamin C intake (Mulyanah & Rini, 2023). Overall, these findings underscore the complex interplay of dietary factors—iron, protein, and vitamin C intake—in the incidence of anemia among female university students, emphasizing the need for improved nutritional education and dietary practices to mitigate the risk of anemia.

Factors related to the incidence of anemia in female students at Semarang State University

Table 4. Factors related to the prevalence of anemia in female students of Universitas Negeri Semarang

Variable	Anemia Status				Total		p-value	PR
	No Anemia		Anemia					
	n	%	n	%	n	%		
Menstrual Patterns								
Abnormal	11	20.4	43	79.6	54	100	0.002*	0.266
Normal	25	49.0	26	51.0	51	100		
Nutritional Status								
Underweight	6	22.2	21	77.8	27	100	0.105**	0.718
Normal	19	35.8	34	64.2	53	100		
Overweight	6	46.2	7	53.8	13	100		
Obesity	5	41.7	7	58.3	12	100		
Knowledge about Anemia								
Less	0	0.0	15	1.00	15	100	0.010*	0.478
Enough	19	39.6	29	60.4	48	100		
Good	17	40.5	25	59.5	42	100		

*Description: *significant if p-value <0.05; PR (prevalence ratio); n (total respondents).*

The Relationship between Menstrual Patterns and the Incidence of Anemia in Female Students of Universitas Negeri Semarang

Table 4 demonstrates a statistically significant association between menstrual patterns and the incidence of anemia among female students at Universitas Negeri Semarang (χ^2 test, p = 0.002). The prevalence ratio (PR = 0.266; 95% CI: 0.113–0.629) indicated a significantly increased risk of anemia associated with abnormal menstrual patterns. These findings align with previous research, including studies by Suhariyati et al. (2020) and Sriningrat et al. (2019), who reported significant associations between menstrual irregularities and anemia incidence in similar populations. Menstrual patterns are influenced by various factors, including hormonal imbalance, systemic disorders, stress, and nutritional status (Cakir et al., 2017; Wiknjosastro, 2022; Zanah et al., 2024). For example, Cakir et al. (2017) reported that 31.2% of adolescents in Turkey experienced irregular menstruation, largely due to hormonal disturbances. Furthermore, nutritional status affects steroid hormone levels, which regulate menstruation, thereby establishing a link between menstrual health and the risk of anemia.

In this study, 54 respondents presented with abnormal menstrual patterns, and 79.6% of them experienced anemia. This observation supports the assertion by Hapzah (2018) and Rahmawati and Sutrisminah (2024) that abnormal menstruation can result in excessive blood loss, leading to reduced red blood cell counts and a subsequent increase in the risk of anemia among adolescent females. The extended duration and increased volume of menstrual bleeding associated with abnormal cycles further elevate this risk, emphasizing the importance of menstrual health management for anemia prevention.

The Relationship between Nutritional Status and the Incidence of Anemia in Female Students of Universitas Negeri Semarang

Table 4 indicates a significant relationship between menstrual patterns and the incidence of anemia among female students at Universitas Negeri Semarang (χ^2 test, p = 0.002, <0.05). The prevalence ratio (PR = 0.266; 95% CI: 0.113–0.629) suggests that abnormal menstrual patterns are associated with a 0.266 times increased risk of anemia compared to normal menstrual cycles; however, this factor did not reach statistical significance as a protective factor.

In contrast, nutritional status based on the BMI-for-age (BMI/U) indicator did not show a significant relationship with anemia in this study. Nutritional status is primarily influenced by macronutrient intake (carbohydrates, fats, and proteins), which serves as the primary energy source for the body. Insufficient energy intake can negatively impact nutritional status, whereas a balanced intake can maintain it. Conversely, excessive energy intake or physical inactivity can lead to obesity. Micronutrients, such as vitamins and minerals, have a minimal impact on BMI/U due to their limited contribution to energy intake, and deficiencies typically develop over extended periods. This study observed relatively adequate micronutrient intake, including vitamin C and iron (Wati & Fitriahadi, 2020).

These findings diverge from those of Lutfitasari (2021), who reported a significant association between poor nutritional status and an increased anemia risk among female students. This discrepancy may be attributable to other dominant factors influencing anemia incidence in the present study, such as menstrual patterns, iron and vitamin C consumption habits, and access to bioavailable-iron sources. Furthermore, differences in measurement methodologies, nutritional awareness, supplement utilization, and adherence to healthy lifestyle practices may mitigate the risk of anemia despite a suboptimal nutritional status.

The Relationship between Knowledge and the Incidence of Anemia in Female Students of Universitas Negeri Semarang

Table 4 presents the results of the chi-square test, demonstrating a significant relationship between knowledge of anemia and its incidence among female students at Universitas Negeri Semarang (p = 0.010). The prevalence ratio (PR = 0.478) suggests that adequate knowledge of anemia serves as a protective factor, reducing the risk of anemia by approximately 52%, although this association did not achieve statistical significance. This finding is consistent with that of Budianto and Fadhilah (2022), who also reported a significant relationship between knowledge of anemia and incidence of anemia among adolescent girls (p = 0.002). Knowledge of anemia encompasses an understanding of its causes, symptoms, risk factors, and management strategies, which are crucial for preventing anemia and alleviating symptoms such as impaired concentration, fatigue, and dizziness (Thamrin & Masnilawati, 2021).

Furthermore, knowledge about anemia influences the nutritional behaviors essential for anemia prevention. Supporting this, Ngatu and Rochmawati (2018) found a significant association between knowledge of anemia and the fulfillment of nutritional needs among female students (p = 0.007). This suggests that enhanced awareness can positively impact dietary practices, contributing to improved anemia outcomes.

Multivariate Analysis of Dominant Predictors of Anemia Risk Among Female Students

From the bivariate analysis, 11 variables with a p-value <0.25 were included as candidates in the multivariate analysis. Logistic regression using the enter method, following the elimination of non-significant variables, identified residence, iron intake, protein intake, and menstrual patterns as significant variables. Residence was the most dominant variable (p = 0.020; OR = 12.463) (Table 5), indicating that students residing in boarding houses had a 12-fold higher risk of anemia than those not residing in dormitories.

Table 5. Multivariate test results

Variable	P-value	Exp (B) OR	95%α	
			Lower	Upper
Residence Type Consumption of Meals	0.020	12.463	1.486	104.503
Fe Intake	0.001	0.037	0.006	0.215
Protein Intake	0.001	0.013	0.001	0.146

Menstrual Patterns	0.025	0.143	0.025	0.802

Multivariate analysis revealed that residence was the primary determinant of anemia incidence among female students at Universitas Negeri Semarang, with an odds ratio (OR) of 12.463 (Table 5). This suggests that students residing in boarding houses are 12 times more likely to develop anemia than those living with their families. Residence significantly impacts the risk of anemia through its influence on dietary practices, access to nutritious food, and lifestyle factors. Students in boarding houses or dormitories often encounter restricted cooking facilities, limited food quality control, and demanding schedules that may result in missed meals or dependence on convenience foods (Purwandari, 2018). Moreover, living apart from family can diminish social support for maintaining balanced nutrition, thereby increasing susceptibility to iron and other nutrient deficiencies. Thus, residence is not simply a physical location but is intrinsically linked to eating behaviors and health outcomes, including anemia risk, among female students (Ersila & Prafitri, 2018).

A key strength of this study lies in the control of potential confounding variables during the analysis, which strengthens the validity of the observed associations. Furthermore, conducting research within a specific institutional setting enabled a more focused evaluation of the student population, yielding contextually relevant findings for targeted interventions. However, this study has certain limitations. The cross-sectional design precludes the establishment of causal relationships between the variables. Additionally, the employment of purposive sampling introduces potential selection bias, which may constrain the generalizability of the results to a wider student population.

Conclusion

This study demonstrated a significant association between residence, dietary intake, menstrual patterns, and knowledge of anemia and the incidence of anemia among female students at the Universitas Negeri Semarang. Students residing in boarding houses exhibited a notably higher risk, highlighting the influence of living arrangements on dietary habits and nutritional adequacy of the diet. Regular menstrual patterns and knowledge of anemia served as protective factors, whereas inadequate consumption of iron, protein, and vitamin C increased the risk of anemia. However, nutritional status was not significantly associated with the incidence of anemia. These findings underscore the importance of targeted interventions within the student population, particularly for those living away from home, to promote balanced diets, adequate micronutrient intake, and anemia prevention. Students should adhere to balanced dietary guidelines, avoid consuming iron absorption inhibitors during meals, and monitor their menstrual patterns to prevent anemia. Health institutions should provide nutrition education, and future studies should employ larger sample sizes and explore additional variables related to anemia.

Acknowledgments

References

Akib, A., & Sumarmi, S. (2017). Kebiasaan Makan Remaja Putri Yang Berhubungan Dengan Anemia: Kajian Positive Deviance Food Consumption Habits Of Female Adolescents Related To Anemia: A Positive Deviance Approach. *Amerta Nutrition*, *1*(2), 105–116.

Alfiah, S., & Dainy, N. C. (2023). Asupan Zat Besi, Vitamin C Dan Konsumsi Tablet Tambah Darah Berhubungan Dengan Kejadian Anemia Remaja Putri Smpit Majmaul Bahrain Bogor. *Jurnal Ilmu Gizi Dan Dietetik*, *2*(2), 103–108.

Ambarwati, D., & Pangesti, W. D. (2017). Analisis

Faktor Yang Mempengaruhi Kejadian Anemia Mahasiswa Diii Kebidanan Universitas Muhammadiyah Purwokerto. *Jurnal Smart Kebidanan Stikes Karya Husada Semarang*, *4*(2).

Annisa, R., Skripsiana, N. S., Muthmainah, N., Juhairina, J., & Heriyani, F. (2024). Hubungan Tingkat Konsumsi Protein, Zat Besi, Dan Asam Folat Dengan Kejadian Anemia Pada Mahasiswi Pskps Fakultas Kedokteran Ulm. *Homeostasis*, *7*(1), 179–192.

Budianto, A., & Fadhilah, N. (2022). Anemia Pada Remaja Putri Dipengaruhi Oleh Tingkat Pengetahuan Tentang Anemia. *Jurnal Ilmiah Kesehatan*, *5*(10).

Cakir, M., Mungan, I., Karakas, T., Girisken, I., & Okten, A. (2017). Menstrual Pattern And Common Menstrual Disorders Among University Students In Turkey. *Pediatrics International*, *49*(6), 938–942.

Dinas Kesehatan Kota Semarang. (2023). *Profil Kesehatan Kota Semarang Tahun 2023*. Dinas Kesehatan Kota Semarang. Https://Dinkes.Semarangkota.Go.Id/Content/Menu/7

Ersila, W., & Prafitri, L. D. (2018). Hubungan Tempat Tinggal Dan Motivasi Konsumsi Zat Besi Dengan Kadar Hemoglobin Pada Mahasiswa Kebidanan Stikes Muhammadiyah Pekajangan Pekalongan. *Jurnal Kebidanan Indonesia*, *8*(1).

Hadiyanto, J. N., Gracia, M., Cahyadi, A., & Steffanus, M. (2018). Anemia Penyakit Kronis. *Journal Of The Indonesian Medical Association*, *68*(10), 443–450.

Hapzah, Y. R. (2018). Hubungan Tingkat Pengetahuan Dan Status Gizi Terhadap Kejadian Anemia Remaja Putri. *J. Media Gizi Pangan*, *13*(1).

Harahap. (2018). Faktor-Faktor Yang Berhubungan Dengan Kejadian Anemia Pada Remaja Putri. *Nursing Arts*, *12*(2), 78–90.

Harahap, & Damayanty. (2023). Hubungan Pola Makan Dan Indeks Massa Tubuh Dengan Kejadian Anemia. *Jurnal Kedokteran Dan Kesehatan: Publikasi Ilmiah Fakultas Kedokteran Universitas Sriwijaya*, *10*(3), 309–316.

Istawati, R. (2022). Analisis Faktor-Faktor Yang Berhubungan Dengan Kejadian Anemia Pada Mahasiswa Akbid Helvetia Pekanbaru Tahun 2021. *Jurnal Endurance*, *7*(1), 48–57.

Kusudaryati, D. P. D., & Prananingrum, R. (2018). Hubungan Asupan Protein Dan Status Gizi Dengan Kadar Hemoglobin Pada Remaja Putri Anemia. *Profesi (Profesional Islam): Media Publikasi Penelitian*, *16*(1), 47–52.

Lutfitasari, A. (2021). Hubungan Status Gizi Dengan Status Anemia Pada Mahasiswa Putri. *Jurnal Kebidanan*, *10*(1), 51–60.

Mulyanah, S., & Rini, A. S. (2023). Hubungan Mobilisasi Dini, Nutrisi Dan Peran Bidan Terhadap Penyembuhan Luka Operasi Sectio Caesarea Di Rsud Malingping Tahun 2022: Relationship Of Early Mobilization, Nutrition And The Role Of Midwives In Wound Healing For Sectio Caesarea Operations At Malingping Hospital In 2022. *Open Access Jakarta Journal Of Health Sciences*, *2*(4), 665–673.

Mulyani, N. S., & Sadrina, C. N. (2021). Asupan Protein, Zat Besi, Dan Vitamin C Dengan Kejadian Anemia Pada Mahasiswi Gizi Poltekkes Kemenkes Aceh. *Jurnal Gizido*, *13*(1 Mei), 33–41.

Ngatu, E. R., & Rochmawati, L. (2018). Hubungan Pengetahuan Tentang Anemia Pada Remaja Dengan Pemenuhan Kebutuhan Zat Besi Pada Siswi Smkn 4 Yogyakarta. *Jurnal Kebidanan Indonesia*, *6*(1).

Purwandari, E. S. (2018). Perbandingan Kejadian Anemia Pada Remaja Putri Yang Tinggal Di Pondok Pesantren Dan Di Rumah Di Madrasah Aliyah Pondok Pesantren Darussalam Kepung Kediri: Comparison Anemia In Adolescent Girls Who Stay At Pondok Pesantren And At Home In Madrasah Aliyah Pondok Pesantren Darussalam Kepung Kediri. *Jurnal Ilmiah Kebidanan (Scientific Journal Of Midwifery)*, *4*(2), 114–119.

Rahmawati, & Sutrisminah, E. (2024). Pola Menstruasi Dan Status Gizi Dengan Kejadian Anemia Pada Remaja Putri: Menstrual Patterns And Nutritional Status With The Incidence Of Anemia In Young Women. *Jurnal Ilmiah Kebidanan Dan Kesehatan (Jibi)*, *2*(1), 22–30.

Riskesdas. 2018. *Prevalensi Anemia Menurut Karakteristik*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan.

Rusman, A. D. P. (2018). Pola Makan Dan Kejadian Anemia Pada Mahasiswi Yang Tinggal Di Kos-Kosan. *Jurnal Ilmiah Manusia Dan Kesehatan*, *1*(2), 144–151.

Saputri, M. D., & Noerfitri, N. (2022). Hubungan Antara Pengetahuan, Sikap, Perilaku Terkait Anemia Dan Asupan Zat Besi Dengan Kejadian Anemia Pada Mahasiswi Baru Stikes Mitra Keluarga. *Jurnal Penelitian Kesehatan" Suara Forikes"(Journal Of Health Research" Forikes Voice")*, *13*(2), 349–352.

Sholichah, F. (2021). Tingkat Kecukupan Gizi, Status Gizi, Dan Status Anemia Mahasiswa Penghafal Al Quran Di Uin Walisongo Semarang. *Journal Of Nutrition College*, *10*(1), 62–71.

Sriningrat, I., Yuliyatni, P. C. D., & Ani, L. S. (2019). Prevalensi Anemia Pada Remaja Putri Di Kota Denpasar. *E-Jurnal Medika*, *8*(2), 1–6.

Suhariyati, Rahmawati, A., & Realita, F. (2020a). Hubungan Antara Pola Menstruasi Dengan Kejadian Anemia Pada Mahasiswi Prodi Sarjana Kebidanan Unissula Semarang. *Jurnal Akademika Baiturrahim Jambi*, *9*(2), 195–203.

Suhariyati, S., Rahmawati, A., & Realita, F. (2020b). Hubungan Antara Pola Menstruasi Dengan Kejadian Anemia Pada Mahasiswi Prodi Sarjana Kebidanan Unissula Semarang. *Jurnal Akademika Baiturrahim Jambi*, *9*(2), 195–203.

Thamrin, H., & Masnilawati, A. (2021). Hubungan Antara Pengetahuan, Tingkat Konsumsi Protein, Zat Besi, Dan Vitamin C Dengan Kadar Hemoglobin Pada Mahasiswi Kebidanan. *Jurnal Penelitian Kesehatan Suara Forikes*, *12*(1), 30–33.

Wati, N. N., & Fitriahadi, E. (2020). Status Gizi Dan Status Kehamilan Mempengaruhi Kejadian Anemia Calon Pengantin Di Puskesmas Wilayah Sleman Yogyakarta. *Prosiding University Research Colloquium*, 279–284.

Who Nutritional Anaemias. (2021). Tools For Effective Prevention And Control. *World Health Organization: Geneva, Switzerland*, 1–83.

Wiknjosastro, H. (2022). Ilmu Kebidanan Edisi Ketiga Cetakan Ketujuh. *Jakarta: Yayasan Bina Pustaka Sarwono Prawirohardjo*.

Yunarsih, Y., & Antono, S. D. (2017). Hubungan Pola Menstruasi Dengan Kejadian Anemia Pada Remaja Putri Kelas Vii Smpn 6 Kediri. *Jurnal Ilmu Kesehatan*, *3*(1), 25–33.

Zanah, I. N., Choeriyah, Y., & Safitri, A. (2024). Hubungan Tingkat Kecemasan Dan Status Gizi Dengan Siklus Menstruasi Pada Remaja Putri Di Smk Negeri 9 Kota Tangerang. *Medic Nutricia: Jurnal Ilmu Kesehatan*, *7*(5), 61–70.