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Analysis of the relationship between anemia knowledge and menu acceptability on hemoglobin levels among female students at Dar El Hikmah Islamic Boarding School, Pekanbaru: A Cross-Sectional Study

Analisis hubungan pengetahuan anemia dan daya terima menu terhadap kadar hemoglobin santri putri di Pesantren Dar El Hikmah Pekanbaru: Studi cross-sectional

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Abstract

Anemia is a common health issue among adolescent girls, including female students at boarding schools, and it was found that the prevalence of anemia in one boarding school in Indonesia was 38%. Anemia is indicated by low hemoglobin levels caused by insufficient intake of iron and other nutrients. This study aimed to analyze the correlation between anemia knowledge, menu acceptability, and nutrient intake and hemoglobin levels in female students. This study used a cross-sectional design conducted at Dar El Hikmah Islamic Boarding School Pekanbaru, with a total of 105 female MA students who were selected purposively based on inclusion and exclusion criteria. Data were collected from November to December 2024. Anemia knowledge was measured using a questionnaire, menu acceptability estimated by leftover food, nutrient intake obtained from 2 × 24 h food recall, and hemoglobin (Hb) level measured using easy touch GCHb. Data were analyzed using the rank-Spearman test. The results showed that most subjects (53,3%) had anemia or Hb levels <12 g/dL. There was a significant negative correlation between the acceptability of the breakfast menu (r=−0,366; p=<0,001), lunch (r=−0,445; p=<0,001), and dinner (r=−0,516; p=<0,001), and a positive correlation between anemia knowledge (r=0,254; p=0,009); protein (r=0,235; p=0,019), iron (r=0,200; p=0,040), vitamin C (r=0,349; p=<0,001), vitamin B9 (r=0,471; p=<0,001), and vitamin B12 intake (r=0,221; p=0,023) with Hb level. In conclusion, knowledge is needed to prevent anemia, and the quality of school menus must be improved to increase acceptance and nutrient intake.

Keywords: Anemia knowledge, hemoglobin levels, menu acceptance, nutrient intake,

Abstrak

Anemia merupakan masalah kesehatan yang sering dialami oleh remaja putri, termasuk santri putri di pesantren, ditemukan prevalensi anemia di salah satu pesantren di Indonesia mencapai 38%. Anemia ditandai dengan rendahnya kadar hemoglobin disebabkan oleh ketidakcukupan asupan gizi besi dan zat gizi lainnya. Penelitian bertujuan untuk menganalisis hubungan pengetahuan anemia dan daya terima menu serta asupan gizi terhadap kadar hemoglobin santri putri. Penelitian ini menggunakan desain cross sectional yang dilakukan di Pesantren Dar El Hikmah Pekanbaru, total subjek 105 remaja putri siswa MA yang dipilih secara *purposive* berdasarkan kriteria inklusi dan eksklusi. Data diambil pada bulan November-Desember 2024. Pengetahuan anemia diukur menggunakan kuesioner, daya terima menu diestimasi dari sisa makanan, asupan zat gizi diperoleh dari food recall 2 × 24 jam dan kadar hemoglobin diukur menggunakan *easy touch* GCHb. Data dianalisis dengan uji *Rank-Spearman*. Hasil penelitian menunjukkan bahwa

sebagian besar subjek (53,3%) mengalami anemia atau kadar hemoglobin (Hb) <12 g/dL. Terdapat hubungan negative signifikan pada daya terima menu sarapan (r=−0,366; p=<0,001), makan siang (r=−0,445; p=<0,001), dan menu makan malam (r=−0,516; p= <0,001); dan terdapat hubungan positif siginifikan pada pengetahuan anemia (r=0,254; p=0,009); asupan protein (r=0,235; p=0,019), zat besi (r=0,200; p=0,040), vitamin C (r=0,349; p=<0,001), vitamin B9 (r=0,471; p=<0,001), dan vitamin B12 (r=0,221; p=0,023) terhadap kadar Hb. Kesimpulan, pentingnya pengetahuan untuk mencegah anemia, dan kualitas menu sekolah harus ditingkatkan untuk meningkatkan penerimaan dan meningkatkan asupan gizi santri

Kata Kunci: Asupan gizi, daya terima menu, kadar hemoglobin, pengetahuan anemia

Introduction

Anemia affects one-third of the world's population and contributes to increased morbidity and mortality (NHLBI, 2021). Young women are at a higher risk of anemia because they are still in the period of growth and development in addition to menstruation (Krishnan et al., 2021). Anemia occurs when the hemoglobin concentration is lower than normal, causing an inability to deliver sufficient oxygen to the body's tissues. The normal hemoglobin (Hb) concentration in adolescent girls is ≥12 g/dL (Stauder et al., 2018). Adolescence is an important period for addressing dietary issues. Poor nutrition during adolescence can also influence future dietary preferences and habits (Kljusurić et al. 2016). Adolescent girls are at a high risk of anemia owing to the high requirement for iron during puberty and loss of iron during menstruation (Habib et al., 2020).

There was an increase in the prevalence of anemia among adolescent girls from 2013 to 2018, with the prevalence increased from 23,9% in 2013 to 27,2% in 2018 (MoH, 2019) In 2019, 29,9% of women worldwide suffered from anemia, with the highest prevalence still found in Southeast Asia at 35%, while the prevalence of anemia in Indonesia in 2019 was 31,2% (WHO, 2022). The incidence of anemia among adolescents in Riau Province has reached 44% (MoH 2019).

According to a report from the Ministry of Religious, the number of students in Indonesia in the 2020/2021 academic year reached 4,37 million, of which 3,85 million lived in Islamic boarding schools. Therefore, students living in boarding school groups need special attention when dealing with nutritional problems among adolescents (MoR 2023). Female students in boarding schools suffer from chronic energy deficiency, a serious nutritional problem (Naufalina et al., 2023).

Research in several boarding schools has shown a high prevalence of anemia. The prevalence of anemia in one boarding school in Bogor with mild anemia was 38,1%, and 20,2% had moderate anemia (Ekayanti et al., 2020), in Tasikmalaya 22,2% (Rahfiludin et al., 2021), in Semarang 17,3% (Utami et al., 2022), in Banten 27,4% (Handini, 2023), and in Bogor in 2022 it was 21,7% (Rimbawan et al., 2023). According to the WHO, anemia prevalence of 5,0-19,9% is considered a mild problem, 20-39,9% is considered a moderate problem, and above 40% is considered a severe public health problem (WHO, 2015).

The main factors leading to anemia among adolescents are insufficient consumption of nutrients, particularly iron, and deficiencies in other substances that support iron absorption, such as vitamin C and proteins (Kassebaum et al., 2019). Students living in boarding schools are at risk of nutritional problems, mainly because they are generally in the adolescent stage of physical growth and change, as well as dense academic and religious activities every day; therefore, they need adequate nutritional intake to maintain their health (Amalia et al., 2023). Food quality is one of the challenges related to boarding schools. Many students living in boarding schools expressed that the quality of the food provided by the school was poor, insufficient, or unbalanced. This situation results in students leaving food behind more often, skipping meals, and skipping some foods, which makes them more likely to experience nutrient deficiencies and makes them vulnerable to nutritional problems (Ekanah et al., 2017).

Low food acceptance can lead to underconsumption of essential nutrients, which can lead to nutritional deficiencies and impair physical and cognitive development. When foods offered, such as those at school, are unpopular or unappealing to adolescents, they tend to

avoid them, which contributes to nutrient gaps and food waste, and can exacerbate nutritional problems such as anemia, chronic energy deficiencies, or even obesity due to an unbalanced diet (Yani et al., 2023; Santana et al., 2023).

Lack of knowledge about anemia is also a major cause of nutritional problems, which can hinder efforts to prevent and manage anemia effectively. Lack of understanding of anemia, including its causes, prevention, and management, results in fewer health-promoting practices and attitudes, ultimately contributing to increased morbidity and mortality rates among women (Jalambo et al., 2017; Rahmad, 2023). Adolescents with a good understanding of anemia are more likely to engage in preventive behaviors such as increasing iron intake and maintaining nutritional balance through a healthy iron-rich diet (Benfo et al., 2023).

Adolescents with higher levels of nutritional knowledge have a positive impact on iron intake and overall health, and a lack of knowledge about the importance of iron-rich foods is associated with an increased risk of anemia (Wiafe et al., 2021). Anemia has a significant impact on adolescent girls, affecting their physical health, cognitive functioning, and overall quality of life. This condition can lead to various complications including impaired learning, decreased physical fitness, and increased susceptibility to infection (Ghimire et al., 2024). Previous studies have shown that anemia among boarding school students is a complex problem influenced by various factors. Some studies also identified the importance of social environment, clean and healthy living behaviors (Amalia et al., 2023), and the availability of health information and facilities (Panyuluh et al., 2018),

However, many studies only focus on individual aspects of students, such as nutrient status, diet, food intake (Ekayanti et al., 2020), and anemia knowledge (Utami et al., 2022), without considering food quality, food organization, and menu acceptance, which should be directly linked to anemia incidence. Research suggests that food acceptance, as evidenced by leftovers, can lead to low food consumption and suboptimal nutrient intake (Smolnikova et al. 2020). Research on anemia knowledge, menu acceptability (food leftovers and satisfaction), and nutrient intake has not been explored much, especially in the context of students attending Islamic boarding schools. Low food acceptance can reduce nutrient intake, especially iron, which in turn has the potential to reduce hemoglobin levels; therefore, this study aimed to determine the relationship between anemia knowledge, menu acceptability, and nutrient intake and hemoglobin levels.

Methods

This research used a cross-sectional study was conducted at the Pekanbaru Dar El Hikmah Islamic Boarding School. Data were collected from November to December 2024. The selection of the research site was carried out purposively on the basis that the boarding school has a large population of students compared to other boarding schools in this region, which allows representative sampling to obtain a more accurate picture of the prevalence of anemia among students. In addition, the prevalence of anemia in Riau Province is relatively high (44%) (MoH 2019).

The population in this study was female students in grades 10 and 11 of the high school level who were selected by purposive sampling. The calculation of the minimum sample size was based on the calculation formula of Lemeshow and David (1997), using the proportion of anemia in Riau Province in 2018, which was 44%; thus, the total minimum sample was 95 (Lemeshow & David, 1997), and a 10% dropout calculation was added to obtain a total of 105 samples. The inclusion criteria used in this study were adolescent girls who lived in a dormitory/boarding school for at least 1 year, did not undergo blood transfusions and blood donations in the previous month, did not suffer from chronic diseases that could affect hemoglobin levels (tuberculosis, dengue fever, malaria, and typhoid), and agreed to participate in the study. The exclusion criteria in this study were subjects who were unable to attend the time of data collection to ensure that the data collected were more accurate.

The data collected in this study included demographic data (class, age, menstrual cycle, and nutritional status [body mass index (BMI) for age], anemia knowledge, menu acceptability, nutritional intake, and Hb levels. Demographic data in the form of class, age, and menstrual cycle were collected by interviewing and filling out questionnaires, while body weight data were obtained from direct measurements using a

digital weighing scale with an accuracy of 0,1 kg, and measured twice. Height was measured twice using a microtoise with an accuracy of 0,1 cm, the measurement was carried out twice.

Data on anemia knowledge were obtained using a questionnaire that consisted of 30 presentations of true or false questions containing descriptions, signs and symptoms, risk factors, impacts, and food sources of iron (Utami et al., 2022). The results of nutritional knowledge into 3, namely less score <60, enough score 60-80 and good score >80 (Khomsan, 2021). The anemia knowledge questionnaire used was tested for validity and reliability by the researchers, with the results showing validity and reliability (*Cronbach's alpha* 0,708).

Menu acceptability data were collected by looking at leftovers and menu satisfaction ratings. Leftovers were measured during one menu cycle obtained through the process of weighing the weight of the food menu portion before and after eating by the subject using a scale and recording. The student satisfaction assessment of each menu served in terms of taste, aroma, consistency, appearance, ripeness, and variety was collected using a food assessment questionnaire. The assessment questionnaire contained 18 questions related to the sensory properties of food from the boarding school, with a Likert scale of 1–4: 4 = very satisfied, 3 = satisfied, 2 = dissatisfied, 1 = very dissatisfied, with a maximum score of 72, which has been tested for validity and reliability by previous researchers (Cronbach's Alpha 0,823) (Amalia et al., 2023).

Food acceptability was categorized as good if the average leftover food was <20 percent and less good if it was ≥20%, whereas the acceptability of the menu satisfaction score was categorized as very good (80-100%), good (60-79%), enough (40-59%), and less (<39%) (Amalia, 2020). Data on nutrient intake, including energy, protein, iron, vitamin C, vitamin B9, and vitamin B12, were collected by interviewing food consumers using 2×24 h food recall, which was carried out on days with a food menu of animal protein sources in the form of chicken and fish. Food recalls were conducted on two different days to collect data on variations in daily consumption. Subjects were given clear instructions and visual guidance in the form of a food photo book to improve their accuracy in estimating consumption portions. Interviewers were also trained to thoroughly explore the consumption information so that the subjects' dietary consumption data were more valid. Nutrient intake will be compared with the daily needs of the subject, and the level of energy and protein adequacy will be classified as deficit (<80% of requirements), normal (80-110% of requirements), and more (≥110% of requirements) (NFNC, 2018). Vitamin and mineral adequacy levels were categorized as deficient if intake was <77% of the RDA and adequate if intake was ≥77% of the RDA (Gibson, 2022)

Data on hemoglobin level (Hb level) were obtained by measuring Hb level (low Hb levels <12 g/dL and normal Hb levels ≥12 g/dL) through a hemoglobin test using the Easy Touch GCHb-type ET-321 made in Taiwan, calibration was performed prior to data collection by inserting the appropriate code chip and verifying the control result fell within the expected range, as per manufacturer's instructions. All measurements were performed by trained health personnel. This tool was used because the results obtained were not different from the results of the cyanmethemoglobin hemoglobin test, as recommended by the WHO (Lailla et al., 2021).

Data were analyzed for normality using the Kolmogorov-Smirnov test and bivariate analysis using Spearman rank correlation tests. This study was approved by the 002593/Research Ethics Committee (REC) Abdurrab University/2024.

Result and Discussion

The subjects in this study were female students in grades 11 and 10 of Madrasah Aliyah (MA), with most of them in grade 11 MA aged 16 years (Table 1). This age is categorized as late adolescence, in the age range of 15-19 years (WHO, 2014). The subjects' menstrual patterns were mostly normal or 21-35 days as much as 61,9%, and abnormal less than 21 more or more than 35 days as much as 38,1%. Based on the duration of menstruation, most subjects experienced moderate duration, which was approximately 5-6 days as much as 45,7%, then subjects who had a long duration or more than 6 days as much as 44,8% and short or less than 4 days as much as 9,5%. Based on the nutritional status data, it was found that there were no subjects with poor or deficient nutritional status; most subjects had a normal

nutritional status (72,4%). This study also found that subjects with an overweight nutritional status of 21% and 6,7% had an obese nutritional status.

Data on the distribution of hemoglobin levels in the subjects are shown in Table 1. Based on Hb levels, it shows that more than half (53,3%) of the subjects in this study were anemic or had Hb levels <12 mg/dL. The prevalence of anemia in Riau Province in 2018 was 44% (MoH, 2019), and according to WHO, a prevalence above 40% is considered a severe public health problem (WHO, 2015).

Table 1. Subject's characteristics (n=105)

Variable	Category	n	%
Class	10	48	45,7
	11	57	54,3
	Mean ± SD	11 ± 0,5	
Age	15	32	30,5
	16	65	61,9
	17	8	7,6
	Mean ± SD (years)	16 ± 0,57	
Menstrual cycle			
Menstrual pattern (per month)	Abnormal (<21 or >35 days)	40	38,1
	Normal (21-35 days)	65	61,9
	mean ± SD	30 ± 11,1	
Duration of menstruation (per period)	Short	10	9,5
	Medium	48	45,7
	Long	47	44,8
	mean ± SD	6,3 ± 1,7	
Nutritional Status	normal	76	72,4
	overweight	22	21
	Obese	7	6,7
	mean ± SD	0,3 ± 1,0	
Hemoglobin Levels	Anemia	56	53,3
	Normal	49	46,7
	mean ± SD	12 ± 1,3	

SD= Standard Deviation

Lack of knowledge is an important factor that can affect the incidence of anemia (Munira & Viwattanakulvanid, 2021). Based on the level of knowledge about anemia (Table 2), most participants had a sufficient level of knowledge, namely 68,6%. Based on the results obtained, the question that was answered incorrectly was about the nutrients that can prevent anemia and the benefits of consuming blood supplement tablets. Knowledge plays an important role in determining food choices and habits (Latha and Mohan 2017).

Table 2 shows the average subject acceptance of the menu provided (Table 2). The subject's acceptance of the menu provided by the boarding school can be seen from the number of leftovers left. Based on the data on acceptability, the percentage of subjects with good acceptability of breakfast and lunch menus was 79%, and that of the dinner menu was 81%.

Food acceptability is the extent to which a food is liked and acceptable, based on cultural, sensory, and individual preferences that influence dietary choices (Azimah & Mulyatiningsih 2024). The types of food provided by the boarding school kitchen included staple foods, animal-side dishes, vegetable-side dishes, and vegetables. The breakfast menu that is usually served consists of carbohydrate-source foods including white rice, fried rice, noodles, and yellow noodles. The lunch menu usually consists of animal protein foods that are also a source of iron, including chicken soup and stews, catfish, mackerel fish, and pangasius catfish, and includes a menu of Indonesian vegetable salad with peanut sauce, soup, tauco (paste made from preserved fermented yellow soybeans), and kale vegetables. The usual food menu provided for dinner meals is from plant protein foods and vegetables, which are in the form of spicy fried tempeh, tofu, braised tempe, and tofu in sweet soy sauce; the vegetables are sauteed cabbage and carrots, bean sprouts, and napa cabbage.

Based on the analysis of the results of leftovers on the breakfast menu, it was found that leftover food from carbohydrate sources, a breakfast menu that only provided a source of carbohydrates with a breakfast menu cycle for only three days. Based on the leftover food in the lunch menu, most leftover foods were mackerel and sauteed spinach. The leftovers of mackerel fish are a source of iron; therefore, a high amount of food from mackerel fish will have an impact on nutrient intake, especially daily iron intake. Mackerel fish are a source of proteins and iron (Januarita et al. 2022; Utari & Al Rahmad, 2022)). Based on the survey, many participants did not like mackerel fish, resulting in high food waste, including leftover rice and vegetables provided on the menu. Based on the dinner menu, it was found that the leftover foods were vegetables, namely mustard greens and bean sprouts. According to Roe et al. (2020), vegetables are the most common food waste in children (Roe et al., 2020). Low vegetable consumption among adolescents can increase the risk of micronutrient deficiencies, which can lead to various health problems including anemia (Igbokwe et al., 2025). Lack of vegetable consumption increases the risk of anemia (Djogo & Letor, 2022).

T**able 2.** Subject distribution based on knowledge level and menu acceptability (n=105)

Variable	Mean ± SD	Category	n	%
Anemia knowledge	73 ± 12	Good (> 80%)	24	22,9
		Sufficient (60-80%)	72	68,6
		Poor (<60%)	9	8,6
Menu Acceptability				
Breakfast		Good	83	79
		Poor	22	21
Lunch menu		Good	83	79
		Poor	22	21
Dinner menu		Good	81	77,1
		Poor	24	22,9
Nutritional intake				
Energy (Kcal)	1488 ± 159	Deficit	65	61,9
		Normal	40	38,1
Protein (g)	48 ± 6,7	Severe deficit	90	85,7
		Normal	15	14,3
Iron (mg)	9,2 ± 1,8	Deficit	97	92,4
		Adequate	8	7,6
Vitamin C (mcg)	22,7 ± 10,3	Deficit	103	98,1
		Adequate	2	1,9
Vitamin B9 (mcg)	116 ± 25,7	Deficit	105	100
Vitamin B12 (mcg)	1,2 ± 0,6	Deficit	105	100

SD= Standard Deviation

Based on the level of energy adequacy, it was found that 61,9% of the subjects had insufficient levels of energy intake, and only 38,1% of subjects had normal levels of energy adequacy. Energy is an important factor that supports optimal growth and development processes. Adolescence is characterized by changes in body composition and physical activity. Although physical activity does not always increase, energy needs continue to increase with body size (Parks et al. 2020). Protein intake was also found in most subjects 85,7% had insufficient protein levels and only 3,8% of subjects had normal protein levels. Adequate protein intake is needed to help prevent anemia because proteins are an important component of the hemoglobin structure and play an important role in tissue repair and optimal body function (Sari et al., 2022).

The vitamin and mineral intake of the subjects was still very insufficient, most of the subjects 92,4% had insufficient levels of iron, 98,1% had insufficient levels of vitamin C, and 100% had insufficient levels of vitamin B9 and B12. Low iron intake causes the body to lack oxygen, which affects the development of anemia (Djogo & Letor, 2022). Micronutrients are required by the body in micro amounts, but they play a crucial role in various body

functions, including the production of red blood cells. Micronutrients, especially iron, vitamin B12, and folate, are essential for preventing anemia, and deficiencies in these micronutrients can disrupt red blood cell production and cause anemia (Dhurde et al., 2024). This study also observed the subjects' satisfaction with the menu, as seen in the categories of taste, aroma, consistency, freshness, appearance, ripeness, and variety (Table 3).

Table 3. Distribution of subject satisfaction with the menu provided (n=105)

Menu	Breakfast menu				Lunch menu				Dinner menu			
satisfaction	n	%	r	p-value	n	%	r	p-value	n	%	r	p-value
Taste												
Very satisfied	34	32,4	−0,404	<0,001*	62	59	0,148	0,132	2	1,9	0,024	0,810
Satisfied	60	57,1			43	41			87	82,9		
Enough	11	10,5			0	0			16	15,2		
Mean ± SD	75 ± 11				80 ± 6,6				66 ± 5,8			
Aroma			−0,285	0,003*			0,015	0,883			0,101	0,304
Very satisfied	27	25,7			21	20			0	0		
Satisfied	73	69,5			81	77,1			90	85,7		
Enough	5	4,8			3	2,9			15	14,3		
Mean ± SD	74 ± 7,7				74 ± 6,8				66 ± 5,8			
Consistency			−0,130	0,187			0,030	0,761			0,010	0,923
Very satisfied	19	18,1			20	19			1	1,0		
Satisfied	80	76,2			79	75,3			97	92,4		
Enough	6	5,7			6	5,7			7	6,7		
Mean ± SD	73 ± 8,0				73 ± 6,5				69 ± 5,6			
Freshness			0,084	0,396			0,073	0,459			0,077	0,436
Very satisfied	22	21			23	21,9			9	8,6		
Satisfied	77	73			82	78,1			93	88,6		
Enough	6	5,7			0	0			3	2,9		
Mean ± SD	74 ± 7,5				75 ± 6,7				71 ± 6,4			
Appearance			−0,031	0,754			−0,013	0,898			−0,263	0,007*
Very satisfied	1	1,0			11	10,5			5	4,8		
Satisfied	63	60			93	88,6			92	87,6		
Enough	40	38,1			1	1,0			8	7,6		
Less	1	1,0			0	0			0	0		
Mean ± SD	59 ± 8,3				72 ± 6,2				65 ± 6,0			
Ripeness			−0,179	0,068			0,160	0,103			0,000	0,997
Very satisfied	10	9,5			16	15,2			1	1,0		
Satisfied	85	81			89	84,8			87	82,9		
Enough	10	9,5			0	0			17	16,2		
Mean ± SD	74 ± 7,7				74 ± 5,7				65 ± 6,0			
Variety			−0,165	0,092			−0,139	0,157			−0,121	0,220
Very satisfied	0	0			4	3,8			5	4,8		
Satisfied	0	0			101	96,2			100	95,2		
Enough	23	21,9			0	0			0	0		
Less	82	78,1			0	0			0	0		
Mean ± SD	42 ± 3,2				73 ± 3,6				69 ± 4,9			

Based on the assessment of menu satisfaction (Table 3), it was found that almost all participants were satisfied with the breakfast, lunch, and dinner menu items that had been provided in terms of taste, aroma, consistency, freshness, appearance, ripeness, and variety. However, on the breakfast menu, it was found that almost all subjects were less satisfied in the category of breakfast menu variations. Although most of the subjects were satisfied with the menu, many subjects left the food, which was considered to have low acceptability. Waste food can lead to unhealthy eating patterns, including the potential for overeating or other disordered eating behaviors in adolescents (Panizza et al., 2017).

Furthermore, based on Spearman rank analysis, the acceptability of the breakfast menu was influenced by taste and aroma (Table 3). This is in agreement with Silva and Barros (2016), who assessed students' satisfaction with school lunches, stating that the taste and aroma of food play an important role and are related to the acceptability of food (Silva & Barros, 2016). Based on research by Amalia et al. (2023), the main reason for menu satisfaction is the taste of the food, with 82,9% of students indicating that taste is their top priority when choosing food, highlighting the importance of interesting flavors in school foods (Amalia et al., 2023).

Based on the participants' menu satisfaction assessment of the lunch menu (Table 3), it was not found that the menu satisfaction assessment was related to the acceptability of the lunch menu. Based on the dinner menu, it was found that there was a negative correlation between the appearance and acceptability of the dinner menu ($p<0,05$), and it was concluded that the higher the satisfaction score in the appearance category, the better the subject's acceptance. Food appearance can affect appetite and acceptance (Kokaji and Nakatani 2021). During lunch and dinner meals, the boarding school canteen operates, which causes students to consume more snacks and the heavy meals available in the canteen, making them feel full and leaving food behind. Students often prefer snacks to meals provided at boarding schools, suggesting that satisfaction ratings may not be the main factor influencing their food choice (Amalia et al., 2023). Amalia (2020) also mentioned that the assessment of food satisfaction or quality is not related to students' acceptability of consumption (Amalia, 2020). The selection of unhealthy foods, especially at school with a long schedule, which lasts from the morning, is likely to affect the diet and diet quality of adolescent girls (Watts et al., 2017).

The following is an analysis of the correlation between anemia knowledge and Hb levels (Table 4). Based on the correlation analysis with Spearman rank tests, there was a significant negative correlation between subject characteristics and the duration of menstruation (period) ($p<0,05$) with Hb levels. Menstruation is a major factor leading to iron-deficiency anemia in women of reproductive age. Prolonged periods of blood loss can have a significant impact on adolescents' overall health, leading to increased fatigue and emotional distress, which are common symptoms of anemia (Attia et al., 2023). This study is not in accordance with the research of Banerjee et al. (2022), as nutritional status is associated with the incidence of anemia, as overweight adolescents affect iron metabolism by inhibiting iron absorption in both adolescents and adults (Banerjee et al., 2022).

Based on the correlation analysis using the Spearman rank test (Table 4), there was a positive correlation between anemia knowledge and Hb levels ($p<0,05$). This means that the higher a person's anemia knowledge, the higher is the Hb level. This is in accordance with the research of Utami et al. (2022), who found that lack of knowledge of adolescents, especially regarding anemia, nutrients, and healthy eating habits, is a factor in malnutrition, one of which is anemia in adolescents (Utami et al., 2022).

The root cause of anemia is often an unbalanced diet, where people do not consume enough iron-rich foods or foods that increase iron absorption. A lack of understanding of iron-rich food sources and increased absorption can increase the prevalence of anemia (Omari et al., 2017). Dietary recommendations with the implementation of nutrition education programs are needed to reduce anemia among adolescent girls. Considering the important role of schools in the field of education, nutrition education programs are being developed in schools as a means of intervention to improve nutritional knowledge (Tyas et al., 2020). The importance of ongoing health promotion programs in the

boarding school environment is to increase awareness of anemia and encourage positive anemia prevention behaviors among students (Hamid et al., 2024).

Table 4. The results of the correlation analysis between the variables to hemoglobin level

Variable	Hemoglobin level	
	r	p-value
Class	0,149	0,128
Age	0,167	0,089
Menstrual cycle		
Menstrual pattern (day)	−0,007	0,945
Duration of menstruation (day)	−0,511	<0,001*
Nutritional Status	−0,042	0,674
Anemia knowledge	0,254	0,009*
Menu Acceptability		
Breakfast	−0,366	<0,001*
Lunch menu	−0,445	<0,001*
Dinner menu	−0,516	<0,001*
Nutritional intake		
Energy (kcal)	0,159	0,104
Protein (g)	0,235	0,019*
Iron (mg)	0,200	0,040*
Vitamin C(mcg)	0,349	<0,001*
Vitamin B9 (mcg)	0,471	<0,001*
Vitamin B12 (mcg)	0,221	0,023*

*significant if p<0,05

As shown in Table 4, there was also a significant negative correlation between the acceptability of breakfast, lunch, and dinner menus (p<0,05) and Hb levels, which means that the lower the subject's acceptability of leftover food on the menu, the lower the Hb level. This is because participants who leave food reduce their daily intake (Nasir et al., 2024). Low intake will have an impact on the lack of most vitamins, as well as insufficient intake of minerals and microelements; if insufficient protein intake and iron are not met, it will have an impact on Hb levels (Smolnikova et al., 2020). Skipping or not eating meals is associated with suboptimal iron intake, which is in line with previous findings that skipping meals contributes to poor micronutrient intake among adolescents (Fanelli et al., 2021).

Based on this study, there was a positive correlation between nutritional intake, such as protein, iron, vitamin C, vitamin B9, and vitamin B12 (p<0,05); therefore, it can be assumed that the higher the intake of these nutrients, the higher the Hb level. This is in accordance with the research of Paramastri et al. (2021), who stated that insufficient iron intake is a major factor causing anemia, which often occurs in adolescents in boarding schools that do not consume enough iron-rich foods, which can cause iron deficiency anemia (Paramastri et al., 2021).

The consumption of micronutrients is particularly important for adolescent girls because deficiencies can lead to complications during pregnancy and affect overall health and development. Vitamin B12 deficiency, highlighting its strong association with anemia in adolescence, suggests that addressing vitamin B12 deficiency could be crucial in combating anemia, as vitamin B12 is essential for proper red blood cell formation and neurological function (Dhurde et al., 2024). The participants' eating behavior, as seen from the assessment of menu acceptability, such as preferring food provided in the canteen and leaving the food provided by the boarding school, so that the availability of snacks plays a more significant role in their food intake (Amalia et al., 2023).

A lack of dietary variety contributes to a low intake of protein and micronutrients, which play an important role in enhancing iron absorption (Watts et al., 2017). The availability of iron and nutrients that support the absorption of iron in the menu, such as dietary intake of protein, total iron, non-heme iron, and iron support substances (vitamin C), is associated with Hb concentrations (Hidayanti et al., 2024). Iron deficiency anemia is not only limited to the amount of iron intake, but also the speed of absorption, which requires interaction with other nutrients (Wati et al., 2023).

Students living in boarding schools face greater challenges in maintaining a balanced diet due to limited food variations, cultural preferences, nutritional quality, mealtimes, and food acceptance (Amalia, 2020). In the boarding school environment, anemia is not only caused by nutritional factors but can also be influenced by a lack of hygiene, which can lead to increased susceptibility to infection, causing inflammation and affecting the body's ability to absorb nutrients, including iron, which is essential for hemoglobin production (Amalia et al., 2023). Adolescents without good personal hygiene are more likely to become anemic (Kumar and Mohanty 2023). Good sanitation, such as washing hands with soap after using the toilet, can reduce the risk of spreading the disease (Jolly et al., 2023). Having good behavior and environment is an effort to prevent anemia, especially in adolescents who live in a shared environment such as a boarding school (Amalia et al., 2023).

Conclusion

The results of the study showed that the duration of menstruation, anemia knowledge, menu acceptability, and intake of protein, iron, vitamin C, B9, and B12 affected the hemoglobin level of female students. A sustainable health promotion program is needed in the Boarding School environment to increase awareness and encourage anemia prevention behavior and improve food quality, especially taste and aroma, to increase the acceptance of students in boarding schools. Future researchers should conduct nutrition education programs, especially regarding the importance of nutrients in preventing anemia and the benefits of consuming blood supplement tablets.

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References

Amalia, F., Katmawanti, S., Paramita, F., Kurniawan, A., & Fauzi, R. (2023). Relationship between satisfaction of food service with energy and macronutrients intake of islamic boarding school students in Malang City, Indonesia. *E3S Web of Conferences*, *448*, 1–10. https://doi.org/10.1051/e3sconf/202344801016

Amalia, N. N., Dieny, F. F., Candra, A., & Nissa, C. (2023). Hubungan daya terima makanan dengan kualitas diet pada santri. *Gizi Indonesia*, *46*(1), 43–56. https://doi.org/10.36457/gizindo.v46i1.761

Amalia, S. I. (2020). Hubungan Karakteristik Santri, Mutu Makanan, dan Daya Terima Konsumsi Santri Di SMA Al Izzah International Islamic Boarding School Kota Batu. *Amerta Nutrition*, *4*(1), 1-13. https://doi.org/10.20473/amnt.v4i1.2020.13-22

Amalia, S., Marliyati, S. A., Dewi, M., & Utami, D. W. (2023). The association of clean and healthy living behavior along with hemoglobin and serum ferritin levels among adolescent Girls. *Amerta Nutrition*, *7*(1), 54–62. https://doi.org/10.20473/amnt.v7i1.2023.54-62

Attia, G. M., Alharbi, O. A., & Aljohani, R. M. (2023). The Impact of Irregular Menstruation on Health: A Review of the Literature. *Cureus*, *15*(11), 1–9. https://doi.org/10.7759/cureus.49146

Banerjee, M., Bhatti, B. V. K., Roy, D., & Tomo, S. (2022). A national survey of the prevalence of anemia and obesity in Indian School Children. *Journal of community hospital internal medicine perspectives,* *12*(5), 48–53. https://doi.org/10.55729/2000-9666.1110

Benfo, A., Zumesew, F., Akoto, E. B., Ahiakwah, E., Baidoo, B., Agyapong, N. A. F., Boachie, J., & Adu, P. (2023). Exploring the perspective of young adults about anaemia prevention; the contributions of knowledge about at-risk groups and consequences of anaemia. *BMC Public Health*, *23*(1), 1–13. https://doi.org/10.1186/s12889-023-16980-2

Dhurde, V. S., Patel, A. B., Locks, L. M., & Hibberd, P. L. (2024). Anaemia prevalence, its determinants and profile of micronutrient status among rural school adolescent girls aged 14-19 years: a cross-sectional study in Nagpur district, Maharashtra, India. In *Public health nutrition 27*(1), 1-10 https://doi.org/10.1017/S1368980024002234

Djogo, H. M. A., & Letor, Y. M. . (2022). The Association Between Nutritional Status and Anemia in Adolescent Girls in Kupang City: A Cross-Sectional Study. *KnE Life Sciences*, *2022*, 909–919. https://doi.org/10.18502/kls.v7i2.10391

Ekanah, K. S., Otowve, A., & Rose, E. (2017). Nutritional Status of Day and Boarding Female Adolescent Secondary School Students in Warri South Local Government Area of Delta State. *Journal of Food and Nutrition Sciences*, *5*(3), 131-139. https://doi.org/10.11648/j.jfns.20170503.20

Ekayanti, I., Rimbawan, R., & Kusumawati, D. (2020). Risk factor of anemia among female students in Darusalam Islamic Boarding School Bogor. *Media Gizi Indonesia*, *15*(2), 79–87. https://doi.org/10.20473/mgi.v15i2.79-

87

Fanelli, S., Walls, C., & Taylor, C. (2021). Skipping breakfast is associated with nutrient gaps and poorer diet quality among adults in the United States. *Proceedings of the Nutrition Society*, *80*(OCE1), 2021. https://doi.org/10.1017/s0029665121000495

Ghimire, M., Bhandari, S., & Rajbanshi, M. (2024). Prevalence of anemia and its associated factors among school-going adolescent girls in schools of Dhankuta municipality, Nepal. In *PLOS global public health, 4*(9):1–17. https://doi.org/10.1371/journal.pgph.0003684

Gibson, R. (2022). *Principles of Nutritional Assessment 3rd edition: evaluation of nutrient intakes and diets*. Oxford University Press. https://nutritionalassessment.org/

Habib, N., Abbasi, S.-U.-R. S., & Aziz, W. (2020). An analysis of societal determinant of anemia among adolescent girls in Azad Jammu and Kashmir, Pakistan. In *Anemia, 2020*(1628357), 1-9 https://doi.org/10.1155/2020/1628357

Hamid, N. S., Ansariadi, Amiruddin, R., Noor, N. N., Birawida, A. B., & Stang. (2024). Anemia prevention measures in female students in the Islamic Boarding School of Al-Junaidiyah Biru, Indonesia. *Journal of Education and Health Promotion*, *13*(480), 1–6. https://doi.org/10.4103/jehp.jehp

Handini, K. N. (2023). The correlation between knowledge, sleep patterns, dietary pattern, inhibitors, and enhancers with anemia incidence in Adolescent Girls at Al-Amanah Al-Gontory Islamic Boarding School South Tangerang City. *Amerta Nutrition*, *7*(2), 147–154. https://doi.org/10.20473/amnt.v7i2SP.2023.147-154

Hidayanti, L. H., Saraswati, D., & Aisyah, I. S. (2024). Associations between quantity and quality of dietary intake with haemoglobin concentration among female adolescents in Tasikmalaya, West Java, Indonesia. *Malaysian Journal of Nutrition*, *30*(1), 87–94. https://doi.org/10.31246/mjn-2023-0073

Igbokwe, K. C., Ejoh, S. I., & Iheme, G. O. (2025). Vegetable consumption and promotion among school-age children and adolescents in West Africa: a systematic review and narrative synthesis. *British Journal of Nutrition*, 1–14. https://doi.org/10.1017/S0007114524003301

Indonesian Ministry of Religious. (2023). *Satu Data Kementerian Agama RI*. https://satudata.kemenag.go.id/dataset/detail/jumlah-santri-pada-pondok-pesantren-menurut-jenis-kelamin-dan-kategori-tempat-tinggal

Indonesian Ministry of Health. (2019). *Hasil Riset Kesehatan Dasar (Riskesdas) 2018.* Badan Penelitian dan Pengembangan Kesehatan Kementerian RI. https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/

Indonesian Ministry of Health. (2019). *Laporan Provinsi Riau Riskesdas 2018. Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan*. https://repository.badankebijakan.kemkes.go.id/id/eprint/3884

Jalambo, M. O., Naser, I. A., Sharif, R., & Karim, N. A. (2017). Knowledge, attitude and practices of iron deficient and iron deficient anaemic adolescents in the Gaza strip, Palestine. *Asian Journal of Clinical Nutrition*, *9*(1), 51–56. https://doi.org/10.3923/AJCN.2017.51.56

Januarita, J. V., Ishartani, D., Setiaboma, W., & Kristanti, D. (2022). Nilai gizi dan profil asam amino ikan etong (Abalistes stellaris) dan ikan tongkol (Euthynnus affinis). *Agrointek : Jurnal Teknologi Industri Pertanian*, *16*(2), 213–220. https://doi.org/10.21107/agrointek.v16i2.12051

Jolly, S. P., Roy Chowdhury, T., Sarker, T. T., & Afsana, K. (2023). Water, sanitation and hygiene (WASH) practices and deworming improve nutritional status and anemia of unmarried adolescent girls in rural Bangladesh. *Journal of Health, Population and Nutrition*, *42*(1), 1–17. https://doi.org/10.1186/s41043-023-00453-8

Kassebaum, N. J., Reiner, R. C., Olsen, H. E., Ikeda, C. T., Echko, M. M., Shackelford, K. A. (2019). Diseases, injuries, and risk factors in child and adolescent health, 1990 to 2017: findings from the global burden of diseases, injuries, and risk factors 2017 study. *JAMA Pediatrics*, *173*(6), 1-17. https://doi.org/10.1001/jamapediatrics.2019.0337

Khomsan, A. (2021). *Teknik Pengukuran Pengetahuan Gizi*. PT Penerbit IPB Press.

Kljusurić, J. G., Bosanac, V., Šanko, K., & Colić Barić, I. (2016). Establishing energy-nutritional variety of boarding school daily menus as a result of regional differences using multivariate analysis. *Journal of Food Composition and Analysis*, *51*, 61–68. https://doi.org/10.1016/j.jfca.2016.06.010

Kokaji, N., & Nakatani, M. (2021). With a hint of sudachi: food plating can facilitate the fondness of food. *Frontiers in Psychology*, *12*, 1–15. https://doi.org/10.3389/fpsyg.2021.699218

Krishnan, V., Zaki, R. A., Nahar, A. M., Jalaludin, M. Y., & Majid, H. A. (2021). The longitudinal relationship between nutritional status and anaemia among Malaysian adolescents. *The Lancet Regional Health - Western Pacific*, *15*,(100228) 1-8. https://doi.org/10.1016/j.lanwpc.2021.100228

Kumar, M., & Mohanty, P. C. (2023). Undernutrition and anaemia among Indian adolescents: Role of dietary diversity and hygiene practices. *Journal of Nutritional Science*, *12*(33), 1-10. https://doi.org/10.1017/jns.2023.19

Lailla, M., Zainiar, & Fitri, A. (2021). *P*erbandingan hasil pemeriksaan hemoglobin secara digital terhadap hasil pemeriksaan hemoglobin secara cyanmethemoglobin, *Jurnal Pengelolaan Laboratorium Pendidikan, 3*(2), 63-68. http://dx.doi.org/10.33846/sf14nk209

Latha, K., & Mohan, H. D. (2017). Knowledge about iron rich foods and its consumption pattern among adolescent girls in an urban slum of Kolar. *International Journal Of Community Medicine And Public Health*, *4*(7), 2282-2287. https://doi.org/10.18203/2394-6040.ijcmph20172586

Lemeshow, S., & David, J. (1997). *Besar Sampel dalam Penelitian Kesehatan*. Gadjah Mada University Press.

Munira, L., & Viwattanakulvanid, P. (2021). Influencing factors and knowledge gaps on anemia prevention among female students in indonesia. *International Journal of Evaluation and Research in Education*, *10*(1), 215–221. https://doi.org/10.11591/ijere.v10i1.20749

Nasir, S. A. M., Shaharuddin, I. F., Ismail, N. H., Zaman, M. K., & Rasimun, S. R. R. (2024). Nutritional status and factors affecting food intake among hospitalized patients in Hospital Ampang. *Jurnal Gizi Dan Pangan*, *19*(1), 19–26. https://doi.org/10.25182/jgp.2024.19.supp.1.19-26

Naufalina, M. D., Nabawiyah, H., & Sari, D. D. (2023). Status gizi pada siswi remaja di pondok pesantren modern. *Jurnal Gizi Klinik Indonesia*, *19*(3), 112–118. https://doi.org/10.22146/ijcn.60258

National Food & Nutrition Conference. (2018). *Pemantapan Ketahanan Pangan dan Perbaikan Gizi Masyarakat Berbasis Kemandirian dan Kearifan Lokal. Widyakarya Nasional Pangan dan Gizi*. LIPI Pres. https://adoc.pub/nasional-pangan-dan-gizi-wnpg-x-tahun-2012-akan-

NHLBI. (2021). *Your guide to Anemia, Prevent, Treat, Control*. NIH Publication.

Omari, R., Quorantsen, K. E., & Omari, P. K. (2017). Nutrition knowledge and food consumption practices and barriers in rural Ghana: The case of foods for preventing vitamin A and iron deficiencies. *African Journal of Food, Agriculture, Nutrition and Development*, *17*(1), 11639–11656. https://doi.org/10.18697/ajfand.77.15815

Panizza, C. E., Boushey, C. J., Delp, E. J., Kerr, D. A., Lim, E., Gandhi, K., & Banna, J. C. (2017). Characterizing early adolescent plate waste using the mobile food record. *Nutrients*, *9*(2), 1–10. https://doi.org/10.3390/nu9020093

Panyuluh, D. C., Nugraha, P. P., & Riyanti, E. (2018). Faktor-Faktor yang berhubungan dengan perilaku penyebab anemia pada santriwati Pondok Pesantren Darul Ulum Kabupaten Kendal. *Jurnal Kesehatan Masyarakat*, *6*(2), 2356–3346. http://ejournal3.undip.ac.id/index.php/jkm

Paramastri, R., Hsu, C. Y., Lee, H. A., Lin, L. Y., Kurniawan, A. L., & Chao, J. C. J. (2021). Association between dietary pattern, lifestyle, anthropometric status, and anemia-related biomarkers among adults: a population-based study from 2001 to 2015. *International Journal of Environmental Research and Public Health*, *18*(7), 1–15. https://doi.org/10.3390/ijerph18073438

Parks, E. P., Mascarenhas, M. R., & Goh, V. (2020). Nutrient needs and requirements during growth. In *Present Knowledge in Nutrition: Clinical and Applied Topics in Nutrition* 2, 23-44. https://doi.org/10.1016/B978-0-12-818460-8.00002-2

Rahfiludin, M. Z., Arso, S. P., Joko, T., Asna, A. F., Murwani, R., & Hidayanti, L. (2021). Plant-based Diet and Iron Deficiency Anemia in Sundanese Adolescent Girls at Islamic Boarding Schools in Indonesia. *Journal of Nutrition and Metabolism*, *2021*, 1–7. https://doi.org/10.1155/2021/6469883

Rahmad, A. H. (2023). Scoping Review: The Role of Micronutrients (Fe, Zn, Iodine, Retinol, Folate) During Pregnancy. *Jurnal Kesehatan Manarang*, *9*(1), 1–13. https://doi.org/https://doi.org/10.33490/jkm.v9i1.812

Rimbawan, R., Nurdiani, R., Rachman, P. H., Kawamata, Y., & Nozawa, Y. (2023). School lunch programs and nutritional education improve knowledge, attitudes, and practices and reduce the prevalence of anemia: a pre-post intervention study in an Indonesian Islamic Boarding School. *Nutrients*, *15*(4) 1-15. https://doi.org/10.3390/nu15041055

Roe, B. E., Qi, D., Apolzan, J. W., & Martin, C. K. (2020). Selection, intake, and plate waste patterns of leftover food items among U.S. consumers: A pilot study. *PLoS ONE*, *15*(9), 1–13. https://doi.org/10.1371/journal.pone.0238050

Santana, S. A., Batista, S. A., da Costa Maynard, D., Ginani, V. C., Zandonadi, R. P., & Botelho, R. B. A. (2023). Acceptability of school menus: a systematic review of assessment methods. *International Journal of Environmental Research and Public Health*, *20*(3), 1-48. https://doi.org/10.3390/ijerph20032242

Sari, P., Judistiani, R. T. D., Hilmanto, D., Herawati, D. M. D., & Dhamayanti, M. (2022). Iron Deficiency Anemia and Associated Factors Among Adolescent Girls and Women in a Rural Area of Jatinangor, Indonesia. *International Journal of Women's Health*, *14*(8), 1137–1147. https://doi.org/10.2147/IJWH.S376023

Silva, M. de F. P. da, & Barros, J. D. de S. (2016). School feeding: accession and acceptability of school meals for students of youth and adult education in Cajazeiras, Paraíba, Brazil. *Journal Homepage: International Journal of Research in Social Sciences*, *6*(11), 2249–2496. https://www.researchgate.net/publication/354885060_Dietary_Intake_and_Diversity_Food_Expenditure_and_Meal_Plan_Participation_of_Male_University_Dormers

Smolnikova, F., Khayrullin, M., Pasko, O., Zhukovskaya, S., Zubtsova, Y., & Yakunina, E. (2020). Main problems of school nutrition. *International Journal of Scientific and Technology Research*, *9*(2), 1105–1108. https://doi.org/10.5958/0973-9130.2019.00540.1

Stauder, R., Valent, P., & Theurl, I. (2018). Anemia at older age: etiologies, clinical implications, and management. *Blood*, *131*(5), 505–514. https://doi.org/10.1182/blood-2017-07-746446

Tyas, P., Dodik, B., & Siti, M. (2020). Hubungan Asupan Zat Besi Dengan Status Anemia Remaja Putri Di Kota Bogor. *PREPOTIF Jurnal Kesehatan Masyarakat*, *4*(2), 95–101. https://orcid.org/0000-0002-9401-9137

Utami, A., Margawati, A., Pramono, D., & Wulandari, D. R. (2022). Prevalence of Anemia and Correlation with Knowledge, Nutritional Status, Dietary Habits among Adolescent Girls at Islamic Boarding School. *Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition)*, *10*(2), 114–121. https://doi.org/10.14710/jgi.10.2.114-121

Utari, D., & Al Rahmad, A. H. (2022). Pengetahuan dan sikap ibu hamil dengan pola kepatuhan mengonsumsi tablet tambah darah di Kabupaten Aceh Timur. *Jurnal SAGO Gizi Dan Kesehatan*, *4*(1), 8–13. https://doi.org/10.30867/gikes.v4i1.247

Wati, E., Sistiarani, C., & Rahardjo, S. (2023). Diet behavior and consumption of iron inhibitors: Incidence anemia in adolescent girls. *Journal of Public Health in Africa*, *14*(12), 1-6. https://doi.org/10.4081/jphia.2023.2593

Watts, A. W., Valente, M., Tu, A., & Mâsse, L. C. (2017). Eating Away from Home: Influences on the Dietary Quality of Adolescents with Overweight or Obesity. *Canadian Journal of Dietetic Practice and Research*, *78*(4), 166–171. https://doi.org/10.3148/cjdpr-2017-010

WHO. (2015). *The Global Prevalence of Anaemia in 2011*. World Health Organization. https://www.who.int/publications/i/item/9789241564960.

WHO. (2022). *Prevalence of anaemia in women aged 15 to 49 (%) [Indicator].* World Health Organization. https://data.who.int/indicators/i/41D099F/8D58801

Wiafe, M. A., Apprey, C., & Annan, R. A. (2021). Knowledge and practices of dietary iron and anemia among early adolescents in a rural district in Ghana. *Food Science and Nutrition*, *9*(6), 2915–2924. https://doi.org/10.1002/fsn3.2249

Yani, M., Azhari, A., Al Rahmad, A. H., Bastian, F., Ilzana, T. M., Rahmi, C. R., Andriaty, S. N., Chanda, A., & Salsabila, S. (2023). The relationship between menarche and nutritional status in Junior High School students in Aceh Besar. A study from 30 years of armed conflict area, Aceh, Indonesia. *AcTion: Aceh Nutrition Journal*, *8*(4), 635–641. https://doi.org/10.30867/action.v8i4.1310