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Nutritional Knowledge, Nutritional Status, Compliance with Iron Supplement Tablets, and the Incidence of Anemia in Female Adolescent

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Abstract

Anemia is a significant health issue in society, and it is prevalent, including in Indonesia. This condition can substantially impact the economy, health, and social well-being. This research aims to determine the relationship between nutritional knowledge, nutritional status, compliance with iron supplement tablet consumption, and the incidence of anemia in adolescent girls at Al-Ishlah Vocational School in the year 2023. This study aims to contribute to developing knowledge related to public health, especially in nutrition and anemia. The research adopts a quantitative approach with an analytical method and a cross-sectional design, using purposive sampling to select 47 female adolescents from a population of 143 students. Data analysis involves univariate and bivariate analyses conducted using the Statistical Program for Social Sciences (SPSS). The findings reveal no significant relationship between nutritional knowledge and the incidence of anemia in adolescent girls (p=0.654). Similarly, there is no significant correlation between nutritional status and the occurrence of anemia in these adolescents (p=0.442). Additionally, there is no significant relationship between compliance with iron supplement tablet consumption and the incidence of anemia in the same group of adolescent girls (p=1.000). Recommendations include collaborative efforts between schools and healthcare services to enhance adolescent nutrition, regular monitoring for anemia prevention, health departments implementing policies to enhance nutrition education in schools, school nutrition campaigns, educational activities, and institutions contributing to developing more effective strategies.

Keywords: *Anemia, Female Adolescent, Iron Supplement Tablets, Nutritional Knowledge, Nutritional Status*

Introduction

The prevalence of anemia in Indonesia remains relatively high. According to data from Basic Health Research (*Riset Kesehatan Dasar*), in 2018, the prevalence of anemia among adolescents was 32%, meaning that 3-4 out of 10 adolescents suffered from anemia [1]. This is influenced by suboptimal nutritional intake habits and insufficient physical activity [2]. In 2023, the Health Department of Tasikmalaya Regency reported a prevalence of 3.1% for anemia among adolescents [3]. Based on research in Indonesia and several other countries, the government has established a policy for providing Iron Supplement Tablets (IST) to adolescent girls and women of childbearing age (WCA) once a week, following the applicable Ministry of Health regulations and utilizing a blanket approach [4]. SMK Al-Ishlah Singaparna (a vocational high school) also implements an IST program administered routinely by healthcare professionals to female students from 10th to 12th grades.

Anemia is a significant health issue in society and is widespread, particularly in Indonesia. It can substantially impact the economy, health, and social well-being. Anemia is defined as a condition where

the concentration of hemoglobin (Hb) or iron-rich protein is low in the blood, affecting the production of red blood cells [5]. Data obtained from the Singaparna Primary Health Care Center indicates that the prevalence of anemia among adolescent girls is 57.7%, meaning that 6 out of 10 adolescent girls suffer from anemia. Iron deficiency can occur due to various reasons, such as insufficient dietary intake, poor bioavailability of iron from food, and excessive iron loss from the body. Women often experience significant iron loss, especially during menstruation. Anemia can manifest symptoms such as weakness, fatigue, general malaise, and sometimes difficulty concentrating. Individuals with anemia may also experience difficulty breathing during physical activities. The etiological factors of nutritional anemia include socio-demographic characteristics such as age, gender, social class, eating habits, and infections [6].

Adolescent girls are at a higher risk of experiencing anemia compared to adolescent boys because the peak iron absorption needs occur at the age of 14-15 in adolescent girls. The impact of iron deficiency anemia on adolescents includes decreased work productivity or academic performance in school due to a lack of learning enthusiasm and concentration. Iron deficiency anemia can also disrupt optimal height and weight growth and weaken the immune system, making individuals more susceptible to diseases. According to the life cycle, iron-deficiency anemia during adolescence significantly affects pregnancy and childbirth, leading to miscarriages, giving birth to low birth weight babies, experiencing childbirth complications due to inadequate uterine contractions, and the risk of postpartum bleeding leading to maternal death [7]-[10].

Given that anemia is a prevalent health issue, especially among adolescents and predominantly affecting females, it becomes crucial to study. Adolescent girls are vulnerable to anemia due to significant blood loss during menstruation. Adolescent girls with anemia are at risk of experiencing anemia during pregnancy, negatively impacting fetal growth and development, potentially leading to pregnancy and childbirth complications, and even maternal and infant mortality, including the risk of Low Birth Weight (LBW) infants [11]-[13]. Therefore, knowledge about proper nutrition and good nutritional status is vital for preventing and treating anemia. Nutrition education and appropriate health promotion can help raise public awareness about the importance of adequate nutrient intake and ensure sufficient access to iron-rich foods.

Some research found that there is a relationship between knowledge levels and the occurrence of anemia in adolescent girls [14]-[16]. Adolescent girls with good knowledge of anemia are more likely to meet their nutritional needs to avoid anemia-related issues. Adolescent girls are also a population at higher risk of anemia than boys, often due to menstruation and a desire to stay slim, leading to dieting and reduced nutritional intake [17]. A study by Ref. [18] found a relationship between nutritional status and the occurrence of anemia in adolescent girls. This study aligns with research by Ref. [19] on factors related to anemia in adolescent girls, showing a correlation between body mass index and the occurrence of anemia. It indicates a correlation between body mass index and the occurrence of anemia in the studied population. Ref. [20] emphasized the impact of various factors on iron tablet consumption and the occurrence of anemia. Low iron tablet consumption is attributed to suboptimal food utilization, resulting from a lack of knowledge about nutrition among adolescents and uneven food distribution.

Additionally, insufficient education and cultural factors, including societal superstitions and taboos, contribute to low iron tablet consumption. All these factors hinder adolescents' access to the necessary information to address the issue of anemia. According to Ref. [21], the compliance of adolescent girls in consuming IST is also a factor influencing the occurrence of anemia in adolescents. Non-compliance in taking IST can hinder iron supplementation, caused by boredom, laziness, and IST's unpleasant taste and aroma. Some adolescent girls also experience side effects such as nausea and heartburn after taking IST. The IST distribution program has been implemented as one of the solutions to address anemia. IST is a nutritional supplement containing 60 mg of elemental iron and 400 mcg of folic acid [22]. Although the coverage of IST administration to adolescent girls reaches 76.2%, only 80.9% of those who receive IST at school comply with its consumption. Research by Ref. [23] concluded that there is a correlation between the consumption pattern of iron tablets and the occurrence of anemia, providing a potential solution to addressing anemia.

Based on an interview with the school authorities of SMK Al-Ishlah on March 14, 2023, regarding the Hb measurement screening program, it was revealed that this school is one of the 14 schools selected for anemia measurement by Singaparna Primary Health Care Center in Tasikmalaya Regency. This school also has a routine IST distribution program to prevent anemia in adolescent girls, administered directly by the health center. Students' knowledge of nutrition and anemia at this school is still relatively low, and efforts by the health center include organizing awareness campaigns regarding nutrition knowledge and anemia prevention. Given this background, the objective of this research is to elucidate the relationship between nutritional knowledge, nutritional status, and compliance with IST consumption and the occurrence of anemia in adolescent girls.

Material and Methods

A. Research Design

The type of research used is quantitative research with an analytical method and a cross-sectional approach, where the objects are measured and data are collected simultaneously. This study estimates the relationship between nutritional knowledge, nutritional status, and compliance with IST consumption with the occurrence of anemia in adolescent girls at SMK Al-Ishlah in 2023. Table 1 shows the operational definitions.

Table 1. The operational definitions

No	Variable	Definition	Measurement Method	Measuring Instrument	Measurement Result	Scale
Independent Variables						
1	Nutritional Knowledge	Respondents know everything about nutrition, including definitions of nutrition, nutritional benefits, balanced nutrition, healthy foods, the impact of anemia, anemia prevention, and causes of anemia.	Observing questionnaire responses	Questionnaire sheet	Good (Correct answers 76-100%) 2. Adequate (Correct answers 56-76%) 3. Insufficient (Correct answers <56%), Notoadmodjo, 2012	Ordinal
2	Nutritional Status	The respondent's body condition resulting from the food consumed was measured	Anthropometry/ direct measurement	Measuring tape	1. Poor (if Upper Arm Circumference < 22.0 cm)	Ordinal

No	Variable	Definition	Measurement Method	Measuring Instrument	Measurement Result	Scale
		based on upper arm circumference.			2. Good (if upper arm circumference ≥ 22.0 cm)	
3	Compliance in Iron Supplement Tablet (IST) Consumption	The frequency and quantity of iron supplement tablets consumed by the respondent within a specific period, i.e., one week. One tablet regularly per week from March to May 2023.	Observing questionnaire responses	Questionnaire sheet	1. Regular (if consumed at least 1x per week in the last month) / 4x in a month	Ordinal
					2. Irregular (if consumed less than 4x in a month)	
Dependent Variable						
1	Anemia	Hemoglobin (Hb) levels in the blood are lower than normal, i.e., Hb <12g/dl.	Interview, direct measurement	Using the easy touch GCHb measuring tool	0. Anemia < 12g/dl	Ordinal
					1. Non-Anemia ≥12g/dl	

B. Population and Sample

This study was conducted at SMK Al-Ishlah Cintaraja, Singaparna Subdistrict, Tasikmalaya Regency, with the research period in May-June 2023. The population in this study consists of all students in the 10th to 12th grades at SMK Al-Ishlah Singaparna, with a total population of 143 students. In this study, purposive sampling will be used in sample selection. The research sample consists of students with specific criteria, such as female students aged at least 15 years and who have already menstruated. Table 2 shows the inclusion and exclusion criteria in this study.

Table 2. The inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
• Female students in 10th and 11th grades; 12th grade is excluded because the school only allows students in 10th and 11th grades to be included in the study. • Not currently taking exams • Not currently menstruating	• Adolescent girls who do not consent to informed consent • Having chronic diseases (kidney failure, diabetes, and autoimmune disorders) • Adolescent girls who are absent due to (permission/ illness/ without notice)

C. Data Analysis

In this research, descriptive analysis will be conducted using frequency distribution or percentage for each variable, including nutritional knowledge, nutritional status, IST consumption, and anemia. Bivariate Analysis was applied to analyze the relationship or correlation between independent and dependent variables, namely nutritional knowledge with anemia, nutritional status with anemia, and compliance with IST consumption with anemia. The relationship between each variable will be tested using statistical tests, specifically the Chi-Square Test, with a confidence level of 5%.

Results

A. Univariate Analysis

The research focuses on the relationship between knowledge, nutritional status, and compliance with iron supplement tablet consumption with the occurrence of anemia in female students of 10th-grades and 11th-grade. This study aims to analyze the relationship between these variables and the occurrence of anemia in female adolescents. The respondents in this study consist of female students. Fig. 1 shows the characteristics of the respondents based on age and grade distribution.

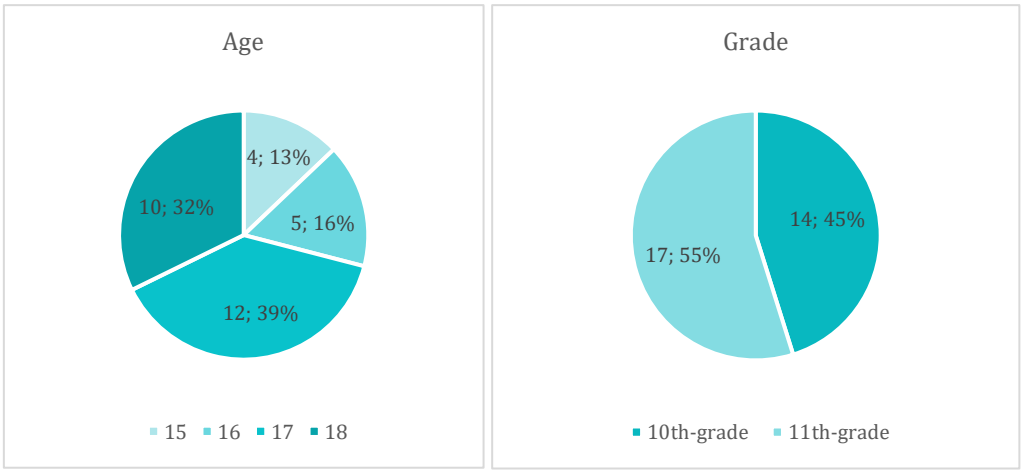


Fig. 1. Respondent characteristics

The distribution of respondents' knowledge for each question can be seen in the following Table 3.

Table 3. Distribution of Respondent Knowledge Based on Questions in the Questionnaire

No	Statement	Know		Do Not Know		Total	
		Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
1	The occurrence of anemia is still a severe nutrition and health issue in Indonesia	31	100	0	0	31	100.0
2	Consumption of chocolate and cheese can increase anemia symptoms	15	48.4	16	51.6	31	100.0
3	Anemia is a condition where the Hb levels in the blood are lower than normal values based on age and gender	31	100	0	0	31	100.0
4	Hemoglobin is a compound of erythrocytes	22	71.0	9	29.0	31	100.0
5	Anemia is a health problem where the body lacks iron	31	100	0	0	31	100.0
6	Substances such as tannin, caffeine, and calcium (in milk, yogurt, and coffee) can inhibit the absorption of iron	22	71.0	9	29.0	31	100.0
7	The science that studies a process that occurs in living organisms to process solid and liquid substances needed to sustain life is the definition of nutrition	29	93.5	2	6.5	31	100.0
8	Decreased immunity, inability to concentrate, and fatigue are the effects of anemia	0	0	31	100	31	100.0
9	Pale skin, spots, and quick hunger are not symptoms of anemia	30	96.8	1	3.1	31	100.0
10	Malnutrition is not only caused by lack of exercise	27	87.1	4	12.9	31	100.0

Based on Table 3, the distribution of answers to respondents' knowledge about nutrition and anemia shows that the majority of respondents do not know the symptoms of anemia, with 31 individuals (100%), the definition of hemoglobin with nine individuals (29.0%), and the causes of anemia with nine individuals (29.0%).

B. Bivariate Analysis

Table 4 uses the Chi-Square test to show the relationship between nutrition knowledge, nutrition status, consumption compliance, and anemia incidence. Based on Table 4, the highest proportion of respondents had good nutritional status, with 28 individuals (90.3%), while respondents with poor

dietary status were three individuals (9.7%). The frequency distribution of compliance with IST consumption above can be concluded that the highest proportion of respondents tends to be not routine in consuming IST, with 27 individuals (87.1%); the number of respondents in this group is much larger compared to the group that routinely consumes tablets, only four respondents (12.9%). The frequency distribution of anemia status shows that the highest proportion of respondents is not anemic, with 26 individuals (83.9%), while respondents with anemia are five individuals (16.1%).

Table 4. Relationship between Knowledge, Nutrition Status, Consumption Compliance and Incidence of Anemia

	Incidence of Anemia				total		
	No Anemia		Anemia				
Categories	**N**	**%**	**N**	**%**	**N**	**%**	**p-value**
Knowledge							
• Good	12	80	3	20	15	100.0	
• Enough	14	87.5	2	12.5	16	100.0	0.654
Nutrition Status							
• Good	24	85.7	4	14.3	28	100.0	
• Worse	2	66.7	1	33.3	3	100.0	0.422
Consumption Compliance							
• Routine	4	100.0	0	00.0	4	100.0	
• Not Routine	22	81.5	5	18.5	27	100.0	1.000
Total	26	83.9	5	16.1	31	100.0	

Data in Table 4 on the relationship between nutrition knowledge and anemia incidence show that in the group of respondents who are not anemic, 12 individuals (80%) have good knowledge, and 14 individuals (87.5%) have sufficient knowledge. This indicates that the proportion of non-anemic respondents with adequate knowledge is higher than those with good knowledge. Statistical analysis using the chi-square test yielded a p-value of 0.654. This value indicates no significant difference in knowledge between the anemia and non-anemia groups.

The relationship between nutritional status and anemia incidence shows that in the group experiencing anemia, there are four individuals (14.3%) with good nutritional status. In contrast, respondents with poor nutritional status are one individual (33.3%). This indicates that the proportion of anemic respondents with good nutritional status is higher than those with poor nutritional status. Statistical analysis using the Chi-Square test yielded a p-value of 0.422. This value indicates no significant difference in nutritional status between the anemia and non-anemia groups. However, the data from the table show that respondents with poor nutritional status tend to suffer from anemia more than those with good nutritional status. This means that factors other than nutritional status may also influence the occurrence of anemia in these female adolescents.

The relationship between compliance with IST consumption and anemia incidence shows that the highest proportion in the non-anemia group is four individuals (100%) who consume Iron Supplement Tablets routinely, and respondents who do not routinely consume IST are 22 individuals (81.5%). This indicates that the proportion of respondents who do not routinely consume Iron Supplement Tablets is higher than those who routinely consume them. Statistical analysis using the Chi-Square test yielded a p-value of 1.000. This value indicates no significant difference in compliance with Iron Supplement Tablet consumption between the anemia and non-anemia groups. However, the data show that five individuals (18.5%) in the anemia group do not consume IIST routinely. In this case, those

who consistently consume IST have a lower risk of anemia than respondents who are inconsistent in consumption.

Discussion

Based on the research results, it can be said that the percentage of respondents based on age shows that the largest age group is 17-year-old female teenagers, with a rate of 38.7%. The smallest age group is 15-year-old female teenagers, with a rate of 12.9%. Research by Ref. [24] stated that 18.4% of adolescents aged 15-24 experienced anemia, supported by the Ministry of Health's data in 2022, indicating the highest proportion of anemia in adolescents aged 15-24 at 32%. In general, several health studies and surveys have shown that female teenagers in late adolescence, especially between 15 and 19 years old, have a high risk of experiencing anemia. Factors such as rapid growth, menstruation, and imbalanced diets often contribute to the high prevalence of anemia in this age group. The age overview in the study aims to provide information about the distribution of age or age groups. Age can also determine a person's maturity level, influencing their behavior and thinking. Based on the research results, the proportion of respondents based on grades shows that 11th grade has more female teenagers, 17 people or 54.8%, compared to class 10th grade with 14 people or 45.2% at SMK Al-Ishlah Singaparna in 2023. Grade distribution provides a data overview for easier visualization and determination of the sample's demographics.

Based on the results, most surveyed respondents have good knowledge (48.4%), and 16 people (51.6%) have sufficient knowledge. Based on the percentage of statement items provided in the questionnaire, some respondents did not know the definition of hemoglobin (29%), did not know foods that could inhibit the absorption of iron (29%), and did not know the impacts of anemia (100%). Respondents in this study received nutrition education from the Singaparna health center but did not receive education about anemia in adolescents. This is due to incomplete and insufficient information received by respondents, supported by Ref. [25], stating that comprehensive details can influence a person's knowledge, even if the person has a low level of education. It will improve their knowledge if they receive good information from mass media such as television, newspapers/books. Furthermore, a person's knowledge level can vary based on experience, education, and information exposure. The researcher assumes the respondents' insufficient knowledge is because they primarily seek information from less accurate sources, leading to an inaccurate understanding of anemia-related nutritional knowledge. This can result in good knowledge not being optimized. Good perception can enhance a good understanding of an object. The time dimension also influences a person's memory ability, so there is a possibility that respondents forget when answering the given questionnaire. To improve their understanding of nutrition and anemia, it is essential to provide education on anemia, its causes and impacts, and foods that can inhibit iron absorption in female teenagers. This should be done comprehensively, presented interestingly, and using creative approaches. Female teenagers can utilize social media platforms as learning tools, with support from schools, parents, and the surrounding environment, to improve their nutritional status and prevent anemia.

Based on the results, 90.3% of respondents have good nutrition, and only 9.7% have poor nutrition. This is due to implementing the "Aksi Gizi" (Nutrition Action) program by the Singaparna

Health Center and regular health screening for respondents. Looking at respondents' breakfast habits, this could be a factor contributing to their excellent nutritional status. In the research of Daris et al., 87.1% of respondents had good nutritional status, and according to Waelan's research, 71.2% of respondents had good nutritional status. Let's look at the measurement method used in this study, Upper Arm Circumference. It aims to detect the risk of chronic energy deficiency in women of childbearing age. The advantage of the Upper Arm Circumference method is that it is easy to use and does not require sophisticated tools. This aligns with research conducted by Ref. [26] stating that the Upper Arm Circumference method can be used as an alternative measurement for assessing nutritional status in adolescents. The advantage of using the Upper Arm Circumference method is that it is simple, fast, and does not require special skills, making it suitable for use in school health services. In addition, the Upper Arm Circumference method has been validated and used in several studies related to adolescent nutritional status.

Nutritional status assessment is essential in providing a basis for intervention programs to improve nutritional intake and prevent anemia in adolescents. The "Aksi Gizi" (a nutrition action program) conducted by the Singaparna health center has contributed to maintaining good nutritional status in female teenagers. The results of the anemia examination show that 6.5% of female teenagers experience anemia, while 93.5% do not experience anemia. This result is supported by the research of Susanti et al. in 2022, which found that 2.5% of female teenagers experienced anemia and 97.5% did not experience anemia. This indicates a relatively low prevalence of anemia among female teenagers. Daris et al.'s research in 2021 also showed that the prevalence of anemia in adolescents was 1.6%.

Based on the age group, the highest prevalence of anemia was found in 15-year-olds (3.2%). According to the WHO, the prevalence of anemia in adolescents is still high in several countries, with the highest prevalence in Southeast Asia at 40% [27]. Several factors, including socioeconomic status, nutritional status, and the prevalence of iron deficiency in the community, influence the prevalence of anemia. The prevalence of anemia can also vary by region. One factor contributing to the low prevalence of anemia among female teenagers is the "Aksi Gizi" program, which includes iron tablets distributed to female teenagers. This program is from the Ministry of Health and aims to improve the nutritional status of adolescents by providing iron supplements to female teenagers. Despite the relatively low prevalence of anemia, it is essential to continue monitoring and implementing programs to prevent and control anemia in adolescents. Regular health check-ups, nutritional education, and iron supplementation programs can contribute to maintaining the low prevalence of anemia in this population.

Conclusion

Most female teenagers have good nutritional status and sufficient knowledge about nutrition. The prevalence of anemia is relatively low, which may be attributed to the "Aksi Gizi" program and regular health check-ups conducted by the Singaparna health center. However, there is still room for improvement in anemia-related knowledge, especially in understanding the definition of hemoglobin, foods that inhibit iron absorption, and the impacts of anemia. Therefore, it is recommended that nutrition education programs be enhanced, including information on anemia prevention and its consequences, to improve female teenagers' overall health and well-being.

Suggestions

Based on the conclusions obtained, the following suggestions can be given:

- Strengthening Nutrition Education: Enhance nutrition education programs for female teenagers, focusing on areas lacking knowledge, such as the definition of hemoglobin, foods that inhibit iron absorption, and the impacts of anemia. Utilize creative and engaging methods to improve understanding and retention of nutritional knowledge.
- Collaboration with Health Institutions: Strengthen collaboration with health institutions, such as the Singaparna health center, to continue implementing health programs like "Aksi Gizi." Regular health check-ups, nutritional counseling, and iron supplementation programs can contribute to maintaining good nutritional status and preventing anemia.
- Regular Monitoring: Implement regular monitoring and evaluation of the nutritional status of female teenagers. This includes periodic health check-ups, nutritional assessments, and anemia screenings to identify prevalence changes and promptly address potential issues.
- Community Involvement: Involve the community, including parents and local leaders, in supporting and promoting nutrition and health awareness. This can create a supportive environment for the well-being of female teenagers, ensuring a holistic approach to health promotion.
- Further Research: Conduct further research to explore additional factors that may influence anemia's nutritional status and prevalence in female teenagers. This could include investigating dietary patterns, lifestyle factors, and environmental influences to gain a more comprehensive understanding.

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