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Role Of Health Programs Utilization and Social Factors On Adolescent Anemia Status

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Abstract

Adolescent-friendly Health Services (PKPR's Nutrition service) are intended to eliminate adolescent malnutrition, including anemia. However, the effect of health program utilization on adolescent friendly anemia has rarely been studied. This study intends to examine the prevalence of anemia, the relation of social and behavioral factors, and the use of PKPR's nutrition service with the anemia status of adolescent girls in Surakarta. A school-based cross-sectional design was conducted at a senior high school in Surakarta in 2024. The sample was 275 female students in grades 10 and 11 who had experienced menstruation. Multiple logistic regression analysis is deployed to model the factors associated with anemia. The prevalence of anemia in female students was 37.82%. The employment status of the father (p = 0.036, OR=1.79) and mother (p =0.014, OR=2.15) is associated with the anemia status of adolescents. Other factors, such as parent education, family affluence scale, behavior factors, parent support, knowledge, attitude, perception, and selfefficacy, were not associated with anemia status. PKPR's nutrition service utilization did not correlate with adolescents' anemia status. PKPR's nutrition service has not yet had an impactful outcome in reducing the frequency of anemia. Further research is needed to evaluate its implementation and impact on adolescent health outcomes.

Introduction

Anemia is a significant public health issue worldwide. According to World Health Organization (WHO) data, the worldwide prevalence of anemia in 2019 was 29.9%. The population at risk of acquiring anemia includes women in the reproductive age group (15-49 years old). The incidence of anemia in non-pregnant women of reproductive age is 29.6%(WHO, 2023). The 2018 Basic Health Research Data (Riskesdas) indicates that 32% of individuals aged 15-24 in Indonesia have anemia (Kemenkes RI, 2018). Adolescent anemia can negatively affect cognitive and physical development and increase susceptibility to illnesses. Consequently, it can have a detrimental impact on productivity in adulthood. Anemia can persist throughout adulthood during pregnancy, particularly among adolescent girls. This can lead to higher rates of morbidity and mortality during pregnancy and childbirth (Basnet *et al*., 2022). Given the widespread occurrence of anemia and its significant consequences on adolescents and their future development, it is crucial to prioritize addressing anemia in this age group.

Anemia is mainly caused by biological reasons, such as infections and genetic diseases affecting the blood (Zutphen *et al*., 2021). Biological factors, including age and gender, affect the incidence of anemia. Girls are more susceptible to getting anemia due to the occurrence of menstruation. Additional biological aspects encompass nutritional inadequacies, such as insufficient consumption of essential nutrients (macronutrients and

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micronutrients) and inadequate absorption of nutrients (Habib *et al*., 2020). Iron deficiency is responsible for 50% of the cases of anemia among these nutritional variables(Chaparro & Suchdev, 2019). Additional factors that contribute to the occurrence of anemia include infections, especially recurring infections, and genetic illnesses associated with blood abnormalities, causing anemia (Chaparro & Suchdev, 2019; Zutphen *et al*., 2021)

The World Health Organization (World Health Organization, 2023) developed a conceptual framework to categorize the causes of anemia. These causes are classified as direct causes, intermediate risk factors, and underlying risk factors. Social and behavioral factors are intermediate factors that indirectly contribute to the risk of anemia in teenagers. However, prior studies have mainly focused on biological factors such as illness, dietary intake, and nutritional status of anemia (Agustina *et al*., 2020; Gonete *et al*., 2018; Mengistu *et al*., 2019; Sari, Judistiani, *et al*., 2022). Limited research on the investigation of indirect factors, such as social factors and behaviors, and the potential advantages of health programs for adolescents, such as Adolescent-Friendly Health Services known as PKPR in Indonesia, specifically concerning anemia in adolescents.

Low access to health and nutrition services is one of the risk factors for anemia. The Indonesian Ministry of Health conducted the PKPR, intending to implement a comprehensive approach to adolescent health (Kementrian Kesehatan RI, 2014). One of the PKPR programs was an adolescent nutrition service that involved education, nutritional counseling, health screening, and Fe tablet supplementation. Previous studies have indicated that the execution of PKPR has not been optimal (Alimin Bin Alias *et al*., 2023; Barida *et al*., 2019; Nooteboom *et al*., 2021; Pham *et al*., 2023). Thus far, no research has been conducted in Indonesia to investigate the impact of school health programs or PKPR on the prevalence of anemia. Hence, it is imperative to research the PKPR program's benefits in reducing anemia in Indonesia.

The selection of the study location was determined by the findings of a preliminary study, which indicated a significant occurrence of anemia among adolescents in Surakarta (Central Java Province). According to data from the Surakarta City Health Office in 2023, the prevalence of anemia in adolescents is 34.96%. Nevertheless, there are 7 Primary Healthcare Centers (Puskesmas in Indonesia) where adolescent anemia exceeds 40%. There is a lack of data regarding the overall prevalence of anemia across the entire adolescent population. Extensive research on anemia and associated risk factors has been conducted in several towns and districts, such as Purwakarta, Bandung, and Kediri, in West Java and East Java in Indonesia. However, no such research has been carried out in Surakarta.(Agustina *et al*., 2020; Andriastuti *et al*., 2020; Sari, Herawati, *et al*., 2022a) Therefore, this study intended to investigate 1) the prevalence of anemia in the study area; 2) descriptive data of the implementation of PKPR's nutrition service(education, nutritional counseling, health screening and Fe tablet supplementation); 3) the relation of social determinants, behavior, and health program (PKPR) effect to the prevalence of anemia in Surakarta City.

Method

Using a school-based cross-sectional approach, the study was conducted in Banjarsari District, Surakarta Regency, from January to June 2024. The multistage cluster random sampling approach is implemented through a series of sequential processes. The researcher selected a single district, Banjarsari District, with the highest anemia prevalence among female students and the highest anemia screening coverage. The study included 7156 female students at the high school level in the area, comprising 14 high schools and 21 vocational schools. The researcher then selected the Puskesmas area, a sub-cluster, and randomly selected two schools within the designated area. The cluster's unit was a class, and all students in the selected classes were eligible respondents. The research sample criteria included female students in grades 10 and 11 who had experienced menstruation and were willing to participate. The sample size was calculated using a 95% confidence level and 80% research power, with a minimum of 214 students required. Those who refused to

participate, did not complete questionnaires, or refused a blood examination were excluded from the study. Despite this, 275 respondents were included in the study.

Data collection was carried out using a self-administered questionnaire. The questionnaires consist of several parts to assess social determinant factors (Father's job, Mother's work, Father's education level, Mother's education level, Family Affluence Scale (FAS)), behavior factors (Fe Tablets consumption, consumption of iron-rich food, consumption of iron absorption inhibitors), Utilization of the PKPR's nutrition services (nutrition counseling, nutrition education, receiving Fe Tablets or hemoglobin level screening), knowledge about anemia, attitude about anemia prevention's behavior. All the questionnaires were developed according to the literature review and were tested for validity and reliability. All the questionnaires were valid and had a Cronbach's alpha score of more than 0.6, indicating good internal consistency.

The Family Affluence Scale, which consists of six questions, was used as a proxy for the adolescent's family welfare using the FAS III (FAS-III) questionnaire (Hobza *et al*., 2017). The Indonesian version of the questionnaire had five valid questions. The study also assessed nutrition services utilization, including counseling, education, iron tablets, and hemoglobin screening. Students were classified as utilizing if they utilized all four components of nutrition services. The frequency of using iron tablets was assessed, with routine usage being 4 times a week. The consumption of iron absorption inhibitors was evaluated using a five-point Likert scale. The consumption of iron-rich food was assessed by evaluating the frequency of consuming iron-rich foods like red meat, fish, eggs, tofu or tempeh, green leafy vegetables, and fruit.

The dependent variable was anemia. The anemia status of the respondents was measured using the internationally accepted cyanmethemoglobin methods. A 10 μL sample of venous blood, previously treated with an anticoagulant, was mixed with 2.5 mL of Drabkin's diluting solution. The absorbance of the combination was quantified at a wavelength of 540 nm using a Microlab 300 Semi-Automated Chemistry Analyzer spectrophotometer after 5 minutes. A sole certified laboratory technician conducted the laboratory procedures, including dilution preparation and absorbance reading. The laboratory measured the hemoglobin levels in grams per deciliter (g/dL) with a precision of three decimal places. Univariate analysis and a bivariate logistic regression were conducted, and statistical significance was established if the p-value was below 0.05. Using purposeful selection modeling, multiple logistic regressions were conducted to identify major deciding factors of anemia. The ultimate model selection was made based on the AIC and BIC values and the Pseudo R2 values. The Hosmer-Lemeshow goodness of fit test assesses the quality of a multivariate model.

Result And Discussion

Table 1 shows a concise overview of the respondents' demographics and socioeconomic features of the parents, as well as the family affluence scale. Based on the table, it is evident that most responders were sixteen years old. More than half of the respondents came from families with highly educated parents. About 25% of the respondents had unemployed mothers, whereas nearly all fathers were employed. Most of the participants were unaware of the parents' income and expenditures. Therefore, we utilized the Family Affluence Scale (FAS) to measure the wealth of the participants' families. The findings revealed that a majority of the respondents, precisely 68.98%, were from families with low levels of affluence.

TABLE 1. Respondents' Characteristics

Characteristics	n	%
Class		
Ten grade	155	56.36%
Eleven grade	120	43.64%
Age		
13	1	0.36%
15	45	16.36%
16	143	52.00%
17	83	30.18%
18	3	1.09%
Fathers' education		
Elementary	16	5.82
Junior High School	17	6.18
Senior High School	109	39.64
College	133	48.36
Mothers' education		
Elementary	13	4.73
Junior High School	19	6.91
Senior High School	111	40.36
College	132	48.00
Fathers' Job		
Unemployed	7	2.55
Civil Servants	37	13.45
Entrepreneur	89	32.36
Permanent Employee	40	14.55
Farmer	2	0.73
Others	100	36.36
Mothers' Job		
Unemployed	69	25.09
Civil Servants	28	10.18
Entrepreneur	62	22.55
Permanent Employee	31	11.27
Farmer	2	0.73
Others	83	30.18
Father's income		
unaware	154	56.00
< Rp. 2.000.000	44	16.00
Rp.2.000.000- Rp.5.000.000	50	18.18
>Rp.5.000.000	27	9.82
Mother's income		
Unaware	189	68.73
< Rp. 2.000.000	37	13.45

Characteristics	n	%
Rp.2.000.000- Rp.5.000.000	37	13.45
>Rp.5.000.000	12	4.36
Expenses		
Unaware	215	78.18
< Rp. 2.000.000	23	8.36
Rp.2.000.000- Rp.5.000.000	27	9.82
>Rp.5.000.000	10	3.64
Family Affluence Scale (FAS)		
Low	189	68.98
Middle High	85	31.02
Fe Tablets Consumption		
0 tablet	148	53.82
1 – 2 tablets	96	34.91
3 tablets	20	7.27
4 tablets	11	4
Consumption of iron-rich food		
Insufficient	228	82.91
Sufficient	47	17.09
Consumption of Fe inhibitors		
High	115	41.82
Low	160	58.18
Parents' support		
Not supportive	136	49.45
Supportive	139	50.55
Knowledge		
Low	131	47.64
High	144	52.36
Anemia Status		
Normal	171	62.18
Anemia	104	37.82

Source: Primary Data, 2024

Table 2 shows that most respondents had utilized one of the four components of the PKPR nutrition service. The Fe Tablet program was the most widely used nutrition service provided by PKPR, as almost all respondents received Fe Tablets from the program. Only 60% of the responders obtained anemia screening or a Hemoglobin examination. Data showed that most respondents received all the nutrition services provided by teachers or health professionals in the school setting. Based on the PKPR's nutrition service utilization data, only 39,27% of respondents received all components of the nutrition service altogether.

The female students' mean and median Hemoglobin concentrations (n = 275) were 12.122 (SD = 1.72) and 12.43 g/dL, respectively. The study found that the prevalence of anemia was 37.82%. Of the female students with anemia, 5.09% had mild anemia, and 32.73% had moderate anemia. Compared to the national data, this current study's prevalence is higher than the national data, which was 32% (Kemenkes RI, 2018). This could indicate regional disparities in the frequency of anemia

TABLE 2. Description of Respondents' PKPR's Nutrition Service Utilization

Characteristics	n	%
Received Fe Tablets from the PKPR service		
No	13	4.73
Yes	262	95.27
School[a]	256	97.70
Puskesmas[a]	30	11.45
Received Nutrition Counselling from the PKPR service		
No	104	37.82
Yes	171	62.18
School[a]	162	94.18
Teacher[*]	13	8.03
Health worker[*]	149	91.97
Puskesmas[a]	35	20.48
Received Anemia Screening from the PKPR service		
No	110	40.00
Yes	165	60.00
School[a]	157	98.12
Puskesmas[a]	37	22.42
Received Nutrition Education from the PKPR service		
No	79	28.73
Yes	196	71.27
School[a]	189	96.42
Teacher[*]	26	13.76
Health worker[*4]	163	86.24
Puskesmas[a]	37	18.87
PKPR Nutrition service utilization		
No	167	60.73
Yes	108	39.27

Note: [a]=place of student received the service [*]=by whom the service is delivered
Source: Primary Data, 2024

among adolescents throughout various areas of the country. Research conducted in multiple locations in Indonesia has found that the prevalence of anemia among adolescent girls ranges from 19% to 45% (Agustina *et al*., 2020, 2021; Knijff *et al*., 2021; Sari, Judistiani, *et al*., 2022). Compared to the prevalence of anemia in other countries, this study's prevalence was similar to a previous study in rural areas of Saudi Arabia, which found 39.1% (Madani *et al*., 2022), and lower than that found in other developing countries, Tanzania and India, with a prevalence of 53.3% and 71.7%, respectively (Subramanian *et al*., 2022; Yusufu *et al*., 2023). However, the prevalence of anemia in the range of 20% to 39.9% is considered a moderate public health problem that needs to be addressed.

Table 3 provides a bivariate analysis of factors associated with the anemia status of female students. Mothers' employment status was the only factor statistically significant with anemia. Other variables, such as socioeconomic factors, behavioral factors, knowledge, attitude, and utilization of the PKPR nutrition service, were not significantly associated with anemia. In multivariable analysis, Table 3 shows a higher prevalence of anemia related to fathers with permanent jobs, with an OR value of 1.813 95% CI 1.049-3.133. A higher prevalence of anemia was also associated with working mothers, with an OR value of 2.174 and 95% CI (1.176-4.020).

TABLE 3. Bivariate Analysis of Factors Associated with Anemia in Adolescents.

Variables	n(%)	Anemia Status		COR	P-value
		Non-Anemia	Anemia		
Fathers' Job					
Permanent job	77 (28)	41 (53.25)	36 (46.75)	1.678 (0.982-2.866)	0.058
Impermanent job	198 (72)	130 (65.66)	68 (34.34)		
Mothers' employment status					
Working	206 (74.9)	120 (58.25)	86 (41.75)	2.030 (1.109-3.716)	0.022
Not working	69 (25.1)	51 (73.91)	18 (26.09)		
Fathers' education					
High	242 (88)	147 (60.74)	95 (39.26)	1.723 (0.767-3.867)	0.187
Low	33 (12)	24 (72.73)	9 (27.27)		
Mothers' education					
High	243 (88.3)	149 (61.32)	94 (38.68)	1.387 (0.629-3.060)	0.417
Low	32 (11.7)	22 (68.75)	10 (31.25)		
FAS					
Middle High	85 (30.9)	47 (55.29)	38 (44.71)	1.506 (0.894-2.538)	0.124
Low	189 (69.1)	123 (65.08)	66 (34.92)		
Parents' Support					
Supportive	139 (50.54)	86 (61.87)	53 (38.13)	1.027 (0.630-1.672)	0.914
Not supportive	136 (49.46)	85 (62.50)	51 (37.50)		
Knowledge					
High	144 (52.4)	88 (61.11)	56 (38.89)	1.100 (0.675-1.793)	0.701
Low	131 (47.6)	83 (63.36)	48 (36.64)		
Attitude					
Positive	167 (60.72)	107 (64.07)	60 (35.93)	0.815 (0.496-1.341)	0.422
Negative	108 (39.28)	64 (59.26)	44 (40.74)		
PKPR Nutrition service utilization					
Yes	108 (39.27)	63 (58.33)	45 (41.67)	1.307 (0.795-2.149)	0.290
No	167 (60.73)	108 (64.67)	59 (35.33)		
Received Fe Tablets from the PKPR service					
Yes	262 (95.27)	162 (61.83)	100 (38.17)	1.388 (0.416-4.629)	0.593
No	13 (4.73)	9 (69.23)	4 (30.77)		
Received Nutrition Counselling from the PKPR service					
Yes	171 (62.18)	104 (60.82)	67 (60.82)	1.166 (0.703-1.933)	0.550
No	104 (82)	67 (64.42)	37 (35.58)		

Variables	n(%)	Anemia Status		COR	P-value
		Non-Anemia	Anemia		
Received Nutrition Education from the PKPR service					
Yes	196 (71.27)	118 (60.20)	78 (39.80)	1.347 (0.777-2.334)	0.288
No	79 (28.73)	53 (67.09)	26 (32.91)		
Received Anemia Screening from the PKPR service					
Yes	165 (60)	96 (58.18)	69 (41.82)	1.540 (0.928-2.556)	0.095
No	110 (40)	75 (68.18)	35 (31.82)		
Fe Tablets Consumption					
Regularly	61 (22.18)	38 (62.30)	23 (37.70)	0.993 (0.552-1.787)	0.984
Irregularly	214 (77.82)	133 (62.15)	81 (37.85)		
Consumption of iron-rich food					
Sufficient	160 (58.18)	98 (61.25)	62 (38.75)	1.099 (0.670-1.804)	0.707
Insufficient	115 (41.82)	73(63.48)	42 (36.52)		

Source: Primary Data, 2024

Table 4 shows the multivariable analysis of factors associated with anemia in adolescents. Respondents whose father had a permanent job and the mother was a working mother had a higher chance of getting anemia with an OR value of 1.795 with a 95% CI of 1.037-3.103, and an OR value of 2.15 with a 95% CI of 1.16-3.98, respectively. Another factor, PKPR Nutrition services' utilization, was not related to the anemia status of adolescents.

This study suggests that the factor associated with anemia was the father's job. Anemia was more frequent in families where the father had a permanent job. This result is similar to a previous study that found the social determinant of the parent was related to the adolescent's anemia status (Ekasanti *et al*., 2020; Gedefaw *et al*., 2015; Mulianingsih *et al*., 2021). A prior study in Indonesia found the same results of factors correlated to adolescent iron intake, which found that adolescents who had fathers who worked in the informal sector had higher iron intake. Father's employment in the informal sector is beneficial in choosing and determining iron intake. It is hypothesized that the role of fathers in controlling the quantity, type, and quality of foods for households will be more significant due to having more time to communicate and interact with mothers (Aji *et al*., 2021).

The mother's employment status, which was working, is associated with anemia as well. This finding is similar to previous studies that found that a mother's socioeconomic factors related to adolescent anemia status(Agustina *et al*., 2021; Subramanian *et al*., 2022). A previous study found that mothers who work in private services and are self-employed were at higher risk of anemia (Habib *et al*., 2020). This is probably due to the long working hours, which could lead to less time to practice choosing ingredients, buying and cooking nutritious foods, and paying attention to their child's eating pattern and daily food intake. The previous qualitative studies found that adolescents had poor meal regularity and preferred food purchased in the street rather than traditional home-cooked meals. Working makes less time for a mother to supervise her children's daily dietary intake(Gillespie *et al*., 2023). Future research should explore how fathers' employment sector influences household nutrition choices and how mothers' work schedules impact their ability to support

TABLE 4. Multiple Logistic Regression Model of Factors Associated with Anemia in Adolescents

Variables	SE	P	OR (95% CI)
Father's job (permanent job)	0.503	0.036*	1.795 (1.037-3.103)
Mother's employment status (working)	0.675	0.014*	2.15 (1.16-3.98)
PKPR Nutrition service utilization (Yes)	0.329	0.350	1.27(0.76- 2.11)

Note: *=p-value <0.05, Quality of the model= Pseudo R2:3%, Goodness of fit test value=0.300. AIC=361.73, BIC=376.19

Source: Primary Data, 2024

adolescents' diets. Health services could use these insights to create targeted educational programs for fathers and practical resources for working mothers to help families prevent anemia.

Interestingly, behavior factors, including iron-rich food and Fe tablet consumption, were not associated with anemia status. This study's results were different from the previous studies, which found that frequent consumption of animal-based iron-rich foods, protein intake, and Fe tablet consumption were significantly associated with a lower risk of anemia (Knijff *et al*., 2021; Mulianingsih *et al*., 2021; Sari, Judistiani, *et al*., 2022). This is probably due to the etiology of the anemia, not only because of iron deficiency. A prior systematic review of Indonesian adolescent anemia found that, on average, 53% to 58% of anemia cases could be explained by iron deficiency, whereas 42% to 47% could not and are caused by other underlying causes (Zutphen *et al*., 2021). Although iron deficiency seems to be a significant cause of anemia in Indonesian adolescents, a similar proportion of anemia cases are due to other causes and are unlikely to be resolved with iron supplementation only(Muwakhidah *et al*., 2024; Zutphen *et al*., 2021). Therefore, future studies should include measures of more than one etiology of anemia and measure its determinant factors (Shaban *et al*., 2020).

An interesting finding of this study was that PKPR nutrition service utilization did not correlate with adolescents' anemia status. One of the services provided through PKPR was the Fe tablet distribution. Almost all the female students received the Fe tablet distribution. Surprisingly, this study found about half of the respondents (53.8% (Table 1)) never consumed the Fe tablet that they got. This could explain why the utilization of the service did not affect the anemia status, since this distribution of Fe tablets did not guarantee the consumption of Fe tablets. If adolescents consume iron (Fe) tablets routinely, it can increase hemoglobin levels, thereby reducing the risk of anemia, as indicated by previous studies (Muwakhidah *et al*., 2024). A prior qualitative study in India found that most adolescents rarely consume the given Fe tablets; adolescents take the tablet, hide it, or throw it away (Gillespie *et al*., 2023). Moreover, a previous qualitative study in Indonesia stated that health workers only entrusted Fe tablet distribution to teachers, and often, no further monitoring was carried out to determine whether the tablets were distributed evenly or whether the adolescents were consuming the tablets (Sari, Herawati, *et al*., 2022b). A previous study found that the direct observed consumption of Fe tablets by teachers improves adherence and increases haemoglobin (Meilani & Setiyawati, 2023). Therefore, adding monitoring for consuming the tablet would be beneficial in improving the effectiveness of Fe distribution programs. Nevertheless, this Fe tablet distribution needs to be evaluated since compliance with taking Fe tablets is still low, discontinuation program during school holidays, and the nature of the program was a "blanket approach," meaning that all adolescents are given iron supplements without first undertaking a hemoglobin test (Sungkar *et al*., 2022). This Fe tablet distribution needs further evaluation to increase the efficiency of PKPR's nutrition service delivery.

This study also found that most students utilized PKPR counseling and education services in schools, 94.18% and 96.4%, respectively. In schools, the health worker conducts PKPR's health education and counseling services annually. Most female students utilized counseling and education services by health workers, even though the service was

conducted in schools. A prior qualitative study in Indonesia found that PKPR service delivery is still lacking in many aspects, including limited facilities and infrastructure. PKPR's counseling service often could not be conducted due to the unavailability of the counseling room in Puskemas or schools, or inappropriate rooms, such as outside the classroom. Besides, the quality of the counseling and education services provided was also lacking due to the lack of communication skills of health workers (Sari, Herawati, *et al*., 2022b). The previous study found that counseling and education about nutrition improve adolescents' behavior (Firmansyah *et al*., 2020). The inadequate implementation of the program probably affects the fact that PKPR's nutrition service does not yet have an impactful outcome, which is to reduce the frequency of anemia. This could indicate that the PKPR nutrition service needs a thorough evaluation following an improvement to achieve its target of reducing the prevalence of anemia in adolescents. A qualitative study about the review of the implementation of PKPR in Surakarta needs to be conducted before improving the implementation of PKPR's nutrition service.

This is the first study in Indonesia that investigated the outcome of PKPR's nutrition service, which was the anemia status of adolescents. Since the evaluation uses a quantitative descriptive evaluation, exploring any implementation aspect is inadequate. Besides, since the assessment uses a cross-sectional design, the causality of the program and the outcome are unclear. An improved outcome evaluation of PKPR's nutrition service is needed, using a longitudinal design to define the causalities. A qualitative study is also required to explore more aspects of program implementation. Another limitation is the use of frequency questionnaires on food consumption, which could lead to recall bias. The use of 7-day food frequency questionnaires or 24-hour food recalls provided a better estimate of food consumption than the recall of frequency, as this study provided. Therefore, further study should improve the measurement of iron-rich and Fe-enhancer food consumption.

Conclusion

All in all, this suggests that the father's and mother's employment status is associated with adolescents' anemia status. Other factors, such as parent education, family affluence scale, behavior factors, parent support, knowledge, attitude, perception, and self-efficacy, were not associated with anemia status. Moreover, health program factors, namely PKPR's nutrition service utilization, did not correlate with adolescents' anemia status. Further research is needed to evaluate the implementation of the PKPR's nutrition service and investigate the impact of the PKPR's nutrition service on adolescent health outcomes. Future research should examine how fathers' job sectors and mothers' work hours impact adolescent nutrition. Health services can use these insights to develop targeted support for families to help prevent anemia in adolescents.

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References

Agustina, R., Nadiya, K., El Andini, A., Setianingsih, A.A., Sadariskar, A.A., Prafiantini, E., Wirawan, F., Karyadi, E., & Raut, M.K., 2020. Associations of Meal Patterning, Dietary Quality and Diversity With Anemia and Overweight-Obesity Among Indonesian Schoolgoing Adolescent Girls in West Java. *PLoS ONE*, 15(4), pp.1–19.

Agustina, R., Wirawan, F., Sadariskar, A.A., Setianingsing, A.A., Nadiya, K., Prafiantini, E., Asri, E.K., Purwanti, T.S., Kusyuniati, S., Karyadi, E., & Raut, M.K., 2021. Associations of Knowledge, Attitude, and Practices toward Anemia with Anemia Prevalence and Height-for-Age Z-Score among Indonesian Adolescent Girls. *Food and Nutrition Bulletin*, 42(1_suppl), pp.S92–S108.

Aji, G.K., Laily, N., & Susanti, I., 2021. Iron Intake Among Adolescent Girls Based on Family Socio-Economic, Frequent High-Iron Foods Consumed and Knowledge About Anemia in Pandeglang District. *Media Gizi Indonesia*, 16(1), pp.17.

Alimin Bin Alias., Dewanti, L., & Qorib, M.F., 2023. The Comparison of Factors That Can

Influence Utility of Primary Health Care Among Youth Community in Indonesia and Malaysia. *World Journal of Advanced Research and Reviews*, 17(1), pp.111–118.

Andriastuti, M., Ilmana, G., Nawangwulan, S.A., & Kosasih, K.A., 2020. Prevalence of Anemia and Iron Profile Among Children and Adolescent With Low Socio-Economic Status. *International Journal of Pediatrics and Adolescent Medicine*, 7(2), pp.88–92.

Barida, I., Nurmansyah, M.I., & Sabilla, M., 2019. An Evaluation of Youth Care Health Program (PKPR) in Public Health Center in Jakarta, Indonesia. *ICSDH 2018*, pp.56–60.

Basnet, T., Sitaula, S., Sah, M.K., & Yadav, P., 2022. Analysis of Causes and Contributory Factors for Maternal Mortality during Covid-19 Lockdown. *International Research Journal of Multidisciplinary Scope*, 3(2), pp.22–28.

Chaparro, C.M., & Suchdev, P.S., 2019. Anemia Epidemiology, Pathophysiology, and Etiology in Low- and Middle-Income Countries. *Ann N Y Acad Sci.*, 1450(1), pp.15–31.

Ekasanti, I., Adi, A.C., Yono, M., Nirmala G,F., & Isfandiari, M.A., 2020. Determinants of Anemia among Early Adolescent Girls in Kendari City. *Amerta Nutrition*, 4(4), pp.271.

Firmansyah, F., Tamtomo, D.G., & Cilmiaty, R., 2020. Comparing the Effect of Nutritional Booklets and Social Media on Knowledge and Consumption of Fattening Foods among Adolescents in Surakarta, Indonesia. *International Journal of Nutrition Sciences*, 5(2), pp.84–89.

Gedefaw, L., Tesfaye, M., Yemane, T., Adisu, W., & Asres, Y., 2015. Anemia and Iron Deficiency Among School Adolescents: Burden, Severity, and Determinant Factors in Southwest Ethiopia. *Adolescent Health, Medicine and Therapeutics*, 189.

Gillespie, B., Katageri, G., Salam, S., Ramadurg, U., Patil, S., Mhetri, J., Charantimath, U., Goudar, S., Dandappanavar, A., Karadiguddi, C., Mallapur, A., Vastrad, P., Roy, S., Peerapur, B., & Anumba, D., 2023. Attention for and Awareness of Anemia in Adolescents in Karnataka, India: A Qualitative Study. *PLoS ONE*, 18(4), pp.1–15.

Gonete, K.A., Tariku, A., Wami, S.D., & Derso, T., 2018. Prevalence and Associated Factors of Thinness Among Adolescent Girls Attending Governmental Schools in Aksum Town, Northern Ethiopia. *Archives of Public Health*, 2018, pp.158–164.

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. *Anemia*, 2020.

Hobza, V., Hamrik, Z., Bucksch, J., & De Clercq, B., 2017. The Family Affluence Scale as an Indicator for Socioeconomic Status: Validation on Regional Income Differences in the Czech Republic. *International Journal of Environmental Research and Public Health*, 14(12).

Kemenkes RI., 2018. *Laporan Hasil Riset Kesehatan Dasar tahun 2018*. Badan Penelitian dan Pengembangan Kesehatan Kemenkes RI.

Kementrian Kesehatan RI., 2014. *Pedoman Standar Nasional Pelayanan Kesehatan Peduli Remaja (PKPR)*.

Knijff, M., Roshita, A., Suryantan, J., Izwardy, D., & Rah, J.H., 2021. Frequent Consumption of Micronutrient-Rich Foods Is Associated With Reduced Risk of Anemia Among Adolescent Girls and Boys in Indonesia: A Cross-Sectional Study. *Food and Nutrition Bulletin*, 42(1_suppl), pp.S59–S71.

Madani, B.M., Alsulami, A.M., Abu alola, I.A., Alasmari, S.M., Khoujah, F.M., Andijani, O.M., Alhomrani, M.A., Alhomrani, S.S., Alquhaibi, S.S., Alsulami, F.S., Ibrahim, W.A., Abu alola, B.A., & Alqarni, A.H., 2022. Prevalence of Anemia Among Children and Adolescents in Rural Area of Khulais in Saudi Arabia. *Cureus*, 14(2), pp.14–18.

Meilani, N., & Setiyawati, N., 2023. Directly Observed Treatment for Iron Tablet Supplements Consumption Among Female Senior High School Students. *Kemas*, *18*(3), pp.375–382.

Mengistu, G., Azage, M., & Gutema, H., 2019. Iron Deficiency Anemia among In-School Adolescent Girls in Rural Area of Bahir Dar City Administration, North West Ethiopia. *Anemia*, 2019, pp.1–9.

Mulianingsih, M., Nurmayani, W., Oktaviani, E., Pertiwi, A.N., & Info, A., 2021. Factors Affecting Anemia Status in Adolescent Girls Misroh. *Journal of Health Education*, 6(1), pp.27–33.

Muwakhidah, M., Rahmawaty, S., Rakhma, L.R., Widiyaningsih, E.N., Hidayati, L., & Rusdanurmaala, S., 2024. Pil-Pintar Intervention Reduce Anemia among Young Teen Girls: A Pilot Study. *Current Nutrition & Food Science*, 20(8), pp.1000–1005.

Nooteboom, L.A., Mulder, E.A., Kuiper, C.H.Z., Colins, O.F., & Vermeiren, R.R.J.M., 2021. Towards Integrated Youth Care: A Systematic Review of Facilitators and Barriers for Professionals. *Administration and Policy in*

Mental Health and Mental Health Services Research, 48(1), pp.88–105.

Pham, M.D., Sawyer, S.M., Agius, P.A., Kennedy, E.C., Ansariadi, A., Kagilis, F., Wiguna, T., Wulan, N.R., Devaera, Y., Medise, B.E., Riyanti, A., Wiweko, B., Cini, K.I., Tran, T., Fisher, J., Luchters, S., & Azzopardi, P.S., 2023. Foregone Health Care in Adolescents From School and Community Settings in Indonesia: A Cross-Sectional Study. *The Lancet Regional Health - Southeast Asia*, 13(April), pp.100187.

Sari, P., Herawati, D.M.D., Dhamayanti, M., & Hilmanto, D., 2022a. Anemia among Adolescent Girls in West Java, Indonesia: Related Factors and Consequences on the Quality of Life. *Nutrients*, 14(18), pp.1–13.

Sari, P., Herawati, D.M.D., Dhamayanti, M., & Hilmanto, D., 2022b. Aspectos Fundamentales del Desarrollo de un Modelo de Sistema Integrado de Atención a la Salud para la Prevención de la Anemia Ferropénica en Adolescentes: Un estudio cualitativo. *International Journal of Environmental Research and Public Health*, 19(21).

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, pp.1137–1147.

Shaban, L., Al-Taiar, A., Rahman, A., Al-Sabah, R., & Mojiminiyi, O., 2020. Anemia and Its Associated Factors Among Adolescents in Kuwait. *Scientific Reports*, 10(1), pp.1–9.

Subramanian, M., Malhotra, S., Kant, S., Goswami, K., Perumal, V., & Kaloiya, G., 2022. Prevalence of Anemia Among Adolescent Girls Residing in Rural Haryana: A Community-Based Cross-Sectional Study. *Cureus*, 14(1), pp.1–9.

Sungkar, A., Bardosono, S., Irwinda, R., Manikam, N.R.M., Sekartini, R., Medise, B.E., Nasar, S.S., Helmyati, S., Ariani, A.S., Nurihsan, J., Nurjasmi, E., Khoe, L.C., Dilantika, C., Basrowi, R.W., & Vandenplas, Y., 2022. A Life Course Approach to the Prevention of Iron Deficiency Anemia in Indonesia. *Nutrients*, 14(2), pp.1–8.

WHO., 2023. *Anaemia in Women and Children*. The Global Health Observatory.

World Health Organization., 2023. *Accelerating Anaemia Reduction*. World Health Organization.

Yusufu, I., Cliffer, I.R., Yussuf, M.H., Anthony, C., Mapendo, F., Abdulla, S., Masanja, M., Tinkasimile, A., Ali, A.S., Mwanyika-Sando, M., & Fawzi, W., 2023. Factors Associated with Anemia Among School-Going Adolescents Aged 10–17 Years in Zanzibar, Tanzania: A Cross Sectional Study. *BMC Public Health*, 23(1), pp.1–17.

Zutphen, K.G., van Kraemer, K., & Melse-Boonstra, A., 2021. Knowledge Gaps in Understanding the Etiology of Anemia in Indonesian Adolescents. *Food and Nutrition Bulletin*, 42(1_suppl), pp.S39–S58.