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DETERMINANTS OF IRON SUPPLEMENTATION ADHERENCE AMONG ADOLESCENT GIRLS: THE ROLE OF KNOWLEDGE AND FAMILY SUPPORT

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ABSTRACT

Anemia remains an important public health problem among adolescent girls, while the success of iron supplementation programs depends substantially on adherence. Knowledge and family support are behavioral factors that may strengthen adherence. To analyze the association between knowledge of anemia and family support with adherence to iron supplementation among adolescent girls. This quantitative analytical cross-sectional study included 106 respondents selected using purposive sampling from a population of 144 female students.Data were collected using validated and reliable questionnaires assessing knowledge, family support, and adherence, with hemoglobin assessment included in the study protocol. All questionnaire items demonstrated acceptable validity ($r = 0.361–0.842$; $p < 0.05$), with good internal consistency (Cronbach's $\alpha = 0.781–0.912$).. Univariate analysis described variable distributions, while associations between knowledge and family support with adherence were analyzed using the chi-square test and Odds Ratios (ORs) with 95% confidence intervals (CIs). Overall, 54.7% of respondents had good knowledge and 53.8% were reported to be adherent to iron supplementation. The reported analysis identified a significant association between knowledge and adherence (p=0.001; OR=6.400; 95% CI 1.930–21.223) and between family support and adherence (p<0.001; OR=8.542; 95% CI 2.872–25.403). Knowledge and family support were associated with adherence to iron supplementation. Family support showed the larger reported measure of association. These findings support strengthening school-based supplementation strategies through anemia education, reminders, and family engagement. However, the reported cross-tabulations and OR estimates should be verified against the raw dataset before submission because of internal inconsistencies in the source tables.

Keywords: adherence; adolescent girls; anemia; family support; iron supplementation; indonesia; knowledge

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INTRODUCTION

Anemia remains a major public health concern, particularly among adolescent girls and women of reproductive age. Adolescent girls are especially vulnerable because iron requirements increase during rapid growth and because menstruation causes recurrent iron loss. WHO guidance recognizes iron supplementation as an evidence-informed strategy for preventing anemia and iron deficiency among menstruating adolescent girls and women, particularly in populations at risk (World Health Organization [WHO], 2016, 2018).

In Indonesia, anemia among adolescents remains a relevant public health issue. The Indonesian Health Survey (SKI) 2023, as cited in the source material, reported an anemia prevalence of 18% among females aged 15–24 years, compared with 14.4% among males (Ministry of Health of the Republic of Indonesia, 2023). This burden reinforces the importance of preventive interventions during the school years through iron supplementation and behavior-change strategies. The effectiveness of supplementation programs depends not only on tablet availability but also on whether adolescent girls consume the tablets according to the recommended regimen. A systematic review found that adherence to iron supplementation among adolescent girls is influenced by personal, social, environmental, and regimen-related factors; interventions involving supervision and monitoring may improve adherence (Silitonga et al., 2023). Indonesian evidence also indicates

that social support from parents, teachers, peers, and health workers can facilitate adherence through information, encouragement, and reminders (Silitonga et al., 2025).

Knowledge is a predisposing factor in health behavior. Adolescents who understand the benefits, dosage, and potential adverse effects of iron supplementation may be better able to recognize its value and maintain the recommended behavior. Nevertheless, knowledge alone may not be sufficient when adolescents experience barriers such as forgetting, concerns about adverse effects, negative perceptions, or limited environmental support. Recent Indonesian evidence identified forgetting, unpleasant taste or smell, negative experiences, misconceptions, and insufficient parental support as barriers, whereas perceived benefits and parental support were reported as facilitators. Against this background, this study examined the association of knowledge about anemia and family support with adherence to iron supplementation among adolescent girls. Specifically, the study described respondent characteristics, knowledge, family support, and adherence, and assessed the associations of knowledge and family support with adherence.

METHOD

This study used a quantitative analytical cross-sectional design. Independent and dependent variables were measured during the same study period to assess statistical associations between knowledge, family support, and adherence to iron supplementation. The study was conducted from April to July 2025 at one private school in Tangerang Regency, Indonesia. The study population comprised 144 female students, of whom 106 respondents were included in the analysis. The reported sampling method was non-probability purposive sampling. Inclusion criteria were active enrollment, willingness to participate with informed consent, and attendance during data collection. Students who were severely ill or absent, declined participation, or returned incomplete questionnaires were excluded. Knowledge and family support were independent variables, while adherence to iron supplementation was the primary dependent variable. Knowledge covered the benefits, dosage, adverse effects, and importance of iron supplementation, while family support comprised informational, instrumental, appraisal, and emotional support. Adherence was assessed based on the recommended dose and frequency of iron tablet consumption. All questionnaire items demonstrated acceptable validity ($r = 0.361–0.842$; $p < 0.05$), while reliability testing showed good internal consistency, with Cronbach's alpha values ranging from 0.781 to 0.912.

Data were collected through self-administered questionnaires completed with researcher assistance. The study protocol also included hemoglobin assessment. Data were entered and cleaned using IBM SPSS Statistics 23. Univariate analysis was presented as frequencies and percentages. Associations between knowledge and family support with adherence were assessed using the chi-square test at $\alpha=0.05$, with ORs and 95% CIs used to describe the magnitude of association. The protocol also planned multivariable analysis to identify the dominant factor, but the multivariable output was not available in the source material and was therefore not interpreted.

RESULT

Table 1.
Respondent Characteristics

Characteristic	Category	f	%
Age	10–11 years	0	0.0
	12–13 years	86	81.1
	14–15 years	20	18.9
Grade	10	70	66.0
	11	36	34.0
	12	0	0.0
Birth order	First	42	39.6
	Second	35	33.0
	Third	18	17.0
	Fourth	9	8.5

Characteristic	Category	f	%
	Fifth	2	1.9
Ethnicity	Javanese	17	16.0
	Sundanese	88	83.0
	Batak	1	0.9
	Minangkabau/Padang	0	0.0
Living arrangement	Boarding house	1	0.9
	Sibling	1	0.9
	Parents	104	98.1
	Dormitory	0	0.0
Mother's occupation	Housewife	93	87.7
	Private-sector employee	10	9.4
	Teacher	3	2.8
	Nurse	0	0.0
Mother's education	Elementary school	46	43.4
	Junior high school	26	24.5
	Senior high school	29	27.4
	Higher education	5	4.7

Note: n=106. Percentages follow the source data; rounding may result in category totals that do not appear to equal exactly 100%.

A total of 106 respondents were analyzed. Most respondents were aged 12–13 years (81.1%), were in Grade 10 (66.0%), were first-born children (39.6%), were of Sundanese ethnicity (83.0%), and lived with their parents (98.1%). Most mothers were housewives (87.7%), and the most common highest maternal education level was elementary school (43.4%).

Table 2.

Knowledge, family support, and adherence to iron supplementation

Variable	Category	f	%
Knowledge	Good	58	54.7
	Poor	48	45.3
Family support	Good	50	47.2
	Poor	56	52.8
Adherence	Adherent	57	53.8
	Non-adherent	49	46.2

Note: Family-support percentages of 47.2% and 52.8% were calculated from n=106 for consistency of presentation.

Table 3.

Association between knowledge and adherence to iron supplementation

Knowledge	Adherent n (%)	Non-adherent n (%)	Total n	p-value	OR (95% CI)
Good	43 (74.14)	15 (25.86)	58	0.001	6.400 (1.930–21.223)
Poor	24 (50.00)	24 (50.00)	48		

According to the reported study results, knowledge was significantly associated with adherence (p=0.001), with an OR of 6.400 (95% CI 1.930–21.223). However, the cross-tabulation in the source is internally inconsistent with the overall adherence total in Table 2. Therefore, the reported OR should be verified against the raw dataset before publication.

Table 4.

Association between family support and adherence to iron supplementation

Family support	Adherent n (%)	Non-adherent n (%)	Total n in source table	p-value	OR (95% CI)
Good	42 (84.00)	8 (16.00)	50	<0.001	8.542 (2.872–25.403)
Poor	35 (83.33)	21 (16.67*)	42*		

Important note: The source table reports a total of 42 respondents in the low-family-support group, whereas Table 2 reports 56 respondents. In addition, 21/42 is displayed as 16.67%, although mathematically it equals 50%. The table therefore reproduces the reported source figures and should not be treated as a final publication table until verified.

DISCUSSION

Respondent characteristics and anemia-risk context

The predominance of respondents aged 12–13 years indicates that most participants were in early adolescence. This developmental period is characterized by rapid growth and, among menstruating girls, increased iron requirements. These characteristics make anemia prevention during the school years particularly relevant. WHO recommends iron supplementation as a public health strategy for preventing anemia among menstruating adolescent girls in settings where the risk is substantial (WHO, 2016, 2018). Nearly all respondents lived with their parents (98.1%). This household structure provides a potentially important context for family-based interventions because parents can provide reminders, help manage complaints, and reinforce health-related norms at home. Indonesian evidence indicates that parents represent an important source of information and reminders for iron-folic acid supplementation, alongside teachers, peers, and health workers (Silitonga et al., 2023). The maternal education profile should also be considered because 43.4% of mothers were reported to have elementary-school education as their highest educational attainment. This variable was not tested as a determinant in the available analysis, so no causal or associative conclusion can be drawn. Nevertheless, the finding suggests that family education materials should use simple, concrete, and action-oriented language.

Knowledge of anemia and iron supplementation

More than half of the respondents (54.7%) had good knowledge. Conceptually, knowledge may function as a predisposing factor for health behavior because it helps individuals understand the benefits of an action, the consequences of non-adherence, and how to follow recommendations. The present findings are consistent with the reported association between knowledge and adherence. Broader evidence supports the importance of education while also indicating that education alone may not be sufficient. A 2025 systematic review found that printed materials, audiovisual media, telephone/text messages, social media, games, and peer-group approaches can improve knowledge and adherence to iron supplementation among adolescent girls (Septiana et al., 2025). Thus, the present findings support interventions that combine knowledge enhancement with behavioral reminders.

Family support

In the marginal distribution, 47.2% of respondents were categorized as having good family support, whereas 52.8% were categorized as having poor support. This indicates that adequate family support was not present for the majority of respondents. In the context of weekly supplementation, family support may reinforce adherence through reminders, tablet provision, affirmation of benefits, and assistance when adolescents experience barriers. Research from Indonesia indicates that social support and reminders from parents, teachers, peers, and health workers are relevant to iron-folic acid supplementation adherence (Silitonga et al., 2025). A recent Indonesian pilot study also identified positive parental and peer support as facilitators, while parental restrictions, unpleasant experiences, negative perceptions, and forgetting were reported as barriers. These findings reinforce the view that adherence is embedded within a social environment rather than being solely an individual decision.

Adherence to iron supplementation

Overall, 53.8% of respondents were reported to be adherent and 46.2% non-adherent. Although the adherent group was slightly larger, nearly half of the respondents remained non-adherent. Programmatically, this is important because distribution of tablets through schools does not necessarily ensure that the tablets are consumed according to the recommended regimen. This finding is consistent with Indonesian evidence showing persistent challenges in weekly iron-folic acid supplementation. Baseline research identified low receipt and consumption of weekly iron-folic acid supplements and reported forgetting, perceptions that supplementation was unnecessary, and concerns about adverse effects as common reasons for non-consumption (Khusun et al., 2021).

A systematic review also found that supervision, monitoring, and peer-educator approaches can substantially improve adherence (Silitonga et al., 2023).

Association between knowledge and adherence

According to the reported analysis, knowledge was significantly associated with adherence (p=0.001; OR=6.400; 95% CI 1.930–21.223). Substantively, this suggests that respondents with good knowledge were more likely to be adherent than those with poor knowledge. The direction of this association is consistent with health-behavior theory and evidence from adolescent education interventions. However, the OR should be interpreted cautiously. The available cross-tabulation reports 43 adherent respondents in the good-knowledge group and 24 in the poor-knowledge group, while the overall adherence total is only 57. Therefore, these figures cannot simultaneously form the basis of the reported OR. Before submission, the researcher should audit the raw dataset against the SPSS crosstab, chi-square result, OR, and 95% CI. Conceptually, an association between knowledge and adherence does not imply that increasing knowledge automatically produces adherence. Indonesian studies and systematic reviews indicate that social and environmental factors, adverse-effect experiences, forgetting, and reminder support can also shape supplementation behavior (Silitonga et al., 2023, 2025). Because this study is cross-sectional, the observed association should not be interpreted causally.

Association between family support and adherence

The reported findings indicate a significant association between family support and adherence (p<0.001; OR=8.542; 95% CI 2.872–25.403), with a larger reported measure of association than knowledge. If confirmed using the raw dataset, this result would suggest that family support is an important candidate determinant of iron supplementation adherence. This finding is consistent with evidence that social support can provide information, reminders, and reinforcement. Indonesian research has emphasized the roles of parents, teachers, peers, and health workers and the importance of interpersonal trust in building adherence (Silitonga et al., 2025). A systematic review similarly identified social and environmental factors as important components of iron-supplementation adherence among adolescent girls (Silitonga et al., 2023). Nevertheless, the reported OR for family support is also inconsistent with the marginal distribution and cross-tabulation. The poor-family-support group contains 56 respondents in the univariate distribution but 42 in the bivariate table; moreover, 21/42 is displayed as 16.67%, whereas the arithmetic proportion is 50%. Consequently, the magnitude of association should not be considered final until the data are verified.

Implications for practice

The practical implication is that adherence strategies should not focus solely on distributing iron tablets. School-based programs should integrate anemia education, scheduled reminders, adherence monitoring, and family engagement. Recent Indonesian studies indicate that WhatsApp-based reminders and digital interventions can improve knowledge and adherence to weekly iron-folic acid supplementation (Pasamba et al., 2025, 2026). At the school level, potential strategies include repeated brief education sessions, reminders on supplementation days, consumption records, teacher or peer-educator support, and communication with parents. Such an approach is consistent with evidence that adherence results from interactions among personal, social, environmental, and regimen-related factors (Silitonga et al., 2023).

Study limitations

First, the cross-sectional design limits causal inference. Second, knowledge, family support, and adherence were measured using questionnaires and may therefore be affected by information bias and social desirability bias. Third, purposive sampling from a single school limits generalizability. Fourth, although hemoglobin assessment was included in the protocol, Hb results were not available in the provided results and therefore the relationship between adherence and anemia status could not

be assessed. Fifth, internal inconsistencies were identified between the marginal distributions, bivariate tables, and reported ORs; this analytical issue must be resolved before publication.

CONCLUSION

This study found that more than half of respondents had good knowledge and were reported to be adherent to iron supplementation. The reported analyses indicated significant associations between knowledge and adherence and between family support and adherence. The findings support school-based supplementation strategies that combine anemia education with family support and reminder systems. However, because of inconsistencies in the available cross-tabulations and association measures, the ORs and bivariate distributions must be verified against the raw dataset before submission.

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