Factors Influencing Compliance with Iron Supplementation Among Female Adolescents in Senior High Schools, Samarinda City, 2025

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Article Info	Abstrak
	Anemia pada remaja putri merupakan masalah kesehatan yang signifikan akibat meningkatnya kebutuhan zat besi selama pubertas. Tablet Tambah Darah (TTD) merupakan intervensi penting, namun hasil studi sebelumnya menunjukan bahwa 58,4% remaja putri memiliki tingkat kepatuhan konsumsi yang rendah. Penelitian ini bertujuan menganalisis hubungan antara tingkat pengetahuan dan sikap terhadap konsumsi TTD pada siswi SMA/SMK di Kota Samarinda. Studi ini menggunakan desain potong lintang dengan melibatkan 466 responden dari tiga sekolah menengah. Data dikumpulkan melalui kuesioner daring yang mencakup variabel pengetahuan, sikap, dan konsumsi TTD. Hasil menunjukkan bahwa 47,2% responden memiliki pengetahuan sangat baik dan 90,3% memiliki sikap positif. Analisis bivariat menunjukkan tidak terdapat hubungan signifikan antara pengetahuan dan konsumsi TTD (OR = 1,039; 95% CI: 0,680–1,587; p = 0,860). Sebaliknya, sikap menunjukkan hubungan signifikan, di mana siswi dengan sikap kurang lebih banyak tidak mengonsumsi TTD (OR = 1,613; 95% CI: 1,052–2,471; p = 0,028). Temuan ini menunjukkan bahwa sikap berpengaruh lebih besar daripada pengetahuan dalam mendorong perilaku konsumsi TTD. Intervensi peningkatan kepatuhan konsumsi TTD sebaiknya difokuskan pada pembentukan sikap positif di kalangan remaja putri.

Abstract

Anemia in adolescent girls is a significant health problem due to increased iron requirements during puberty. Iron supplements are an important intervention, but previous studies have shown that 58.4% of adolescent girls have low compliance rates. This study aims to analyze the relationship between knowledge and attitudes toward iron supplement consumption among high school students in Samarinda City. This study used a cross-sectional design involving 466 respondents from three secondary schools. Data were collected through an online questionnaire covering knowledge, attitude, and TTD consumption variables. Results showed that 47.2% of respondents had very good knowledge and 90.3% had a positive attitude. Bivariate analysis showed no significant relationship between knowledge and TTD consumption (OR = 1.039; 95% CI: 0.680–1.587; p = 0.860). Conversely, attitude showed a significant relationship, where students with negative attitudes were less likely to consume TTD (OR = 1.613; 95% CI: 1.052–2.471; p = 0.028). These findings indicate that attitude has a greater influence than knowledge in promoting TTD consumption behavior. Interventions to improve TTD consumption compliance should focus on fostering positive attitudes among adolescent girls.

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INTRODUCTION

Iron and folic acid tablets (commonly known as *Tablet Tambah Darah* or TTD) are supplements essential for the formation of red blood cells, which play a critical role in transporting oxygen from the lungs to tissues throughout the body. Adequate iron intake is particularly important during adolescence—a period marked by rapid growth and development—to support the optimal functioning of organs and physiological systems. Iron deficiency disrupts hemoglobin synthesis and leads to anemia. Adolescent girls are particularly vulnerable to iron-deficiency anemia, with a tenfold higher risk than boys, largely due to menstruation, poor dietary iron intake, suboptimal nutrient absorption, and increased iron requirements during puberty (Mesías et al., 2013; Stabell et al., 2021; Wang et al., 2013; Zia et al., 2022).

The impact of anemia in adolescent girls extends beyond physical health, contributing to reduced immune function and diminished academic performance. While dietary sources of iron such as meat, liver, and fish are vital, supplementation through TTD remains necessary. Starting iron supplementation during adolescence has long-term benefits, including reducing the risk of anemia during pregnancy, minimizing the likelihood of perinatal hemorrhage, and lowering the risk of delivering low birth weight infants (Beard, 2000; Gibson et al., 2002; Habib et al., 2020; Mesías et al., 2013; Misunas et al., 2024; Seyoum et al., 2019). Despite these benefits, adherence to TTD supplementation among adolescents remains low.

Anemia is a multifactorial condition. Prior studies have shown that dietary habits significantly contribute to its incidence (Akib & Sumarmi, 2017), while behavioral factors such as knowledge, attitudes, and practices also play crucial roles (Tambunan et al., 2016). A study conducted in Bangalore, India, revealed that the majority of 100 respondents demonstrated poor knowledge, negative attitudes, and inadequate anemia prevention practices (Chaluvaraj & Satyanarayana, 2018). Behavioral modification through improved dietary habits remains a key strategy in preventing anemia among adolescent girls. However, such efforts alone are often insufficient to meet their elevated iron demands. As a result, government-led interventions such as the distribution of TTD supplements have been introduced as a complementary measure (Kemenkes, 2018).

Adherence to TTD supplementation in Indonesia remains generally low to moderate, with considerable regional and demographic variations. One study found that 58.4% of adolescent girls exhibited low adherence, while 41.6% demonstrated moderate adherence, with no participants reporting high compliance (Runiari & Hartati, 2020). Another study reported that only 1.4% of adolescent girls consistently followed TTD consumption guidelines, far below the national target of 58% compliance by 2024 (Nurjanah & Azinar, 2023). Supporting this, data from the National Population and Family Planning Agency (BKKBN) showed that although 76.2% of adolescent girls received TTD supplements, only 0.9% consumed more than 52 tablets annually (*BKKBN: Kepatuhan Remaja Putri Minum Tablet Tambah Darah Rendah - ANTARA News*, n.d.). In Bogor City, 39% of female students were reported as non-adherent, and 31.4% did not consume the tablets at all, despite having received them (Rahmatasya, 2024). Other studies indicate local variations in adherence rates, ranging between 54.8%

and 66.3% across different schools and adolescent populations (Kesehatan Politeknik Kesehatan Makassar et al., 2024; Saleh & Bakoil, 2021; Uswatun Hasanah et al., 2024).

In Samarinda, the City Health Office recorded 454 anemia cases among female students in senior high schools (SMA/SMK/MA) across 26 health center areas in 2022. A preliminary study conducted at Bengkuring Health Center in 2023 identified 276 cases of anemia among 10th-grade students from 12 schools, including 84 mild cases, 165 moderate, and 18 severe. These findings suggest that current TTD distribution efforts by health centers have not effectively reduced anemia prevalence, largely due to the absence of systematic monitoring mechanisms (Dinas Kesehatan Kota Samarinda, 2025). This study aims to examine the consumption patterns of TTD among adolescent girls enrolled in senior high schools in Samarinda, focusing on levels of knowledge, attitudes, and adherence. The findings are expected to inform the development of more effective monitoring and educational strategies to improve compliance with TTD supplementation as a means of preventing anemia in this vulnerable population.

METHOD

This study employed a cross-sectional design with a rapid survey approach to provide an initial overview of TTD consumption among adolescent girls in Samarinda. The rapid survey method was selected due to its speed, efficiency, and suitability for generating representative data under resource constraints (WHO, 2001). The study population included all female students enrolled in senior high schools (SMA), Islamic senior high schools (MA), and vocational high schools (SMK) in Samarinda. A cluster sampling technique was applied, stratified by school type and grade level. Three schools were randomly selected, each representing one of the school categories: SMA, MA, and SMK. The sample size was calculated using Cochran's formula, assuming a population proportion of 78.9%, a 95% confidence level, and a 5% margin of error, yielding a required total of 256 respondents. Primary data were collected through a structured online questionnaire administered via Google Forms. The instrument consisted of close-ended questions using a Likert scale, covering indicators of knowledge, attitudes, and adherence to TTD consumption. Data analysis was conducted descriptively using Microsoft Excel and other data processing tools, focusing on frequency distributions and percentages to illustrate the research findings.

RESULTS

Table 1. Characteristics of Respondents Based on TTD Consumption

Characteristic	TTD Consumption	
	No	**Yes**
Age		
14 years; n (%)	1 (50.0)	1 (50.0)
15 years; n (%)	17 (17.3)	81 (82.7)
16 years; n (%)	66 (27.7)	172 (72.3)
17 years; n (%)	29 (23.4)	95 (76.6)
18 years; n (%)	1 (25.0)	3 (75.0)

Father's Education		
No formal education; n (%)	0 (0.0)	2 (100.0)
Primary School (SD/MI); n (%)	13 (34.2)	25 (65.8)
Junior High School (SMP); n (%)	6 (13.6)	38 (86.4)
Senior High School (SMA); n (%)	51 (23.2)	169 (76.8)
Diploma (D1–D3); n (%)	9 (23.1)	30 (76.9)
Bachelor–Doctorate (S1–S3); n (%)	35 (28.5)	88 (71.5)
Mother's Education		
No formal education; n (%)	1 (50.0)	1 (50.0)
Primary School (SD/MI); n (%)	14 (35.0)	26 (65.0)
Junior High School (SMP); n (%)	14 (28.0)	36 (72.0)
Senior High School (SMA); n (%)	42 (19.8)	170 (80.2)
Diploma (D1–D3); n (%)	10 (21.3)	37 (78.7)
Bachelor–Doctorate (S1–S3); n (%)	33 (28.7)	82 (71.3)
Father's Occupation		
Civil servant/Military/Police/Retired; n (%)	26 (31.3)	57 (68.7)
Private sector; n (%)	39 (24.2)	122 (75.8)
Farmer; n (%)	0 (0.0)	5 (100.0)
Entrepreneur; n (%)	27 (19.0)	115 (81.0)
Laborer; n (%)	8 (32.0)	17 (68.0)
Unemployed; n (%)	6 (42.9)	8 (57.1)
Others; n (%)	8 (22.2)	28 (77.8)
Knowledge Score; Median (Min-Max)	4 (1–5)	4 (2–5)
Attitude Score; Median (Min-Max)	22 (11–25)	23 (11–25)

Based on the characteristics of the respondents, the majority of female students who reported consuming TTD were between the ages of 15 and 17. A higher likelihood of TTD consumption was observed among those whose parents, both fathers and mothers, had attained secondary to higher levels of education. Additionally, parental occupations that were formal in nature or involved entrepreneurship were more commonly found in the group that adhered to TTD consumption. Although the median knowledge scores between the compliant and non-compliant groups did not show significant differences, the attitude scores tended to be higher among students who consumed the tablets. This trend was particularly evident among senior high school students in Samarinda City.
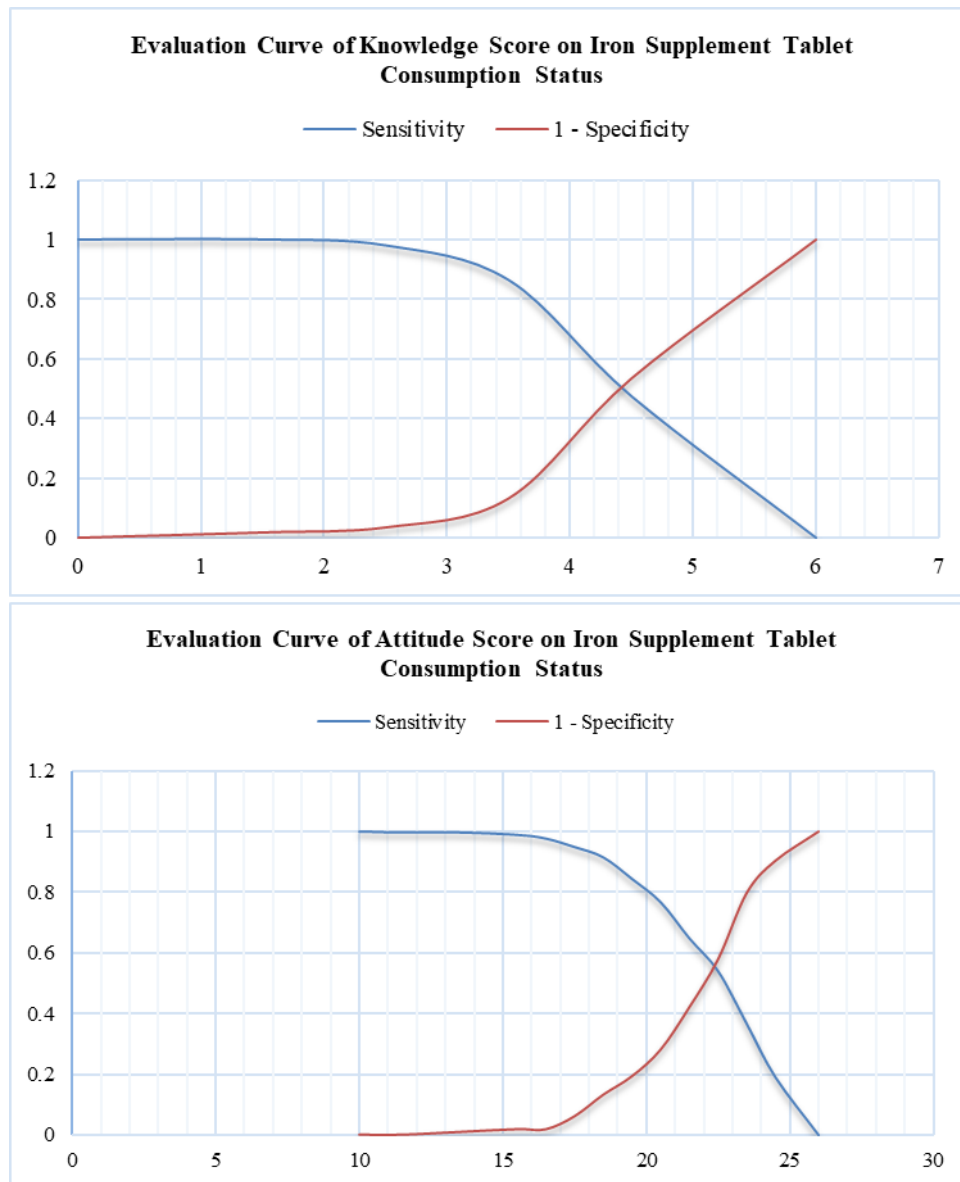
Figure 1. Evaluation Curve of Knowledge and Attitude Score on Iron Supplement Tablet Consumption Status

Based on the analysis of the Receiver Operating Characteristic (ROC) curve presented in Figure 1, the knowledge score exhibited a very low discriminatory capacity in differentiating the consumption status of TTD among senior high school female students in Samarinda City. This is reflected in the Area Under the Curve (AUC) value of 0.504 (p = 0.895; 95% CI: 0.443–0.565), which is close to 0.5 and indicates that knowledge scores do not have significant predictive power regarding TTD consumption behavior. In comparison, the attitude score demonstrated a relatively better, although still low, discriminatory ability, with an AUC of 0.581 (p = 0.010; 95% CI: 0.523–0.638). The ROC curve was subsequently used to establish cut-off points for categorizing respondents into two groups based on knowledge and attitude levels, namely "low knowledge" and "good knowledge" as well as

"negative attitude" and "positive attitude." These classifications were further analyzed in relation to the TTD consumption status, allowing for a more objective assessment grounded in the predictive performance of each variable.

Table 2. Association Between Knowledge and Attitude With TTD Consumption Among Senior High School Girls in Samarinda City

Variable	TTD Consumption No N (%)	OR Yes N (%)	95% CI	p-value
Knowledge				
Poor	61 (53.5%)	185 (52.6%)	1.039	0.680 – 1.587
Good	53 (46.5%)	167 (47.4%)	Ref.	–
Attitude				
Negative	66 (57.9%)	162 (46.0%)	1.613	1.052 – 2.471
Positive	48 (42.1%)	190 (54.0%)	Ref.	–

The analysis of the association between knowledge and attitude with TTD consumption among senior high school female students in Samarinda City revealed that knowledge did not have a statistically significant relationship with TTD intake. The proportion of students with low knowledge was nearly equal between those who did not consume (53.5%) and those who did (52.6%), with an odds ratio (OR) of 1.039 (95% CI: 0.680–1.587; p = 0.860). In contrast, the attitude variable showed a more meaningful association, where students with a negative attitude were more frequently found in the non-consuming group (57.9%) compared to the consuming group (46.0%), with an OR of 1.613 (95% CI: 1.052–2.471) and a p-value of 0.028, which is less than 0.05. These findings indicate that attitude plays a more substantial role than knowledge in influencing the behavior of TTD consumption.

DISCUSSION

The findings of this study indicate a statistically significant association between attitude and TTD consumption behavior among senior high school female students in Samarinda, whereas knowledge showed no meaningful influence. This highlights a critical insight: adolescent health behavior is not solely determined by the extent of knowledge but also by emotional and psychological responses that shape compliance with TTD intake. These results are corroborated by a study conducted at SMAN 5 Tuban, which similarly found that knowledge did not significantly correlate with adherence to TTD supplementation (p = 0.182), and motivation was not statistically significant. The consistency of these findings suggests that knowledge-based education alone is insufficient to drive behavioral change in TTD consumption (Harlisa et al., 2023).

Comparable results were also reported by Uswatun Hasanah et al. (2024), where knowledge yielded a non-significant p-value (p = 0.261), indicating no substantial relationship between knowledge levels and adherence to TTD supplementation among adolescent girls(Uswatun Hasanah et al., 2024). Adherence is defined as a behavior resulting from the interaction between healthcare providers and patients, in which patients understand and accept the prescribed medical plan and consistently follow it.

High levels of adherence to TTD intake are crucial for preventing anemia among adolescent girls. This is in line with previous research, which demonstrated significant associations between nutritional knowledge and TTD compliance with anemia status, reflected in p-values of 0.018 and 0.0005, respectively. Notably, 70.8% of girls with good nutritional knowledge were not anemic, and those who adhered to TTD supplementation generally had hemoglobin levels above 11 g/dL.

A cross-sectional study conducted between April and July 2019 in Tamale Metropolis, Ghana, involving 424 adolescent girls, used structured questionnaires and face-to-face interviews. The study identified maternal education and occupation, awareness of anemia, and adequate knowledge of anemia and TTD programs as significant predictors of adherence. Educational interventions targeting adolescent girls—especially those that enhance their understanding of anemia and the benefits of TTD supplementation, alongside parental involvement—have proven effective in improving adherence rates. Programs that foster positive attitudes and encourage adolescents' active participation in educational processes appear more promising. These findings advocate for a strategic shift from conventional one-way counseling approaches to more collaborative and empathetic models, aiming to cultivate consistent health behaviors (Dubik et al., 2019).

However, this study is subject to certain limitations. The cross-sectional design restricts the ability to establish causal relationships between variables. Additionally, the use of online questionnaires introduces the potential for information bias due to varying respondent interpretations. The study was also confined to three schools within Samarinda, which limits the generalizability of the findings. Nevertheless, a notable strength of this research lies in its substantial sample size and the application of ROC analysis for knowledge and attitude variables, enabling precise identification of cut-off points relevant to TTD adherence among adolescent girls.

CONCLUSION

This study demonstrates that although adolescent girls in Samarinda exhibit relatively high levels of knowledge and positive attitudes toward the consumption of TTD, these have not been fully reflected in consistent consumption behaviors. Low adherence is primarily driven by limited access to IFA tablets, rather than cognitive or affective factors alone. These findings underscore the importance of structural and systemic interventions beyond educational efforts. The results reinforce the urgency of cross-sectoral integration in adolescent anemia prevention through strengthened IFA distribution in schools, implementation of consumption monitoring systems, and active involvement of students, teachers, and healthcare providers. The Theory of Planned Behavior offers a useful framework for designing interventions that not only foster behavioral intentions but also enhance perceived behavioral control and enabling factors. Future research is recommended to adopt a mixed-methods approach and longitudinal design to explore the underlying causes of non-adherence and evaluate the effectiveness of interventions such as digital reminders, participatory education, and peer support in improving adherence and reducing anemia prevalence.

ACKNOWLEDGMENT

REFERENCES

Akib, A., & Sumarmi, S. (2017). Kebiasaan Makan Remaja Putri yang Berhubungan dengan Anemia : Kajian Positive Deviance. *Amerta Nutrition*, *1*(2), 105–116. https://doi.org/10.20473/AMNT.V1I2.2017.105-116

Beard, J. L. (2000). Iron requirements in adolescent females. *Journal of Nutrition*, *130*(2 SUPPL.). https://doi.org/10.1093/JN/130.2.440S,

BKKBN: Kepatuhan remaja putri minum tablet tambah darah rendah - ANTARA News. (n.d.). Retrieved July 26, 2025, from https://www.antaranews.com/berita/3162021/bkkbn-kepatuhan-remaja-putri-minum-tablet-tambah-darah-rendah

Chaluvaraj, T. S., & Satyanarayana, P. T. (2018). Change in knowledge, attitude and practice regarding anaemia among high school girls in rural Bangalore: An health educational interventional study. *Natl J Community Med*, *9*(5), 358–362.

Dinas Kesehatan Kota Samarinda. (2025). *Profil Kesehatan Kota Samarinda Tahun 2024*.

Dubik, S. D., Amegah, K. E., Alhassan, A., Mornah, L. N., & Fiagbe, L. (2019). Compliance with Weekly Iron and Folic Acid Supplementation and Its Associated Factors among Adolescent Girls in Tamale Metropolis of Ghana. *Journal of Nutrition and Metabolism*, *2019*. https://doi.org/10.1155/2019/8242896,

Gibson, R. S., Heath, A. L. M., & Ferguson, E. L. (2002). Risk of suboptimal iron and zinc nutriture among adolescent girls in Australia and New Zealand: causes, consequences, and solutions. *Asia Pacific Journal of Clinical Nutrition*, *11 Suppl 3*, S543–S552. https://doi.org/10.1046/j.1440-6047.11.supp3.10.x

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*. https://doi.org/10.1155/2020/1628357

Harlisa, N., Wahyurianto, Y., Puspitadewi, T. R., & Sumiatin, T. (2023). Pengetahuan, motivasi, dan dukungan keluarga dengan kepatuhan konsumsi TTD pada remaja putri di SMAN 5 Tuban. *Jurnal Pendidikan Tambusai*, *7*(3), 20427–20435.

Kemenkes, R. I. (2018). Pedoman pencegahan dan penanggulangan anemia pada remaja putri dan wanita usia subur (WUS). *Kementerian Kesehatan Republik Indonesia*.

Kesehatan Politeknik Kesehatan Makassar, M., Suaib, F., Sahariah Rowa, S., & Adwiah Jurusan Gizi Poltekkes Kemenkes Makassar, W. (2024). *Hubungan Kepatuhan Konsumsi Tablet Tambah Darah Dengan Kejadian Anemia Pada Remaja Putri*. *1*.

https://doi.org/10.32382/medkes.v19i1

Mesías, M., Seiquer, I., & Navarro, M. P. (2013). Iron Nutrition in Adolescence. *Critical Reviews in Food Science and Nutrition*, *53*(11), 1226–1237. https://doi.org/10.1080/10408398.2011.564333,

Misunas, C., Hindin, M. J., Phillips-Howard, P. A., & Sommer, M. (2024). The Association Between Hormonal Contraceptive Use and Anemia Among Adolescent Girls and Young Women: An Analysis of Data From 51 Low- and Middle-Income Countries. *Journal of Adolescent Health*, *74*(3), 563–572. https://doi.org/10.1016/j.jadohealth.2023.09.013

Nurjanah, A., & Azinar, M. (2023). Kepatuhan Konsumsi Tablet Tambah Darah Remaja Putri pada Sekolah Percontohan Kesehatan Reproduksi dan Seksualitas. *HIGEIA (Journal of Public Health Research and Development)*, *7*(2), 244–254.

Rahmatasya, E. R. (2024). *Evaluasi Penerimaan dan Kepatuhan Konsumsi Tablet Tambah Darah (TTD) Remaja Putri di Kota Bogor*. http://repository.ipb.ac.id/handle/123456789/141324

Runiari, N., & Hartati, N. N. (2020). Pengetahuan dengan kepatuhan minum tablet tambah darah pada remaja putri. *Jurnal Gema Keperawatan*, *13*(2), 103–110.

Saleh, U. K. S., & Bakoil, M. B. (2021). Kepatuhan Konsumsi Tablet Tambah Darah terhadap Anemia Remaja Putri. *Journal Midwifery Jurusan Kebidanan Politeknik Kesehatan Gorontalo*, *7*(2), 86.

https://doi.org/10.52365/jm.v7i2.316

Seyoum, Y., Humblot, C., Nicolas, G., Thomas, M., & Baye, K. (2019). Iron deficiency and anemia in adolescent girls consuming predominantly plant-based diets in rural Ethiopia. *Scientific Reports*, *9*(1). https://doi.org/10.1038/s41598-019-53836-5

Stabell, N., Averina, M., & Flægstad, T. (2021). Chronic iron deficiency and anaemia were highly prevalent in a population-based longitudinal study among adolescent girls. *Acta Paediatrica, International Journal of Paediatrics*, *110*(10), 2842–2849. https://doi.org/10.1111/APA.16016,

Tambunan, L. N., Araya, W., & Safitri, N. (2016). Hubungan Tingkat Pengetahuan Dengan Sikap Tentang Anemia Defisiensi Zat Besi Dan Dampaknya Terhadap Kesehatan Reproduksi Padaremaja Putri. *Dinamika Kesehatan: Jurnal Kebidanan Dan Keperawatan*, *7*(2), 68–82.

Uswatun Hasanah, K., Rezki Amelia, A., Administrasi Kebijakan Kesehatan, P., Kesehatan Masyarakat, F., & Gizi, P. (2024). Faktor Yang Memengaruhi Tingkat Kepatuhan Konsumsi Tablet Tambah Darah Pada Remaja Putri Di SMA Negeri 10 Kota Makassar. *Window of Public Health Journal*, *5*(5), 602–612. https://doi.org/10.33096/WOPH.V5I5.1625

Wang, W., Bourgeois, T., Klima, J., Berlan, E. D., Fischer, A. N., & O'Brien, S. H. (2013). Iron deficiency and fatigue in adolescent females with heavy menstrual bleeding. *Haemophilia*,

19(2), 225–230. https://doi.org/10.1111/HAE.1204 6,

Zia, A., Stanek, J., Christian-Rancy, M., Savelli, S., & O'Brien, S. H. (2022). Iron deficiency and fatigue among adolescents with bleeding disorders. *American Journal of Hematology*, *97*(1), 60–67. https://doi.org/10.1002/ajh.26389