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The Effectiveness of Iron Supplementation in Reducing the Incidence of Anaemia Among Adolescent Girls at Darussalam High School, Wanaraja Garut Regency, 2025

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Abstract
Adolescents are a generation that needs to be prepared to contribute to national development and compete at a global level. Healthy, intelligent and cheerful adolescents are the key to creating high-calibre human resources. Anaemia remains a significant global health issue, particularly amongst adolescents and women of childbearing age. According to the World Health Organisation (WHO, 2023), the prevalence of anaemia among women aged 15–49 years worldwide stands at 30.7 per cent, whilst among pregnant women it reaches 35.5 per cent, with the highest rates found in South Asia and Sub-Saharan Africa. This situation reflects that anaemia remains a major challenge in efforts to improve the nutritional status and health of the global population. In Indonesia, similar problems remain prevalent (WHO, 2023). In West Java Province, the prevalence of anaemia among adolescent girls remains relatively high and shows an upward trend. Data from the West Java Provincial Health Office indicate that in 2024 the prevalence of anaemia among adolescent girls reached approximately 45 per cent, rising to around 47 per cent in 2025 (West Java Provincial Health Office, 2025). Darussalam Wanaraja Senior High School is one of the schools located within the catchment area of the Wanaraja Community Health Centre in Wanaraja Sub-district, Garut Regency, which also has the highest incidence of anaemia among adolescents compared to other schools in the same area. A common cause of anaemia is a reduction in the number of red blood cells or haemoglobin levels in the blood. Based on the above description, the researcher is therefore interested in conducting a study entitled "The Effectiveness of Iron Supplementation in Reducing the Incidence of Anaemia among Adolescent Girls at Darussalam Wanaraja Senior High School, Garut Regency, in 2026".
Keywords: iron, anaemia, adolescent girls

INTRODUCTION

Adolescents are a generation that needs to be prepared to contribute to national development and compete at a global level. Healthy, intelligent and cheerful adolescents are the key to creating high-calibre human resources. The health of adolescent girls needs to be prioritised from an early age, as they will one day take on the role of prospective mothers; consequently, health issues during this period can have an impact on the next generation. Adolescence is characterised by a high level of physical activity, whether related to school or extracurricular activities. Therefore, adolescents' nutritional needs must be met in terms of both quality and quantity (WHO, 2020).

Anaemia remains a significant global health issue, particularly amongst adolescents and women of reproductive age. According to the World Health Organisation (WHO, 2023), the prevalence of anaemia amongst women aged 15–49 years worldwide stands at 30.7 per cent, whilst amongst pregnant women it reaches 35.5 per cent, with the highest rates found in South Asia and Sub-Saharan Africa. This situation reflects the fact that

anaemia remains a major challenge in efforts to improve the nutritional status and health of the global population. In Indonesia, similar problems also remain prevalent (WHO, 2023).

According to a report by the Ministry of Health of the Republic of Indonesia (Kemenkes, 2024), the prevalence of anaemia among adolescents aged 15–24 years stands at around 32 per cent, and the results of the January–September 2025 quarterly monitoring indicate that 22.6 per cent of Year 7 and Year 10 pupils are anaemic. These high figures illustrate that anaemia among adolescents, particularly adolescent girls, remains a public health issue that requires serious attention; consequently, strategic measures such as screening for haemoglobin (Hb) levels and the regular provision of iron (Fe) supplements in schools are needed to reduce the incidence of anaemia in this group.

In West Java Province, the prevalence of anaemia among adolescent girls remains relatively high and is showing an upward trend. Data from the West Java Provincial Health Office indicate that in 2024 the prevalence of anaemia among adolescent girls stood at around 45 per cent, rising to around 47 per cent in 2025 (West Java Provincial Health Office, 2025). In Garut Regency, data from the Health Office show that in 2022, 647 adolescent girls (44.3 per cent) were anaemic; this figure rose to 856 adolescents (51.2 per cent) in 2023, and 52.2 per cent in 2024 (Garut Health Office, 2024).

Darussalam Wanaraja Secondary School is one of the schools located within the catchment area of the Wanaraja Community Health Centre in Wanaraja Sub-district, Garut Regency; it also has the highest incidence of anaemia among adolescents compared to other schools in the same area. According to the Wanaraja Community Health Centre's annual report for 2024, the results of haemoglobin level tests carried out on pupils at Darussalam Wanaraja Senior High School in Wanaraja Sub-district, Garut Regency, showed that 47.6 per cent of female pupils had haemoglobin levels below 12 g/dL (Wanaraja Community Health Centre, 2024).

A common cause of anaemia is a reduction in the number of red blood cells or the haemoglobin level in the blood. Many factors can lead to iron-deficiency anaemia, including increased demand, insufficient iron intake, infections, and gastrointestinal bleeding, amongst other factors. This is certainly detrimental to adolescents' development as it can impair their productivity. Iron-deficiency anaemia can be diagnosed through a medical history, physical examination and supporting tests (Alfian, 2023).

Adolescent girls with anaemia tend to feel tired easily, lose their enthusiasm, find it difficult to concentrate, and experience a decline in academic performance. In the long term, anaemia can compromise the health of future mothers, increasing the risk of pregnancy complications, low birth weight (LBW), preterm birth, and even maternal mortality. Furthermore, anaemia weakens the immune system, making individuals more susceptible to infection, which ultimately affects the quality of the workforce (Tunnisa, 2018).

Efforts to prevent anaemia in adolescent girls can be carried out through haemoglobin screening programmes to detect anaemia at an early stage and the provision of iron (Fe) tablets as an effective intervention (Nancy Olii, 2020). Furthermore, government programmes do not only provide iron tablets to pregnant women; these programmes are also being promoted amongst adolescents. This is done to prevent the onset of anaemia. 23.8 per cent of adolescent girls in Indonesia have not yet received iron tablets from school (RISKESDAS, 2018). The government programme in question is provided to adolescent girls aged 12–18 years in secondary schools

(SMP/SMA/equivalent), with one iron tablet administered once a week throughout the year. This initiative is supported by sub-district health workers as well as teaching staff at the schools. The absorption of iron into the body is also influenced by vitamin C (Artika Sari, 2019).

Haemoglobin (Hb) screening is a simple laboratory test used for the early detection of reduced haemoglobin levels in the blood. This test is extremely useful for determining anaemia status before clinical symptoms appear, thereby enabling earlier intervention. According to the Indonesian Ministry of Health (2021), haemoglobin screening among adolescent girls in schools forms part of the adolescent health programme, which aims to monitor nutritional status and prevent iron-deficiency anaemia. Through regular haemoglobin screening, schools and healthcare professionals can identify students at risk, provide nutritional education, and follow up with the provision of iron (Fe) supplements as a preventive measure and early treatment.

In addition to haemoglobin (Hb) screening, the administration of iron (Fe) tablets is an intervention proven to be effective in reducing the incidence of anaemia. Iron tablets contain iron, which plays a role in the formation of haemoglobin within the body. According to the Ministry of Health of the Republic of Indonesia (2022), adolescent girls are advised to take one iron tablet (containing 60 mg of elemental iron and 0.4 mg of folic acid) every week throughout the year. Iron supplementation helps to meet the increased iron requirements during adolescence due to rapid growth and blood loss during menstruation. Research also shows that regular iron supplementation can increase haemoglobin levels, improve concentration during study, and reduce the risk of anaemia among school-aged adolescents (Wulandari et al., 2023). Therefore, the combination of haemoglobin (Hb) screening for early detection and iron supplementation as a preventative measure is an effective strategy for reducing the prevalence of anaemia in adolescent girls.

A study conducted by Pratiwi and Handayani (2021), entitled "The Effectiveness of the Iron Tablet Programme in Increasing Haemoglobin Levels Among Adolescent Girls at Sukabumi State Senior Secondary School No. 2", showed that there was a significant increase in haemoglobin (Hb) levels following the administration of iron tablets over an eight-week period. The respondents' average haemoglobin levels rose from 10.8 g/dL to 12.3 g/dL, with a p-value of < 0.05. These results indicate that regular consumption of iron tablets can improve anaemia status and reduce the number of adolescents suffering from mild to moderate anaemia.

Furthermore, a study by Rahmadani et al. (2022) entitled "The Relationship between Haemoglobin Screening and Anaemia Prevention Efforts among Adolescent Girls in Tasikmalaya Regency" revealed that routine haemoglobin (Hb) screening plays a vital role in raising adolescents' awareness of their health status. The study's findings indicate a significant association between the implementation of haemoglobin screening and measures to prevent anaemia, with adolescents who underwent screening tending to be more compliant in taking iron tablets and adopting a balanced, nutritious diet compared to those who did not undergo screening.

Another study by Saraswati and Lestari (2023), entitled "The Effectiveness of Iron Tablet Supplementation on the Incidence of Anaemia among Adolescent Girls at SMP Negeri 1 Cirebon", found that following three months of iron tablet administration, the prevalence of anaemia in the intervention group fell from 48.6% to 21.4%. Meanwhile, in the control group, which did not receive supplementation, no significant change was

observed. This study confirms that iron intervention, accompanied by monitoring of haemoglobin levels, is capable of significantly reducing the incidence of anaemia.

Based on the above description, the researcher was therefore interested in conducting a study entitled "The Effectiveness of Iron Supplementation in Reducing the Incidence of Anaemia among Adolescent Girls at Darussalam High School, Wanaraja, Garut Regency, in 2026".

RESEARCH METHOD

This study is a quasi-experimental study using a one-group pre-test post-test design. A quasi-experimental study is a type of research conducted to determine the effect of a treatment deliberately administered by the researcher on the research subjects (Arianto, 2019).

In this study, haemoglobin (Hb) levels were measured prior to the intervention as a pre-test. Subsequently, all adolescent girls diagnosed with anaemia were given iron tablets as an intervention to increase their haemoglobin levels. Once the intervention period had ended, haemoglobin levels were measured again as a post-test. Changes in haemoglobin levels before and after the administration of iron tablets were analysed to determine the effectiveness of the intervention in reducing the incidence of anaemia.

Table 3.1 Study Design

	Pre-test	Treatment	*Post-Test*
Respondents	O_1	X	O_2

Notes:
O_1 : Average haemoglobin level before administration of iron tablets (pre-test)
X_1 : Administration of iron tablets
O_2 : Average haemoglobin levels after administration of iron tablets (post-test)

Data collection in this study utilised the observational method. The observational method is a planned procedure which, amongst other things, involves observing, listening to and recording the number and level of specific activities or specific situations related to the research problem (Notoatmodjo; 2018). The data analysis methods used in this study were univariate and bivariate analysis.

RESULTS AND DISCUSSION

Research Results

Univariate Results

Haemoglobin Levels in Adolescent Girls Before Administration of Iron Tablets

Table 1.
Haemoglobin Levels in Adolescent Girls Prior to Iron Supplementation at Darussalam Wanaraja Senior High School, Garut Regency, in 2026

Results	**Respondents' Hb Levels**				
	N	Min	Max	Mean	SD
Pre-test	36	10.6	11.6	11.086	0.2758

Source: SPSS Data Analysis, 2026

Table 1 shows that, of the 36 respondents prior to the intervention, haemoglobin (Hb) levels ranged from a minimum of 10.6 g/dL to a maximum of 11.6 g/dL, with an average of 11.086 g/dL and a standard deviation of 0.2758.

Haemoglobin Levels in Adolescent Girls Before Administration of Iron Tablets

Table 2.
Haemoglobin Levels in Adolescent Girls Following Iron Supplementation at Darussalam Wanaraja Senior High School, Garut Regency, in 2026

Results	Respondents' Hb Levels				
	N	Min	Max	Mean	SD
Post-test	36	11.1	12.7	11.936	0.4467

Source: SPSS data analysis, 2026

Table 2 shows that, of the 36 respondents who received the intervention, the haemoglobin (Hb) levels measured ranged from a minimum of 11.1 g/dL to a maximum of 12.7 g/dL, with an average of 11.936 g/dL and a standard deviation of 0.4467.

Bivariate Results

A bivariate analysis was conducted to determine whether there were any differences between the *pre-test* and *post-test* results in the iron tablet and red guava juice group and the iron tablet and honey group, as well as differences in the *post-test* results within these groups. However, prior to hypothesis testing, the researcher first conducted a normality test on the data using SPSS v.25 with the *Shapiro-Wilk* test, yielding the following results:

Normality Test

Table 3. Results of the Normality Test

Respondents	N	*p-value*	Notes
Pre-test	36	0.245	Normal
Post-test	36	0.265	Normal

Source: SPSS Data Analysis, 2026

Based on Table 3, it can be seen that the *p-values* for all data are > 0.05; it can therefore be concluded that the research data are normally distributed. Consequently, the data analysis test used is a parametric test, namely the *Paired Samples Test,* with the following results:

Results of the *Paired Samples Test*

Table 4.
The Effectiveness of Iron Supplementation in Reducing the Incidence of Anaemia among Adolescent Girls at Darussalam Wanaraja Senior High School, Garut Regency Year 2026

Results	N	Mean	SD	*p-value*
Pre-test	36	11.086	0.2758	0.000

Post-Test	36	11,936	0.4467

Source: SPSS Data Analysis, 2026

Based on Table 4, the results of the analysis using the Paired Samples Test yielded a p-value of 0.000 ($p < 0.05$). This indicates that there is a significant difference between haemoglobin levels before and after the intervention; it can therefore be concluded that the administration of iron tablets has an effect on increasing haemoglobin levels in adolescent girls at Darussalam Wanaraja Senior High School, Garut Regency, in 2026.

Discussion

Haemoglobin Levels in Adolescent Girls Prior to Iron Supplementation at Darussalam Wanaraja Senior High School, Garut Regency, in 2026

The research findings revealed that the average haemoglobin (Hb) level among adolescent girls prior to the iron tablet intervention was 11.086 g/dL, with a minimum value of 10.6 g/dL and a maximum value of 11.6 g/dL. These results indicate that some of the respondents fell into the category of mild anaemia, as their haemoglobin levels were still below the normal range for adolescent girls, which is ≥12 g/dL. This suggests that, prior to the intervention, the majority of respondents had relatively low haemoglobin levels, putting them at risk of developing more severe anaemia.

The findings of this study are consistent with research conducted by Sari Ningsih (2021), which showed that the average haemoglobin level among adolescent girls prior to the iron supplementation intervention was 10.82 g/dL, which falls within the category of mild anaemia. That study also reported that around 68 per cent of respondents suffered from mild anaemia prior to the intervention. Another study conducted by Lestari (2020) also found similar results, with the average haemoglobin level among adolescent girls before the intervention standing at 10.74 g/dL, and the majority of respondents falling into the mild anaemia category. This condition arises due to low iron intake and an unbalanced diet among adolescent girls, such as low consumption of iron-rich foods and high consumption of fast food.

This situation is also supported by national data showing that the prevalence of anaemia among adolescent girls in Indonesia remains quite high. Survey results reported by the Ministry of Health of the Republic of Indonesia (2018) indicate that around 32 per cent of adolescent girls in Indonesia suffer from anaemia, the majority of which is caused by iron deficiency resulting from inadequate nutritional intake.

In theory, anaemia in adolescent girls can occur due to increased iron requirements during growth and blood loss during menstruation. According to Arisman (2019), adolescence is a period of growth that requires a higher intake of iron than childhood. Furthermore, according to Almatsier (2018), iron deficiency is the main cause of anaemia in adolescent girls, as iron plays a vital role in the formation of haemoglobin in red blood cells.

Based on the findings in the field, the researchers assumed that the low haemoglobin levels among the respondents prior to the intervention were likely influenced by a lack of knowledge regarding the consumption of iron tablets.

Haemoglobin Levels in Adolescent Girls Following Iron Supplementation at Darussalam Wanaraja Senior High School, Garut Regency, in 2026

The research findings indicate that the average haemoglobin levels of adolescent girls following the iron tablet intervention increased to 11.936 g/dL, with a minimum

value of 11.1 g/dL and a maximum value of 12.7 g/dL. These results demonstrate that, following the intervention, haemoglobin levels increased in the majority of respondents, thereby improving the anaemia previously experienced by the respondents.

The findings of this study are consistent with research conducted by Rahmawati (2022), which showed that regular iron supplementation in adolescent girls with anaemia can significantly increase haemoglobin levels. That study reported that the average haemoglobin level of the participants before receiving iron supplementation was 10.87 g/dL, which then increased to 11.92 g/dL following an intervention lasting several weeks. Another study conducted by Handayani (2021) also showed similar results, with the average haemoglobin level of adolescent girls before receiving iron tablets being 10.95 g/dL, rising to 11.85 g/dL following iron supplementation. This increase in haemoglobin levels indicates that the regular administration of iron tablets can help improve anaemia in adolescent girls.

In theory, iron plays a vital role in the formation of haemoglobin, which transports oxygen to all the body's tissues. According to Almatsier (2018), adequate iron intake can increase haemoglobin production, thereby helping to alleviate anaemia. Furthermore, according to Arisman (2019), iron supplementation is one of the effective interventions for increasing haemoglobin levels, particularly among groups at high risk of anaemia, such as adolescent girls.

Based on the observations made during the study, the researchers hypothesised that the increase in haemoglobin levels among the respondents was influenced by their adherence to taking the iron tablets provided during the intervention period.

The Effectiveness of Iron Supplementation in Reducing the Incidence of Anaemia among Adolescent Girls at Darussalam Wanaraja Senior High School, Garut Regency, in 2026

Based on the results of the analysis using a paired samples test, a p-value of 0.000 ($p < 0.05$) was obtained, indicating that there was a significant difference between haemoglobin levels before and after the intervention. The average haemoglobin level increased from 11.086 g/dL to 11.936 g/dL; it can therefore be concluded that the administration of iron tablets was effective in increasing haemoglobin levels among female secondary school pupils at Darussalam Wanaraja Secondary School, Garut Regency, in 2026.

The findings of this study are consistent with research conducted by Pratiwi (2022), which showed that regular iron supplementation can increase haemoglobin levels and reduce the incidence of anaemia in adolescent girls. Another study by Putri (2021) also found a significant difference between haemoglobin levels before and after the administration of iron tablets, with a p-value of < 0.05.

In theory, iron supplementation is one of the recommended strategies for treating iron-deficiency anaemia, particularly among at-risk groups such as adolescent girls. According to the World Health Organisation (2020), iron-deficiency anaemia occurs when the body lacks sufficient iron to produce haemoglobin—the protein in red blood cells responsible for transporting oxygen to all the body's tissues. Therefore, regular iron supplementation can help increase haemoglobin levels and improve the body's iron status. This supplementation is a key component of programmes for the prevention and management of anaemia, as it helps to boost iron stores and supports the process of erythropoiesis, or the formation of red blood cells.

Furthermore, according to Almatsier (2018), iron is an essential mineral that plays a vital role in haemoglobin synthesis and various metabolic processes in the body. Haemoglobin, which is formed from iron, carries oxygen from the lungs to all the body's tissues; consequently, if haemoglobin levels are low, the supply of oxygen to the tissues will also be reduced. This condition can lead to various symptoms of anaemia, such as fatigue, paleness, dizziness and reduced concentration in adolescents. Therefore, increasing iron intake through supplementation or iron-rich foods is essential to improve anaemia.

Iron absorption in the body is also influenced by the presence of other nutrients that can either enhance or inhibit iron absorption. According to Gropper (2018), vitamin C is one such nutrient that can enhance the absorption of non-haem iron in the gut by reducing iron to a form that is more easily absorbed by the body. Conversely, substances such as tannins in tea, phytic acid in grains, and high levels of calcium can inhibit the absorption of iron. Therefore, consuming foods or drinks rich in vitamin C alongside iron supplementation can help improve the effectiveness of iron absorption in the body.

Based on the findings from the fieldwork, the researchers assumed that the increase in haemoglobin levels among the respondents was influenced not only by the administration of iron tablets, but also by the respondents' growing awareness of the importance of maintaining their health and paying attention to their nutritional intake. During the study, some respondents demonstrated behavioural changes, such as starting to pay attention to their consumption of nutritious food and being more disciplined in taking their iron tablets.

CONCLUSION

Based on the results of the data analysis and statistical calculations described in the previous chapter, the researchers can draw the following conclusions:

1) The average haemoglobin level among adolescent girls prior to being given iron tablets at Darussalam High School in Wanaraja, Garut Regency, in 2026 was 11.086 g/dL.
2) The average haemoglobin level among adolescent girls following the administration of iron tablets at Darussalam High School in Wanaraja, Garut Regency, in 2026 was 11.936 g/dL.
3) The administration of iron tablets proved effective in increasing haemoglobin levels in adolescent girls, with a p-value of 0.000 ($p < 0.05$), indicating a significant difference between haemoglobin levels before and after the administration of iron tablets.

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