



## OVERVIEW OF PROTEIN AND FE INTAKE WITH THE EVENT OF ANEMIA IN ADOLESCENT: SYSTEMATIC REVIEW

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### ABSTRACT

**Background:** Adolescents are a group that is prone to anemia. Anemia is defined as a lower than normal haemoglobin level. The prevalence of anemia in adolescents in Indonesia is the highest at the age group of 15-24 years, 32%. The most common cause of anemia is lack of nutrients needed for erythrocyte synthesis. Substances that play a role in haemolysis are protein, vitamins (folic acid, vitamin B12, vitamin C and vitamin E), and minerals (Fe and Cu).

**Objective:** To analyse the intake of protein and iron expected incidence of anemia in adolescent girls.

**Methods:** This study used a systematic review method. The databases used to conduct this research are Scopus, PubMed, Science Direct, Portal Garuda and Google Scholar. The keywords used in Indonesian are "Anemia", "Remaja", "Asupan Gizi" or "Nutrisi", "Protein", "Fe" or "Zat besi" and in English are "Anemia", "Adolescent", "Nutritional Intake", "Ferrous Sulfate" OR "Protein"

**Results:** From several articles that have been reviewed, it is shown that protein intake and Fe (iron) intake of adolescents related to anemia are associated with the incidence of anemia experienced by adolescents. A good protein intake will affect haemoglobin levels in adolescent girls. In addition, intake of Fe (iron) will also affect haemoglobin levels in adolescents.

**Conclusion:** intake of protein and iron will affect haemoglobin levels in adolescents.

**Keywords:** Anemia, Protein Intake, Fe Intake, Health, Adolescent.

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## INTRODUCTION

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Anemia is defined as a lower than normal hemoglobin level<sup>[1]</sup>. Hemoglobin is an iron-containing protein in red blood cells whose function is very important for oxygen transport to tissues<sup>[2]</sup>. Anemia is a nutritional problem that is often found in adolescents<sup>[3]</sup>. Patients with anemia in Indonesia are very high in the age group 15-24 years 32%, 15-34 years 15.1% and at the age of 35-44 years as much as 16.7%, according to gender, women are greater than men, namely women by 27.2% and men by 20.3%<sup>[4]</sup>. Adolescents are a group that is prone to anemia, due to the increasing need for nutrients during adolescence to balance the very rapid growth and development at puberty<sup>[5]</sup>. Adolescent girls experience a higher risk than boys because young girls experience blood loss during menstruation<sup>[6]</sup>.

Iron is a mineral needed for the formation of red blood cells (hemoglobin). Indonesian people whose consumption is still dominated by vegetables as a source of iron (non-heme iron). Meanwhile, meat and animal protein (chicken and fish) which are known to be good sources of iron (heme iron) are rarely consumed, this causes a low use and absorption of iron<sup>[8]</sup>.

The most common cause of anemia is a lack of nutrients needed for erythrocyte synthesis, substances that play a role in hemolysis are protein, vitamins (folic acid, vitamin B12, vitamin C and vitamin E), and minerals (Fe and Cu)<sup>[9]</sup>. In the research of Wijayanti and Fitriani (2019), it was shown that those suffering from anemia had a low average level of both macro and micro nutrients, which played an extremely important role in the synthesis of hemoglobin in an effort to reduce anemia<sup>[10]</sup>.

The impact of anemia causes the body to feel weak, sluggish and tired easily, often called as the 5L (lethargic, tired, weak, tired and negligent), accompanied by dizziness, light-headed eyes, easily drowsy, and difficulty concentrating due to reduced oxygen levels in brain and muscle tissue. In adolescents,

the decline in fitness and concentration will affect the decline in learning achievement in school and activities outside of school. In addition, anemia can reduce the body's resistance, furthermore it is easy to get infectious diseases. The long-term effect on adolescents who experience anemia is that as prospective mothers who will become pregnant, the young women will not be able to meet the nutrients for themselves and the fetus they contain. This causes complications in pregnancy and childbirth, the risk of maternal death, prematurity, low birth weight (LBW) and perinatal death<sup>[5]</sup>.

One of the ways to prevent anemia is by fulfill nutritional adequacy in two ways, namely consuming iron-rich foods and taking blood-added tablets. Iron intake can be obtained from various sources of animal protein such as liver, fish and meat. As well as vegetable sources such as soybeans, green beans, red spinach, green vegetables and others. To increase the absorption of iron, especially those from vegetable sources, it is recommended to consume fruits that contain vitamin C, such as oranges, guava and others. Efforts made by the government by giving blood-added tablets to adolescents are carried out through School/Madrasa Medical Room or UKS/M (*Unit Kesehatan Sekolah/Mahasiswa*) in educational institutions (junior high school and high school or the equivalent) by determining the day of taking blood-added tablets together<sup>[11]</sup>.

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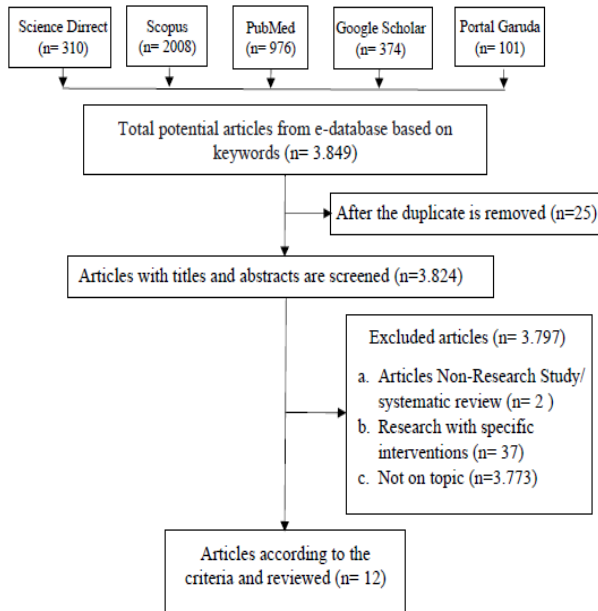
## METHOD

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This study uses a type of secondary research in the form of a systematic review. The databases used when searching for research articles are Scopus, PubMed, Science Direct, Portal Garuda and Google Scholar. In searching for research journal articles the keywords used in Indonesian are "Anemia", "Remaja", "Asupan Gizi" or "Nutrisi", "Protein", "Fe" or "Zat Besi" and keywords using English in Bahasa Indonesia. English is "Anemia",

“Adolescent”, “Nutritional Intake”, “Ferrous Sulfate” OR “Protein”.

The literature search process is reported in the PRISMA flowchart with the aim of explaining the search and screening process in a clear and transparent manner. The PRISMA flowchart is illustrated as follows:



**Figure 1.** PRISMA flowchart

Figure 1 shows In the first search process found 2,008 articles from Scopus, 976 articles from PubMed, 310 articles from Science Direct, 374 articles from Google Scholar, and 101 articles from the Garuda Portal. Furthermore, the total potential articles from the e-database based on keywords are 3,849. Then, the researcher obtained 12 research articles, this filtering is based on the suitability of topics, research methods, and the results of the research of each journal article.

After screening articles using inclusion criteria (Research published in the last 5 years (2016-2021)), literature in Indonesian or English, full text literature can be accessed, open access literature, research on adolescents aged 10-19 years, research in Indonesia, Quantitative Research) and exclusion criteria (Sources come from non-research studies (conferences, papers, book chapters, reports), research with certain

interventions, studies in the form of systematic reviews, articles duplicate), the articles are assessed using Quality Assessment Tool for Quantitative Studies from Effective Public Health Practice Project (EPHPP) which assessing with selection bias, study design, confounders, blinding, data collection method, withdrawals and dropouts and assisting critical appraisal in knowing the quality of the reviewed journal.

## RESULT

Table 1 shows the results of a review of 12 journal articles. Journal articles discussing protein found 7 articles with 3 articles stating there was a correlation between protein intake and the incidence of anemia in adolescent girls (Junegsih (2017), Sholihah et al (2019) and Kertini et al (2019)) and 4 articles stating there was no correlation between intake protein with the incidence of anemia in adolescent girls (Lewa (2016), Restuti et al (2017, Pratama et al (2020) and Fithria et al (2021)). Journal articles discussing Fe (iron) found 11 articles with 6 articles stating there was a correlation between Fe intake with the incidence of anemia and 5 articles stated that there was no correlation between Fe intake and the incidence of anemia in adolescent girls.

**Tabel 1.** Review of 12 journal articles

Researcher	Year	Research Tittle	Research Sample	Research Method	Research Result
<b>Sholihah., et al</b>	2020	<i>Hubungan Tingkat Konsumsi Protein, Vitamin C, Zat Besi dan Asam Folat dengan Kejadian Anemia Pada Remaja Putri SMAN 4 Surabaya</i>	44	Cross sectional	There is a significant correlation between the level of protein consumption with the incidence of anemia ( $p < 0,001$ ; OR=30,33) and there is no significant correlation between Fe and the incidence of anemia ( $p < 0,001$ ; OR=8,737)
<b>Restuti., et al</b>	2017	<i>Hubungan Antara Asupan Zat Gizi Dan Status Gizi Dengan Kejadian Anemia Pada Remaja Putri</i>	71	Cross sectional	There is no correlation between protein intake and the incidence of anemia ( $p \text{ value} > 0.05$ )
<b>Kusudaryati., et al</b>	2018	<i>Hubungan Usia, Asupan Vitamin C Dan Besi Dengan Kadar Hemoglobin Pada Remaja Putri Anemia</i>	18	Cross sectional	There is no significant correlation between iron intake and the incidence of anemia ( $p=0,787$ ).
<b>Junengsih and yuliasari</b>	2017	<i>Hubungan Asupan Zat Besi Dengan Kejadian Anemia Pada Remaja Putri SMU 98 di Jakarta Timur</i>	186	Cross sectional	There is a significant correlation between protein (OR 1,9 and $p \text{ value}$ 0,046) and iron intake with the incidence of anemia (OR 7,9 and $p \text{ value}$ 0,001)
<b>Casteli., et al</b>	2018	<i>Hubungan Tingkat Konsumsi Fe, Vitamin C dan Status Anemia</i>	79	Cross sectional	There is no correlation between Fe intake with the incidence

		<i>dengan Kejadian Dismenorea pada Remaja Putri di SMA Negeri 1 Sukawati</i>			of anemia <i>p value</i> = 0.356 ( $\alpha > 0.05$ )
<b>Simanungkalit., et al</b>	2018	<i>Hubungan Pengetahuan Anemia, Pengetahuan Tablet Tambah Darah, Status Gizi dan Asupan Gizi (Fe) dengan Anemia Remaja Putri di SMA/K Kota Depok Tahun 2017</i>	122	Cross sectional	There is no correlation between Fe intake with the incidence of anemia ( <i>p value</i> 0,25)
<b>Putri., et al</b>	2018	<i>Hubungan Jumlah Konsumsi Zat Besi Dari Food Recall 24 Jam Dengan Kadar Hb Remaja Putri Di Lingkungan Jempong Barat Kota Mataram</i>	89	Cross sectional	There is a correlation between the amount of iron consumption and the Hb level of adolescent girls ( <i>p</i> =0.000).
<b>Pratama., et al</b>	2020	<i>Hubungan Asupan Protein dan Zat Besi dengan Kejadian Anemia pada Remaja Putri di SMPN 18 Banjarmasin</i>	88	Cross sectional	There is no correlation between iron <i>p-value</i> 0,084 ( <i>p</i> >0,05) and protein intake on anemia <i>p-value</i> 0,149 ( <i>p</i> >0,05)
<b>Fithria., et al</b>	2021	<i>Hubungan Antara Asupan Zat Gizi Dengan Kejadian Anemia Pada Remaja Putri Sma Negeri 1 Barangka Tahun 2019</i>	57	Cross sectional	There is a significant correlation between iron intake and anemia ( <i>p-value</i> 0.000) and there is no correlation between protein intake ( <i>p-value</i> 0.466) and the incidence of anemia
<b>Silvia.,et al</b>	2019	<i>Hubungan Asupan Zat Gizi</i>	70	Cross sectional	There is a significant

		<i>(Protein, Zat Besi, Vitamin C) Dan Pola (Siklus, Lama) Menstruasi Dengan Kadar Hemoglobin (Studi Pada Remaja Putri Di Smk Negeri 10 Semarang)</i>			correlation between protein intake and the incidence of anemia ( $p=0,035$ )
<b>Lewa, Abd.Farid</b>	2016	<i>Hubungan Asupan Protein , Zat Besi Dan Vitamin C Dengan Kejadian Anemia Pada Remaja Putri Di MAN 2 Model Palu</i>	75	Cross sectional	There is no correlation between protein and iron intake with the incidence of anemia ( $p\text{-value} > 0,05$ )
<b>Pibriyanti., et al</b>	2020	<i>Relationship between micronutrient and anemia incidence in adolencents at Islamic boarding school</i>	92	Case control	There is a significant correlation between Fe intake and the incidence of anemia ( $p\text{-value} 0,0001$ , OR 3,091)

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## DISCUSSION

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Based on the results of the review, there were 12 journal articles that matched the inclusion criteria. 7 of them discussed protein intake and 11 journal articles discussed Fe (iron) intake.

### Protein Intake

Protein is a very important nutrient as a developmental and regulatory substance, besides that protein also regulates human health by providing molecular precursors of amino acids and also functions as a component in body cells, protein also has a role in the transportation of iron to the spinal cord for formation red blood cells. Protein intake, especially animal protein intake helps increase iron absorption, therefore low protein intake can affect Hb levels to be less, which can lead to anemia<sup>[12]</sup>. In the study of Sholihah, et al (2019), it was shown that the average protein intake of adolescents who were not anemic was higher when compared to the anemic group. Adolescents with less protein intake have a 30.333 times greater risk of developing anemia compared to female adolescents who have adequate levels of consumption. Junengsih and Yuliasari (2017), Silvia, et al (2019), showed that there was a significant and positive correlation.

Protein is one of the nutrients needed for iron absorption, with low protein consumption it can cause low iron absorption by the body. So that it can cause the body to lack iron which can cause anemia or a decrease in Hb levels<sup>[13]</sup>. Protein is a nutrient that has an important role in life, which functions in the formation of essential bonds in the body, including the formation of hemoglobin and has a very important role in the process and transport of iron in the body<sup>[14]</sup>.

Protein intake in quality and quantity must be in good condition, so that hemoglobin synthesis goes well. If the

amount of protein is sufficient but if the quality in protein is not good, then the role of protein in the formation of hemoglobin and transport of iron will be disrupted, so that hemoglobin synthesis does not run optimally and can cause a decrease in hemoglobin levels<sup>[14]</sup>. The respondents' food consumption is still monotonous, the habit of consuming instant noodles which is low in nutrients, the habit of drinking tea water after eating are some of the factors that cause low absorption of iron in the body<sup>[13]</sup>.

However, in a study conducted by Restuti and Susindra (2017), it was found that protein intake was not associated with the incidence of anemia in adolescent girls. Supported by research by Lewa (2016), Pratama, et al (2020), and Fithria, et al (2021). This may be influenced by various other factors such as: frequently consuming sweet tea, almost every day consuming junk food in the form of sausages, and some students are reducing weight or dieting. The habit of consuming the same food has limited the intake of vitamins, minerals, and the consumption of vegetable protein which is more dominant is also one of the causes of anemia because vegetable protein is non-heme making it difficult to digest<sup>[15][16]</sup>. Then, some respondents stated that they did not eat enough, incomplete foods such as rice and side dishes or rice and vegetables only with the reason that there was only food at home, for protein sources, consume a lot of tempeh, tofu is only consumed when eating heavy and more often eating heavy carbohydrate sources concurrently a once-daily protein source<sup>[17]</sup>. The other factors that influence are knowledge, education, type of parental occupation, family income, and menstrual patterns<sup>[16]</sup>.

### Fe Intake

Fe has an important role in the body, which plays a role in the formation of hemoglobin, helps metabolic processes by assisting various enzymes by binding

oxygen<sup>[18]</sup> and increasing erythrocytes in the body<sup>[14]</sup>.

In Sholihah et al's research (2019), Junengsih and yuliasari (2017), Putri., et al (2018), Fithria., et al (2021), Pibriyanti., et al (2020), showed that there was a significant and positive correlation between the level of iron consumption and the incidence of anemia, the average iron intake of respondents who did not experience anemia was higher than the group with anemia and young women who consumed iron. iron is less at risk of 8.737 times greater risk of anemia. Iron has a very important role in the body, some of which are in the formation of hemoglobin, helping metabolic processes by helping various enzymes by binding oxygen<sup>[12]</sup>. If the body lacks iron intake, the body will activate iron reserves to meet functional iron, but if the amount of iron stores is reduced and the amount of iron obtained from food is low, there will be an iron imbalance in the body which causes hemoglobin levels to drop<sup>[14]</sup>.

The iron requirement for adolescent girls is 15 mg/day. Iron content is found in animal foods, vegetables, and foods that contain vegetable protein. However, the best foods to eat are animal foods because the absorption of Fe in the body can be up to 80% maximum. These foods include beef, eggs, milk, and foods derived from other animal products<sup>[19]</sup>.

The cause of low Hb levels in adolescent girls is the lack of iron consumption in their daily diet, this is because the amount and frequency of consuming iron is still low, some adolescents with anemia do not consume vegetables and do not regularly consume blood-added tablets<sup>[13]</sup>. If the intake of iron is less and the frequency of consumption of inhibitors is more often than the consumption of iron sources, it can cause low iron levels in the body and can trigger iron anemia. Iron can function in the human body, iron requires transferrin proteins, transferrin receptors, and ferritin, which act as providers and stores of iron in

the body as well as iron regulatory proteins to regulate the supply of iron, iron that is absorbed by the intestines every day 1- 2 mg and is secreted in equal amounts<sup>[18]</sup>.

However, in a study conducted by Kasudaryati et al (2018), it was found that there was no correlation between protein intake and the incidence of anemia in adolescent girls. Supported by Lewa (2016), Casteli et al (2018), Simanungkalit et al (2018) and Pratama et al (2020). This is probably because it is influenced by the other factors not controlled by the researcher, such as nutritional status, infectious diseases, and intake of other nutrients. In addition, 24-hour food recall has a weakness when researchers explore information about iron intake, which may underestimate or overestimate in conveying food intake and the memory and honesty factors of respondents in providing information also affect<sup>[15][20][21]</sup>.

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## CONCLUSION

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The results of a systematic review study show that:

1. Protein intake is a very important nutrient in the formation of hemoglobin. Protein is a nutrient that has an important role in life, which functions in the formation of essential bonds in the body, including the formation of hemoglobin and has a very important role in the process and transportation of iron in the body. And is one of the nutrients needed for the absorption of iron, with low consumption of protein it can cause low absorption of iron by the body
2. Intake of Fe or iron is a nutrient that is very important in the manufacture of hemoglobin and helps metabolic processes by helping various enzymes by binding oxygen. Then, iron intake is an extremely influential on anemia, the higher the iron intake the better the hemoglobin level or



the less risk of anemia. Furthermore, it is necessary to pay attention to the intake of nutritious food to meet the required Fe needs.

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