# Description of Nutritional Status, Hemoglobin Level and Tibc Level in Female Adolescents

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**ABSTRACT**

Anemia is a public health problem that still has a high prevalence, especially among adolescents. According to WHO data, approximately 25% of adolescents worldwide experience anemia caused by iron deficiency. Adolescents are an age group that is vulnerable to anemia because they experience accelerated growth and menstruation, so they need nutritional intake containing iron. One of the challenges in treating anemia is identifying the right cause to determine iron deficiency. One of the laboratory examinations needed to establish an accurate diagnosis is TIBC (Total Iron Binding Capacity ), which measures the capacity of blood to bind iron through transferrin. This study aims to describe nutritional status, hemoglobin levels, and TIBC levels. This type of research is analytically descriptive. A cross-sectional observational research methodology is employed. 76 female adolescents from SMK Baitul Hikmah made up the study's population. Total sampling was the method employed, and it was based on the screening findings, which included female adolescents. The study's findings outline measurements of TIBC, hemoglobin, and BMI. There are 66.7% underweight adolescents, 9.5% have anemia, and 28.5% have abnormal TIBC levels. The study concluded that examining nutritional status, hemoglobin levels, and Total Iron Binding Capacity (TIBC) is important in assessing individuals' health, especially in malnutrition and anemia. Continuous monitoring and other examinations are needed to support the diagnosis of adolescents who experience anemia.

**Keyword:** Nutritional status, Hemoglobins, Total Iron Binding Capacity, Adolescent health.

**ABSTRAK**

Anemia merupakan salah satu masalah kesehatan masyarakat yang masih tinggi prevalensinya, terutama pada kelompok remaja. Menurut data WHO, sekitar 25% remaja di dunia mengalami anemia yang disebabkan oleh defisiensi zat besi. Remaja merupakan kelompok usia yang rentan terhadap anemia karena mengalami percepatan pertumbuhan dan mengalami menstruasi sehingga membutuhkan asupan nutrisi yang mengandung zat besi. Salah satu tantangan dalam penanganan anemia adalah identifikasi penyebab yang tepat untuk mengetahui kekurangan zat besi. Salah satu pemeriksaan laboratorium diperlukan untuk menegakkan diagnosis yang akuratadalah TIBC (Total Iron Binding Capacity mengukur kapasitas darah dalam mengikat zat besi melalui transferrin. Penelitian ini bertujuan untuk mengetahui gambaran status gizi, kadar hemoglobin, dan kadar TIBC. Jenis penelitian ini adalah deskriptif analitik. Metodologi penelitian observasional cross-sectional digunakan. Sebanyak 76 remaja putri dari SMK Baitul Hikmah menjadi populasi penelitian. Total sampling adalah metode yang digunakan, dan didasarkan pada temuan skrining, yang mencakup remaja perempuan. Temuan penelitian ini menguraikan pengukuran TIBC, hemoglobin, dan BMI. Terdapat 66,7% remaja dengan berat badan kurang, 9,5% mengalami anemia, dan 28,5% dengan kadar TIBC yang tidak normal. Penelitian ini menyimpulkan bahwa pemeriksaan status gizi, kadar hemoglobin, dan Total Iron Binding Capacity (TIBC) penting untuk menilai kesehatan individu, terutama pada malnutrisi dan anemia. Pemantauan secara terus menerus dan pemeriksaan lainnya diperlukan untuk mendukung dalam menentukan diagnosis remaja yang mengalami anemia.

**Kata Kunci:** Status gizi, Hemoglobin, Total Iron Binding Capacity , Kesehatan Remaja.

## Introduction:

Anemia is a condition where the hemoglobin (Hb) level in the blood is less than usual, where the standard limit is 12 g/dl (Regasa & Haidar, 2019). Iron deficiency is the main cause of anemia, an interesting nutritional condition that is particularly prevalent in underprivileged female adolescents. Adolescent girls have a higher risk of anemia due to increased demand, low intake of hematopoietic nutrients, and low intake of nutrients that enhance the absorption of these hematopoietic nutrients (Y. Handayani & Budiman, 2022). Iron nutritional anemia in adolescent girls is at higher risk because it causes a person to experience a decrease in endurance, so they are easily exposed to health problems (Anggoro, 2020). Anemia is a significant global health problem, especially among adolescent girls, which can have long-term consequences on reproductive health (Indonesia, 2018).

According to data from the World Health Organization (WHO), the prevalence of anemia among adolescent girls in developing countries reaches around 53.7% (Amalia et al., 2024). WHO states that two billion people in the world suffer from anemia, and 50% of them are caused by iron deficiency; in Indonesia, the rate of iron nutrition anemia is 72.3% (Utami & Farida, 2022). Based on data from Riskesdas 2018, adolescent girls who experience anemia increased to 48.9% from 37.1 in 2013 (Nasruddin et al., 2021). In 2018, there were 648 instances in the Jember Regency, one of the districts in East Java, with a 19.76% anemia rate among teenage girls aged 15 to 18. Symptoms of anemia were mainly in the low category of 76.9% health students and 54.7% non-health students (R. Handayani et al., 2023).

The problem of iron deficiency anemia in adolescent girls is caused by the lack of information delivery a lack of concern from parents, the community, and the government for adolescent health and not optimal adolescent health services (Anggoro, 2020). Adolescents with low knowledge about anemia tend not to know the causes, dangers, and prevention of anemia during menstruation (Larasati et al., 2021). Low intake or entry of iron and other nutrients into the body, such as vitamin A, vitamin C, folate, riboflavin, and B12, is a contributing factor to the high incidence of anemia in adolescent girls (Puspikawati et al., 2021). The impact of anemia on adolescent girls is stunted growth; the body during growth is easily infected, resulting in reduced fitness or freshness and decreased enthusiasm for learning or achievement (Khobibah et al., 2021). Iron deficiency in pregnant women increases the risk of premature birth, low birth weight, and stunting (Yuliawati et al., 2023). The leading cause of anemia in pregnant women is iron deficiency; however, pregnant women rarely develop iron deficiency anemia due to nutritional problems (Susilawati et al., 2021).

Iron deficiency in adolescent girls can be prevented through several efforts, including education, screening, and treatment. The provision of education on preventing and treating anemia by fulfilling nutrition has been carried out but has not yet obtained maximum results. The Indonesian government has made several efforts to prevent and overcome anaemia in adolescent girls by launching an iron supplementation program (Helmyati et al., 2023). Adolescents should take iron supplementation every month during menstruation to replace the iron lost and not fulfilled from food (Fitriana & Dwi Pramardika, 2019). Screening can be done through laboratory examinations, namely hematological and biochemical examinations. The biochemical examination aims to detect iron deficiency before and after anemia. In this study, female adolescents with anemia had a biochemical analysis of their TIBC levels. TIBC examination measures the total amount of iron bound by transferrin protein in the blood to determine whether the blood in the adolescent's body has excess or iron deficiency in preventing anemia.

## Methods:

This type of research is analytically descriptive. The research method used is observational, using a cross-sectional methodology. The data collection process is carried out at one time, namely measuring height, weight, hemoglobin levels, and TIBC levels. The

population in this study consisted of 76 adolescent girls from SMK Baitul Hikmah. The sampling technique used was total sampling based on the screening results, namely 21 adolescents. The inclusion criteria in this study include adolescent girls aged 16-18 years who are ready to participate as respondents. Conversely, the study's exclusion criteria are adolescent girls who, in their right mind, are menstruating and sick. The place of research implementation is at SMK Baitul Hikmah. At the time of implementation in February- March 2023, data collection techniques were carried out with observation sheets. The determination of nutritional status in adolescent girls can be done by measuring height and weight. Height measurement uses a height measuring instrument in units of size (Cm) and a weight measuring instrument in units (Kg). Determining hemoglobin levels in adolescent girls can be done by examining hemoglobin with the procedure for determining the part that will be stabbed, namely the tip of the finger. Then, clean with alcohol cotton as an antiseptic, wait until it dries, then prick the finger using a sterile lancet with a drop of capillary blood. A drop of capillary blood that comes out of the puncture is inserted into the test strip. This blood sample will be analyzed using the Fortabel system EasyTouch GCHb model ET-321. Height, weight, and hemoglobin checks can be done by midwives. The TIBC examination will be carried out by SIMA laboratory personnel by taking a blood sample in a vein of as much as 3 cc and analyzing it. The results of these measurements were sorted into groups using Body Mass Index (BMI) limits according to age mentioned in the Republic of Indonesia's Regulation of the Minister of Health Number 2 of 2020, which describes the Child Anthropometric Standards (Handayani et al., 2024). Data on anemia were obtained from the examination of Hb levels and serum TIBC conducted by the sampling team, namely the midwife and the laboratory SIMA team. With No.034/KEPK/UDS/III/2023, this study has been approved by the Dr. Soebandi University Ethics Committee.

**Results:**

This study appears to explain adolescents' nutritional profiles based on body mass index and anemia status. The following will present in detail the results of examinations in adolescents related to nutritional status:

**Nutritional Status based on BMI**

Table 1. Frequency Distribution by Nutritional Status

| Nutritional Status | f | % |
|---|---|---|
| Thin | 14 | 66,7 |
| Normal | 7 | 33,3 |
| Fat | 0 | 0 |
| Total | 21 | 100 |

Data Source: March 2023

Based on the data above, respondents are included in the thin category, which is 66.7%.

**Hemoglobin Levels**

Table 2 Frequency Distribution by Hemoglobin Levels

| Hemoglobin | f | % |
|---|---|---|
| Anemia | 2 | 9,5 |
| Normal | 19 | 90,5 |
| Total | 21 | 100 |

Data Source: March 2023

Based on the data above, 2 respondents had anemia, which was 9.5%.

**TIBC Levels**

Table 3 Frequency Distribution by TIBC Levels

| TIBC | f | % |
|---|---|---|
| Normal | 15 | 71,5 |
| Unusual | 6 | 28,5 |
| Total | 21 | 100 |

Source of Data: March 2023

Based on the data above, the results of 6 respondents whose TIBC levels were abnormal, namely 28.5%.

**Discussion :**
**Nutritional Status**

Based on the results of the BMI examination of adolescent girls at SMK Baitul

Hikmah, 66.7% are in the thin category. The results of measuring height and weight do not match the normal BMI threshold value because adolescent girls lack understanding during growth, which requires nutritional fulfilment. Adolescent nutritional health can be reflected in a regular diet and physical activity to achieve optimal physical growth. Teenagers pay attention to the adequacy of food intake every day. Adolescent girls pay less attention to the nutritional content of their food, especially iron. Adolescent girls consume more fast food without paying attention to nutritional content and rarely consume vegetables that contain much iron. The wrong diet also causes adolescents' nutritional needs to be less so that nutritional status becomes less. One of the behaviors of adolescents doing the wrong diet is because they are afraid of being overweight. This is because many adolescent girls consider themselves overweight or quickly become fat, so they often diet incorrectly, such as limiting or reducing the frequency of eating and the number of meals.

According to the Indonesian Ministry of Health in 2019, the BMI threshold value for Indonesia is thin < 17, Normal 18.5-25, and Fat > 27. BMI can be used as a measurement tool in monitoring nutritional status in a simple manner (Y. Handayani & Handayani, 2023). Adolescent nutrition intake during this growth period should receive attention, one of which is iron intake (Handriyanti, 2022). Nutritional status is crucial for adolescent girls' health, especially in reproductive health. Adolescence is a critical stage of life, so this period is categorized as a vulnerable group and has high health risks, but adolescents often receive less attention in health service programs (Rafiqi et al., 2022). During the growth period, adolescents need nutrition in the form of protein, calories, and energy. The energy needed by adolescents must be by the activities they do so that if it is not appropriate, it will affect the increase in body weight and height (Oktaviana et al., 2022). Nutritional intake in adolescents is very important because nutrition is one of the factors that influence the occurrence of anemia, and adolescents who have suffered from anemia affect activity patterns and learning concentration (Nurjannah & Putri, 2021).

Normal nutritional status can be achieved by balancing intake, expenditure, and needs (Lindayani et al., 2023). Achieving normal nutritional status can be achieved by meeting the body's needs by regulating diet, especially iron needs, to prevent anemia, namely by consuming foods that contain iron and fulfilling iron supplementation, balanced with regular light exercise, as for foods that are recommended to get higher the consumption of foods high in iron, such as green vegetables, red meat, and sources of vitamin C to help iron absorption. Educating adolescents about the importance of fulfilling balanced nutrition to prevent anemia is necessary. Health workers can carry out nutrition education in collaboration with schools, parents, and peers to remind each other of the importance of fulfilling nutrition to achieve normal nutritional status. Sustainability efforts can be done by regularly monitoring adolescent girls' nutritional status and health.

**Hemoglobin Levels**

The analysis of hemoglobin examination showed that 9.5% of SMK Baitul Hikmah adolescent girls were anemic. This is due to nutritional factors that are not fulfilled, which can be seen from poor nutritional status. Complaints such as weakness, fatigue, lethargy, drowsiness, and dizziness are considered normal, even though this condition is said to be anemia. In this phase, adolescent girls do not understand what causes anemia and how to prevent it. Adolescent girls pay less attention to health, especially anemia, and do not realize if they are experiencing anemia. Adolescent girls are the most vulnerable group to iron deficiency anemia, because adolescent girls experience menstruation every month as well as an increased need for iron to replace iron lost during menstruation. The degree of awareness among female adolecents about anemia greatly affects The conduct of teenagers in meeting nutritional needs in the body. Female adolescents experience anemia due to iron deficiency.

Anemia is a condition with hemoglobin, hematocrit, and red blood cell levels lower than the normal value, which is 12g/dL hemoglobin for adolescents (Amalia et al., 2024). Iron

deficiency is a condition of adolescents with anemia caused by iron deficiency (Salangka et al., 2022). The causes of iron deficiency are excessive bleeding during menstruation, lack of food intake, and impaired absorption (Herwandar & Soviyati, 2020). Nutritional status greatly affects the incidence of anemia because nutritional deficiencies will inhibit the formation of normal red blood cells (Widhawati et al., 2024). The nutrients in the formation of red blood cells are vitamin B12, folic acid, and iron (Rodiyah, 2022). Adolescent girls with poor nutritional status will be at risk for physical health before and during pregnancy. The risks that occur include low birth weight, premature birth, stillbirth, and increased risk of newborn death Premature birth, stillbirth, and increased risk of newborn death (R. P. Sari et al., 2023).

Prevention and overcoming anemia in adolescent girls requires special attention by raising awareness about the importance of nutrition and early detection of anemia, providing education about anemia to adolescents at least once a month, and having a routine program to check the Hb levels of female students so that they are more aware of the incidence of anemia (Fitripancari et al., 2023). Other prevention methods can be implemented, such as maintaining a regular diet, fulfilling iron intake, and drinking enough minerals because minerals are essential for the body. In addition, regular checks are important for the early detection of anemia, and adolescents need health education regarding good nutrition. The government is trying to work together across sectors and programs to provide comprehensive and informative care regarding the treatment of anemia. Attempts to treat females' anemia can be centered on initiatives for prevention and promotion, including increasing iron-rich foods, blood-boosting supplements, and food fortification with iron and folic acid. Blood supplementation for adolescent girls is one of the Indonesian government's efforts to fulfill iron intake (Setyaningrum et al., 2023).

## TIBC

Based on the examination results, 28.5% of adolescent girls have abnormal TIBC levels.
Generally, adolescents have normal TIBC levels of 240 to 450 micrograms per deciliter (mcg/dL). Nutritional deficiencies, especially iron, can cause increased TIBC in adolescent girls. Decreased blood iron levels can be caused by iron deficiency, so the body experiences increased transferrin production to maximize the transport of available iron. Conditions like this can result in adolescent girls experiencing an increase in TIBC values. An increase in high TIBC levels can cause adolescent girls to experience anemia.

Anemia is caused by iron deficiency (P. Sari et al., 2022). Iron is an essential nutrient the body needs to form hemoglobin, a protein that transports oxygen from the lungs to the rest of the body (Chaparro & Suchdev, 2019). An iron test, known as total iron binding capacity (TIBC), is needed to determine whether the body's iron levels are normal. Nutritional fulfillment through nutrition education against iron deficiency anemia is effective for ferritin, serum iron, TIBC, and hematocrit levels (Ghadam et al., 2023).

Screening of TIBC levels is very effective in assessing adolescent girls who experience anemia due to iron deficiency. However, it is necessary to To precisely identify the type of anemia and its etiology, combine the findings of the TIBC with those of further tests, such as blood tests for iron and ferritin. TIBC testing can help monitor the effectiveness of therapy, which provides an essential insight into the status of iron metabolism in the body(R. Handayani et al., 2024). Given the importance of iron deficiency and anemia in adolescent girls, further interventions are needed to overcome iron deficiency anemia with monitoring and evaluation using digitalization.

## Conclusions:

The study concluded that examining nutritional status, hemoglobin levels, and Total Iron Binding Capacity (TIBC) is an important aspect in assessing individuals' health, especially in malnutrition and anemia. Nutritional status reflects the balance between nutrients entering the body and their utilization. Assessment of nutritional status can be done through direct methods such as anthropometry, which is very easy and effective. Low hemoglobin levels

indicate anemia, which can be caused by iron deficiency. Meanwhile, high TIBC can be caused by iron deficiency. Further monitoring is needed to prevent the occurrence of anemia in adolescents. In addition, other examinations are needed to support in determining the diagnosis of adolescents experiencing anemia.

**Acknowledgements:**

**References:**

Amalia, N. R., Jamil, M. U., Dewi, H. A., & Hidayatulloh, A. I. (2024). Analisis Pengetahuan Remaja Putri tentang Anemia di Wilayah Kerja Puskesmas Karang Anyar. *Jurnal Kesehatan Ilmiah Indonesia ( Indonesian Health Scientific Journal*, *9*(1), 311–320.

Anggoro, S. (2020). Faktor-Faktor yang Mempengaruhi Kejadian Anemia pada Siswi SMA. *Jurnal Ilmiah Permas: Jurnal Ilmiah STIKES Kendal*, *10*(3), 341–350. http://download.garuda.kemdikbud.go.id/article.php?article=1742402&val=17145&title=FACTORS AFFECTING THE EVENT OF ANEMIA IN HIGH SCHOOL STUDENTS

Chaparro, C. M., & Suchdev, P. S. (2019). Anemia epidemiology, pathophysiology, and etiology in low- and middle-income countries. *Annals of the New York Academy of Sciences*, *1450*(1), 15–31. https://doi.org/10.1111/nyas.14092

Fitripancari, A. D., Arini, F. A., Imrar, I. F., & Maryusman, T. (2023). The Relationship between Iron and Vitamin C Intake, Risk Beverage Consumption Frequency, and Dietary Behavior with Anemia Adolescent Girls in Depok City. *Amerta Nutrition*, *7*(2SP), 100–106. https://doi.org/10.20473/amnt.v7i2SP.2023.

100-106

Ghadam, O. S., Sohrabi, Z., Mehrabi, M., Fararouei, M., Shahraki, M., Hejazi, N., Clark, C. C. T., Mehrabani, S., Gerami, S., & Nouri, M. (2023). Evaluating the effect of digital game-based nutrition education on anemia indicators in adolescent girls: A randomized clinical trial. *Food Science and Nutrition*, *11*(2), 863–871. https://doi.org/10.1002/fsn3.3120

Handayani, R., Anggraeni, E., Handayani, Y., & Kumala D, Y. (2023). Skrining Anemia Melalui Pemeriksaan HB, TIBC dan Serum Iron Pada Remaja Putri di SMK Baitul Hikmah Tempurejo. *Shihatuna : Jurnal Pengabdian Kesehatan Masyarakat*, *3*(2), 101. https://doi.org/10.30829/shihatuna.v3i2.15448

Handayani, R., Anggraeni, E., Handayani, Y., Sari, M. P., & Yuningsih. (2024). Early Detection of Anemia in Adolescent Girls Through Nutritional Status Examination and Iron Panel Analysis (Tibc, Serum Iron, Iron Saturation). *Indonesian Journal of Public Health*, *19*(2), 344–355. https://doi.org/10.20473/ijph.v19i2.2024.344-355

Handayani, Y., & Budiman, I. A. (2022). Hubungan Kepatuhan Konsumsi Tablet Fe Terhadap Kejadian Anemia. *Oksitosin : Jurnal Ilmiah Kebidanan*, *9*(2), 121–130. https://doi.org/10.35316/oksitosin.v9i2.1560

Handayani, Y., & Handayani, R. (2023). Status Gizi Calon Pengantin Wanita. *Oksitosin : Jurnal Ilmiah Kebidanan*, *10*(1), 62–68. https://doi.org/10.35316/oksitosin.v10i1.2287

Handriyanti, R. F. (2022). Hubungan Pengetahuan Gizi, Frekuensi Konsumsi Inhibitor Zat Besi, Asupan Vitamin C, Zat Besi, Dan Protein Dengan Kejadian Anemia Pada Siswi Smkn 5 Kota Bekasi. *Jurnal Kesehatan Saintika Meditory*, *5*(2), 28. https://doi.org/10.30633/jsm.v5i2.1533

Helmyati, S., Syarifa, C. A., Rizana, N. A., Sitorus, N. L., & Pratiwi, D. (2023). Acceptance of Iron Supplementation Program among Adolescent Girls in

Indonesia: A Literature Review. *Amerta Nutrition*, *7*(3SP), 50–61. https://doi.org/10.20473/amnt.v7i3SP.2023.50-61

Herwandar, F. R., & Soviyati, E. (2020). Perbandingan Kadar Hemoglobin Pada Remaja Premenarche Dan Postmenarche Di Desa Ragawacana Kecamatan Kramatmulya Kabupaten Kuningan Tahun 2018. *Jurnal Ilmu Kesehatan Bhakti Husada: Health Sciences Journal*, *11*(1), 71–82. https://doi.org/10.34305/jikbh.v11i1.154

Indonesia, K. K. R. (2018). *Pedoman Pencegahan dan Penanggulangan Anemia Pada Remaja Putri dan Wanita Usia Subur*.

Khobibah, K., Nurhidayati, T., Ruspita, M., & Astyandini, B. (2021). Anemia Remaja Dan Kesehatan Reproduksi. *Jurnal Pengabdian Masyarakat Kebidanan*, *3*(2), 11. https://doi.org/10.26714/jpmk.v3i2.7855

Larasati, D. K., Mahmudiono, T., & Atmaka, D. R. (2021). Literature Review : Hubungan Pengetahuan dan Kepatuhan Mengkonsumsi Tablet Tambah Darah dengan Kejadian Anemia Defisiensi Besi Literature Review : Correlation Of Knowledge and Compliance of Iron Folic Acid Supplement Consumption with Iron Deficiency Anemi. *Media Gizi Kesmas*, *10*(02), 120. http://repository.ub.ac.id/167777/

Lindayani, E., Ningrum, D., Setiadi, D. K., Nuryani, R., Sejati, A. P., & Sukaesih, N. S. (2023). Peningkatan Pengetahuan Status Gizi pada Remaja Putri dalam Mencegah Kejadian Anemia di SMPN 1 Conggeang. *PengabdianMu: Jurnal Ilmiah Pengabdian Kepada Masyarakat*, *8*(5), 708–713. https://doi.org/10.33084/pengabdianmu.v8i5.4880

Nasruddin, H., Faisal Syamsu, R., & Permatasari, D. (2021). Angka Kejadian Anemia Pada Remaja di Indonesia. *Cerdika: Jurnal Ilmiah Indonesia*, *1*(4), 357–364. https://doi.org/10.59141/cerdika.v1i4.66

Nurjannah, S. N., & Putri, E. A. (2021). Hubungan Status Gizi Dengan Kejadian Anemia Pada Remaja Putri Di Smp Negeri 2 Garawangi Kabupaten Kuningan. *Journal of Midwifery Care*, *1*(02), 125–131.

https://doi.org/10.34305/jmc.v1i02.266

Oktaviana, R., Rizal, M., Program, P., Klinik, S. G., Kesehatan, J., & Jember, P. N. (2022). Hubungan Pola Makan Dan Status Gizi Dengan Kejadian Anemia Pada Santriwati Pondok Pesantren Annuriyyah Rambipuji. *HARENA : Jurnal Gizi*, *2*(2), 54–61. https://publikasi.polije.ac.id/index.php/harena/article/view/2806

Puspikawati, S. I., Sebayang, S. K., Dewi, D. M. S. K., Fadzilah, R. I., Alfayad, A., Wrdoyo, D. A. H., Pertiwi, R., Adnin, A. B. A., Devi, S. I., Manggali, T. R., Septiani, M., & Yunita, D. (2021). Pendidikan Gizi tentang Anemia pada Remaja di Kecamatan Banyuwangi Jawa Timur. *Media Gizi Kesmas*, *10*(2), 278–283.

Rafiqi, A., Fahra, Matondag, I., & Fevria, R. (2022). Iron Nutrition Anemia (AGB) Causes Malnutrition At The Adolescent Level. *Prosiding SEMNAS BIO*, 827–832.

Regasa, R. T., & Haidar, J. A. (2019). Anemia and its determinant of in-school adolescent girls from rural Ethiopia: A school based cross-sectional study. *BMC Women's Health*, *19*(1). https://doi.org/10.1186/s12905-019-0791-5

Rodiyah, R. (2022). Hubungan Indeks Massa Tubuh Dengan Kejadian Anemia Pada Mahasiswi Tingkat 1 Sarjana Keperawatan Stikes Pemkab Jombang. *Jurnal Ilmiah Keperawatan (Scientific Journal of Nursing)*, *8*(2), 365–372. https://doi.org/10.33023/jikep.v8i2.1147

Salangka, A. M., Mantik, M. F. J., & Salendu, P. M. (2022). Peran Nutrisi terhadap Kejadian Anemia Defisiensi Besi pada Anak. *E-CliniC*, *11*(1), 103–109. https://doi.org/10.35790/ecl.v11i1.44322

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*(August), 1137–1147. https://doi.org/10.2147/IJWH.S376023

Sari, R. P., Silaban, E. M. L., & Merry, Y. A. (2023). Correlation of Hemoglobin Levels

with Nutritional Status in Adolescent Girls: A Health Promotion Perspective. *Jurnal Promosi Kesehatan Indonesia*, *18*(2), 109–115. https://doi.org/10.14710/jpki.18.2.109-115

Setyaningrum, Y. I., Wulandari, I., & Purwanza, S. W. (2023). *Literatur Review Penyebab dan Upaya Pencegahan Anemia pada Remaja Putri*. *3*(2), 84–100.

Susilawati, E., Suryanti, Y., Sari, L. A., Herinawati, & Murtiyarini, I. (2021). The Impact of an Android Application on Compliance With Iron Supplementations in Pregnant Women. *Journal of Client-Centered Nursing Care*, *7*(3), 237–244. https://doi.org/10.32598/JCCNC.7.3.380.1

Utami, N. A., & Farida, E. (2022). Kandungan Zat Besi, Vitamin C dan Aktivitas Antioksidan Kombinasi Jus Buah Bit dan Jambu Biji Merah sebagai Minuman Potensial Penderita Anemia. *Indonesian Journal of Public Health and Nutrition*, *2*(3), 372–260. https://doi.org/10.15294/ijphn.v2i3.53428

Widhawati, S., Suparji, S., Handayani, T. E., & Herlina, T. (2024). Relationship Between Diet Patterns and Anemia in Female Adolescents. *Health Dynamics*, *1*(8), 304–308. https://doi.org/10.33846/hd10805

Yuliawati, R., Ardi Bastian, & Agustin Widyowati. (2023). Knowledge and Awareness Impact on Adherence to Iron Supplementation: Study in Baron sub-district, Nganjuk Regency. *Journal Of Nursing Practice*, *7*(1), 121–126. https://doi.org/10.30994/jnp.v7i1.489