

## Basil Seeds Infused Water Increases Hemoglobin Levels in Adolescent Women in Jember City

Febrina Artha Widiyanti<sup>1\*</sup>, Sharvianty Arifuddin<sup>2</sup>, Mardiana Ahmad<sup>3</sup>, Veny Hadju<sup>4</sup>, Werna Nontji<sup>5</sup>, Andi Aryandy<sup>6</sup>

<sup>1,2,3</sup> Department of Midwifery, Postgraduate Faculty, Universitas Hasanuddin University, Makassar

<sup>4</sup> Department of Nutrition Science, Faculty of Public Health, Hasanuddin University, Makassar

<sup>5</sup> Department of Nursing, Faculty of Nursing, Hasanuddin University, Makassar

<sup>6</sup> Department of Physiology, Faculty of Medicine, Hasanuddin University, Makassar

\*Correspondence author: [widiyantifa21p@student.unhas.ac.id](mailto:widiyantifa21p@student.unhas.ac.id)

Submitted : 2023-06-07 ; Accepted : 2023-10-05

Doi: 10.36858/jkds.v11i2.507

### ABSTRACT

Anemia is a condition of decreased hemoglobin levels, hematocrit and erythrocyte count and requires the availability of sufficient iron and protein so that hemoglobin synthesis can be carried out. Basil seeds are a good source of micronutrients and have excellent antioxidant potential for health and can be used as an attractive beverage with various benefits. This study aims to determine the effect of giving Basil Infused Water on increasing Hemoglobin levels which is expected to be a solution to prevent anemia in young women as a preparation for becoming a mother so that complications do not occur during a future pregnancy. Materials and This research was conducted at the Nuris Islamic Boarding School, Jember Regency. This research is a Quasy Experiment with a blinded pre-post test group design . The sample used was 52 young women. Sampling by purposive sampling in accordance with the inclusion criteria. Data analysis using statistical tests paired T-test and Independent T-Test . The study showed that there was an increase in hemoglobin levels in young women after being given intervention in the form of basil infused water for 90 days with a total of three times a week. The statistical test results showed that there was a mean difference of 1.6423 gr/dl and statistically significant with  $p = 0.000$  where  $p < 0.05$  which means there was an increase in hemoglobin levels before and after being given basil seeds infused water .

**Keyword:** Basil Seeds, Hemoglobin, Adolescent Women

### ABSTRAK

Anemia merupakan kondisi penurunan kadar hemoglobin, hematokrit dan hitung eritrosit serta diperlukan ketersediaan zat besi dan protein yang cukup untuk dapat dilakukan sintesis hemoglobin. Biji selasih merupakan sumber mikronutrien yang baik dan memiliki potensi antioksidan yang sangat baik untuk kesehatan dan dapat digunakan sebagai minuman yang menarik dengan berbagai manfaat. Penelitian ini bertujuan untuk mengetahui pengaruh pemberian Infused Water Selasih terhadap peningkatan kadar Hemoglobin yang diharapkan dapat menjadi solusi untuk mencegah terjadinya anemia pada remaja putri sebagai persiapan untuk menjadi seorang ibu sehingga tidak terjadi komplikasi pada saat terjadinya sebuah kehamilan ke depannya. Penelitian ini dilakukan di Pondok Pesantren Nuris, Kabupaten Jember. Penelitian ini merupakan Quasy Experiment dengan rancangan blinded pre – post test group design. Sampel yang digunakan sebanyak 52 remaja putri. Pengambilan sampel dengan cara purposive sampling yang sesuai dengan kriteria inklusi. Data analisis dengan menggunakan uji statistik T-test berpasangan dan Independent T-Test. Penelitian menunjukkan terdapat peningkatan kadar hemoglobin pada remaja putri setelah diberikan intervensi berupa infused water selasih selama 90 hari dengan jumlah pemberian tiga kali dalam satu minggu. Hasil uji statistik menunjukkan bahwa terdapat selisih mean 1.6423 gr/dl dan signifikan secara statistik dengan  $p = 0.000$  di mana  $p < 0.05$  yang berarti terdapat peningkatan kadar hemoglobin sebelum dan sesudah diberikan infused water selasih.

**Kata Kunci:** Biji Selasih, Hemoglobin, Remaja Putri

\*Correspondence author: [widiyantifa21p@student.unhas.ac.id](mailto:widiyantifa21p@student.unhas.ac.id)

How to Cite: How to Cite : Widiyanti, FA., Arifuddin, S., Ahmad, M., Hadju, V., Nontji, W., Aryandy, A., (2023) . *Basil Seeds Infused Water Increases Hemoglobin Levels in Adolescent Women in Jember City*. Jurnal Kesehatan dr. Soebandi Vol. 11 No. 2 Hal. 100 – 106. <https://doi.org/10.36858/jkds.v11i2.507>

## Introduction:

Anemia is a condition of decreased number of erythrocytes which is characterized by decreased levels of hemoglobin, hematocrit and erythrocyte count. Adequate availability of iron and protein is required for hemoglobin synthesis to occur. Protein is needed to transport iron to the bone marrow so that new hemoglobin can be formed (Astuti & Kulsum, 2020) (Astuti & Kulsum, 2020). The incidence of anemia is influenced by consumption patterns that lack iron. When people consume food that contained good nutrition, then the nutritional status will be good.

In 2013, 37.1% of female adolescents suffering from anemia increased to 48.9% in the 2018 based on Basic Health Research (*RISKESDAS 2018*, n.d.). Data from the East Java Provincial Health Office in 2020 as many as 42% of young women in East Java and 41% of young women in Jember Regency suffer from anemia (*RISKESDAS Jawa Timur 2018*, n.d.). The National Health Survey shows that the prevalence of anemia is higher in peri-urban areas than in urban areas.

According to the Minister of Health of the Republic of Indonesia Number 25 of 2014 (Kemenkes RI, 2014) adolescents are residents aged 10-18 years. This period is called the transitional period in which a child develops into an adult and is followed by physical, emotional and cognitive changes that have an impact on the nutritional status of adolescents. The dramatic physical growth and development experienced by adolescents can even exceed the growth rates experienced as infants, which will significantly increase the need for energy, protein, vitamins and minerals. The rapid growth rate will result in an increase in blood volume during adolescence. Menarche that occurs during adolescence also increases the need for iron. Hemoglobin levels are used to determine whether a person has iron deficiency anemia or not. Iron intake needed by young women aged 12-19 years is 12.0 mg/day (Brown et al., 2016).

Adolescent women are a group that is prone to anemia and have a ten times higher risk than adolescent men. Because adolescent women through menstrual cycles and are in a period of growth that requires more iron intake than usual.

Imbalance nutritional intake experienced by adolescent women is also a cause of anemia because adolescent women tend to pay attention to body shape thereby limiting food consumption (Triyonate & Kartini, 2015).

Adolescents with anemia will have disturbances in their growth so that they have below normal height and weight. Anemia in adolescents also causes disturbances in the pregnancy they will experience later so that the risk of premature labor and giving birth to babies with low birth weight (LBW) will also increase (Brown et al., 2016). The iron status of adolescents who experience anemia must be corrected immediately so that the risk of anemia during pregnancy can be reduced.

Basil (*Ocimum basilicum* L.) is a native plant in tropic area and belongs to the same genus as basil. The name basil comes from the Greek "Basileus" which means "kingdom" or "king" and is often known as the king of plants, because of its various benefits in medicine, cosmetics, the pharmaceutical and food industries (Munir et al., 2017). Basil is a plant that is used as food and medicine. Basil seeds are widely used as a traditional medicine for dyspepsia, ulcers, diarrhea, diabetes, cardiovascular disease and various other diseases. Basil seeds are a food source that contains high enough iron, which is equal to 22.7 mg. Basil seeds also contain high levels of protein, fiber, healthy fats and carbohydrates. According to research from Masooma Munir, et al in 2017, basil seeds are a good source of micronutrients and have excellent antioxidant potential for human health (Calderón Bravo et al., 2021).

People's lifestyles have changed and tend to eat delicious, easy-to-find and affordable food, of course, have an impact on the new generation in the form of disease as a result of low intake of fiber and lack of nutritional components. So that, food scientists and technology are try to make and develop nutritious and healthy food but still according to people's needs. The results of various studies and studies are supplementation and added value of food products such as *bakery*, *dairy* and beverages. Drinks are an excellent medium for nutritional intake because they are consumed to satisfy appetite and meet the body's

need for water. Basil seeds are a cheap and easy source of micronutrients. So that the research from Masooma Munir, et al in 2017 studied the nutritional needs of consumers by utilizing drinks economically (Munir et al., 2017).

Consuming foods that contain lots of iron both from animal foods (meat, fish, liver, eggs, chicken) and plant foods (vegetables, nuts) can increase hemoglobin levels significantly. Based on research from Triyonete (Triyonete & Kartini, 2015) protein is also related to hemoglobin levels because it plays a very important role in the transportation of iron in the human body.

Preliminary studies that have done at the Nuris Islamic Boarding School, Jember City, found data that Ferrous supplement had never been distributed to adolescent women in this school. After studying the description above regarding the factors that affect the increase in hemoglobin levels in the blood, the researchers will focus on meeting the nutritional needs of adolescent women by give basil seeds infused water because basil seeds contain iron, vitamin A, vitamin C and high protein which can increase hemoglobin levels.

## Methods:

This is a quantitative research with True Experiment design. This research used "Single Blinded Pre and Post Test with Control Group". The group was divided into 2, intervention group and the control group. All samples will be pretested by examining hemoglobin (Hb). The intervention group will be given 100 grams of wet basil seeds dissolved in 240 ml of infused water in which there are 20 grams of lemon slices and 4 grams of sugar 3 times a week and given Iron tablets once a week and every day during menstruation (1 months consuming  $\pm 10$  tablets of Fe). The control group will be given a placebo in the form of 240 ml of water and Fe tablets once a week and every day during menstruation. So, both of them will be consume 36 times basil seeds infused water and placebo during the experiment. The control and intervention groups will be monitored for nutritional intake through a 24-hour food recall . After 90 days, a post test was carried out by examining Hemoglobin levels.

This research was conducted at the Nuris Islamic Boarding School, Jember City from November 2022 to February 2023. The population in this study was 470 female students living in the Islamic boarding school environment. The sampling technique in this study was carried out by means of Purposive Sampling with the sample criteria divided into inclusion criteria and exclusion criteria. Eligibility criteria are Adolescent women aged 15-18 years, menarche already, Hb level  $< 12$  gr/dL, not on a diet program, there is not mass in the stomach, diarrhea, intestinal worms or inflammation or other infectious disease. Not eligibility criteria are experiencing menstruation with long cycles, menometrorrhagia. Drop out criteria for the study are not consuming Fe tablets or basil seeds infused water for more than 2 weeks, refusing to continue taking Fe tablets or basil seeds infused water . After screening the entire population, 52 female students were found to meet the inclusion criteria.

The tools used in this study were: sheets for recording the results of Hb levels, sheets for respondent characteristics, checklist sheets for monitoring adherence to consumption of basil seeds infused water and Fe tablets, sheets for recording 24-hour food recall, basil seeds, Fe tablets, PoCT (Point of Care *Testing* ) Easy Touch brand , *blood lancet* , hemoglobin *stick* , *hand scoon*, *alcohol cotton*, *dry wipes*, *dry cotton*. The essential ingredient used is capillary blood at the respondent's fingertips. Consumables used are basil seeds, sugar, lemon and Fe tablets.

Quality Control is carried out by researchers to ensure that basil seeds and Fe tablets are actually consumed by respondents. To ensure good quality control, the researchers carried out: calibrated the digital scales, microtoise and Hb meter for the Easy Touch brand used, made observations every 2 days with respondents then filled out control cards and food recall sheets and distributed basil infused water and tablets Fe every 2 days, the teacher paid attention to the respondents so they could consume basil seeds and Fe tablets according to the schedule given by the researcher. The research was conducted after requesting ethical clearance from the Faculty of Public Health,

Hasanuddin University Makassar with letter number: 13982/UN4.14.1/TP.01.02/2022

## Results:

Table 1 Contribution of Basil Seeds Infused Water to the Daily Nutritional Needs

Nutrient content	Nutrients Total Basil Infused Water	Contribution of Basil Infused Water to Daily RDA
Energy	45.8 kcal	2.1%
Proteins	3.25 gr	5%
Fat	0.84 gr	1%
Carbohydrate	8 gr	2%
Iron	3.27 mg	22%
Vitamin A	264 RE	44%
Vitamin C	28mg	4%

Table 1 contains the contents and contributions of Infused Water Basil formula 1 which is the result of the organoleptic tests that have been carried out previously. This content was obtained from the Food Composition Table of the Ministry of Health (Kementerian Kesehatan RI, 2017) and *Food Data Central United States* (United State Departement of Agriculture (USDA), 2019).

Table 2 Frequency Distribution of Hemoglobin Levels

No	Criteria	Pre Test		Posttest	
		n	%	n	%
1	Intervention Group				
	9.0 – 9.9 gr/dl	3	11.5	1	3.8
	10.0 – 10.9 gr/dl	12	46.2	1	3.8
	11.0 – 11.9 gr/dl	11	42.3	7	26.9
	> 12 gr/dl	-	-	17	65.4
2	Control Group				
	9.0 – 9.9 gr/dl	1	3.8	-	-
	10.0 – 10.9 gr/dl	10	38.5	3	11.5
	11.0 – 11.9 gr/dl	15	57.7	16	61.5
	> 12 gr/dl	26	-	7	26.9

In table 2, it was found that in the intervention group, when the pre-test was carried out to measure hemoglobin levels, the highest number was obtained in the group 10.0 – 10.9 gr/dl with a total of 46.2%, but when the post-test was carried out to measure hemoglobin levels, the

number at most above 12 gr/dl as much as 65.4%. In the control group, the highest amount of data during the pre-test was at levels of 11.0 – 11.9 gr/dl as much as 57.7%. When the post test was carried out, the highest levels were also in the same class range, namely at 11.0 - 11.9 gr/dl with a total of 61.5%.

Table 3 Nutritional Content of Snacks

No	Content	Intervention	Group		
			% AKG	Control	%A KG
1	Fe	2,31	15,4	3.46	23
2	Proteins	3.04	4,6	2.85	4,3
3	Vitamin A	0.73	0.12	0.35	0.06
4	Vitamin C	3,19	0.42	2.88	0.38

In table 3 it is known that the Fe content in the snacks consumed by respondents in the control group has a higher number (23%) than the intervention group (15.4%). Meanwhile, the amount of protein, vitamin A and vitamin C in the snacks consumed by the intervention group was higher than the control group.

Table 4 Adolescent Girl Hemoglobin Levels

Group	Measurement	n	Means	Difference	Standard deviation	p value
Intervention	Before	26	10.75		0.80	
	After	26	12.40	1.64	1.12	0.00
Control	Before	26	10.98		0.44	
	After	26	11.55	0.57	0.57	0.00

(paired t-test)

In table 4, the data processing from the SPSS program, namely the difference before and after being given basil infused water in the intervention group was 1.64 and in the control group was 0.57 with a p value of 0.00. Before testing the data using SPSS, a normality test was first performed and the results showed that the data were normally distributed, so a paired T-test was performed for the intervention and control groups. In both groups there was a p-value of 0.00 which means below 0.05, so it means that

there was a significant increase before and after being given basil infused water .

Table 5 Differences in Hemoglobin Levels

Group	N	Mean s	Differ ence	Standard deviatio n	p value
Intervention	26	1.64		0.957	
Control	26	0.57	1.06	0.58	0.014

(independent t-test)

Table 5 contains differences hemoglobin levels in the two groups. Based on the table, there is a mean value in the intervention group of 1.64 and a mean value in the control group of 0.57 so that the delta score is 1.06 with a p value of 0.014. The p value is below 0.05 so that there is a significant difference between the intervention and control groups.

### Discussion:

Adolescence is a period of transition from childhood to adulthood. During this period there were significant physical and mental changes. Physical changes in adolescent women are marked by the appearance of menstruation which is a sign that their reproductive organs are developing properly. Adolescents are children who are in the age range of 10-18 years (Kemenkes RI, 2014).

From the data obtained, all respondents had never consumed iron tablets. This is because the public health center never came to provide education and distribute Iron tablets and there was no distribution of Iron tablets from the Nuris Islamic boarding school. Adolescent women are experiencing a menstrual phase where at this time they will need more iron than usual. The need for iron increases during adolescence due to the physical changes they are experiencing and there is a new phase experienced by young women, called menstruation. This is in line with research from Lestari (2018) that there is a relationship between health facilities for preventing anemia and the incidence of anemia (Lestari, 2018).

Based on the statistical data in table 5, it was found that there was a significant difference in hemoglobin levels before and after being given

basil seeds infused water in the intervention group with a p-value on the statistical test result of 0.00. There was an average increase of 1.64 in hemoglobin levels before and after being given the intervention of giving basil infused water

Basil seeds infused water contains quite good nutrients such as iron, vitamin A, vitamin C, and protein. The nutritional content of basil infused water has energy of 45.8 kcal (2.1% RDA), iron 3.27 mg (22% RDA), vitamin A 264 RE (44% RDA), vitamin C 28 mg (4% RDA) per 100 grams basil seeds (United State Departement of Agriculture (USDA), 2018)and (Kementerian Kesehatan RI, 2017). The high iron content in basil infused water will help the process of forming hemoglobin in young women thereby helping to reduce the risk of anemia and facilitating the work of red blood cells which are related to the flow of oxygen in the blood and nutrients throughout the body. This is in line with research conducted by Soedijanto (2015) and Tania (2018) that a lack of consuming foods that contain iron will increase the risk of anemia (Tania, 2018).

The relationship between protein and the risk of anemia is that protein functions as a means of transporting oxygen and carbon dioxide. The protein content of 5% of the RDA in basil *infused water* can help in the formation of erythrocytes as well as transferrin during the process of hemoglobin in the blood. Hemoglobin is a protein that contains iron. Globin found in hemoglobin will be broken down into an amino acid to be used as protein, while heme is used to form red blood cells (Barret et al., 2012). According to research from Soedijanto (2015) shows that there is a significant relationship between protein and the incidence of anemia.

Vitamin A and vitamin C contained in basil infused water help in the process of absorbing iron into the body so that it becomes more optimal. Vitamin C functions as an iron enhancer so that the presence of high vitamin C contained in basil infused water is expected to increase the absorption of existing iron, especially in iron derived from non-heme (Lewa, 2016). Vitamin A in basil seeds infused water is 44% of the RDA. Based on research from Soedijanto16 (Soedijanto et al., 2015)it was found that there was a

significant relationship between vitamin A intake and the incidence of anemia. Vitamin A can help iron to mobilize for the process of erythropoiesis. Low levels of vitamin A will make iron unable to process properly at the stage of erythropoiesis. B carotene in vitamin A will make iron dissolve in the intestinal lumen so that it helps the absorption of iron in the body (Kirana, 2011).

Basil seeds infused water containing 100 grams of wet basil seeds and dissolved in 240ml of water refers to research conducted by Leelahgul. The difference in basil infused water is the addition of 20 grams of lemon and 4 grams of granulated sugar because this formula was obtained after conducting a preliminary acceptance test or organoleptic test. The results showed that the hemoglobin level of the respondents was close to normal. This is also in line with research conducted by Chaudary (Chaudhary et al., 2016). The difference between this study and Chaudary's research is that Chaudary's research used white rats as respondents and the results of the hematological levels in the white rats were normal hemoglobin values.

The addition of iron tablets in the intervention and control groups was because all respondents had never taken iron tablets. So that the dose is given once a week and once a day as long as the respondent is menstruating. This refers to research conducted by Titsamudfa (Titsamudfa, 2021) and blood supplement tablet program that recommended by the government.

There is stimulus factors and inhibiting factors that affect the absorption iron in the body. The stimulus factors are the form of Iron itself, organic acids and the level of gastric acidity. The inhibiting factors are the consuming food that contain acid phytic, oxalic acid, tianin and tannin. Iron absorption occurs in the duodenum and jejunum. This is influenced by gastrointestinal conditions. The level of acidity in the stomach will increase iron solubility. Lack of hydrochloric acid in the stomach or use of alkaline drugs such as antacids, blocking the absorption of iron in every individual is being different.

Lack of Iron intake is also cause of anemia. Whole respondent consumes 250 mg Ferrous Sulfate or equivalent Of 30 mg elemental iron at a

dose of 1 tablet a week and every day during menstruation. So in one day, all respondents get elemental iron from blood supplement tablets about 4.1 mg. The intervention group get additional iron from infused water about 3.27 mg in 2 days. Based on the calculations above, intervention group gets 5.75 mg iron a day, control group gets 4.1 mf iron a day. This is very far from the daily requirement of iron for adolescent women which is 15 mg a day. Based on research from Susilowati<sup>21</sup>, the result obtained were that administration of 60mg iron tablets for 30 days can increase Hb levels as much as 1gr%. In the iron tablet program that recommended by the government, adolescent women are recommended for consume 30mg iron tablet a week. So this program seem less capable for the daily iron intake for adolescent women. So the effective dose is being increased by 2 – 3 tablets a week.

### Conclusions and Recommendation:

Based on the results of research conducted regarding the effect of giving basil seeds infused water on increasing hemoglobin levels in female adolescents at the Nuris Islamic Boarding School, Jember Regency, the results obtained were an increase in hemoglobin levels in adolescents women.

Suggestions for Islamic Boarding Schools: it is hoped that all students will be given Fe tablets so the Indonesian government's program can be done, it is hoped that basil seeds infused water is one of food menu is presented in the cafeteria or dining room of the Nuris Islamic boarding school as an effort to treat anemia for their students. Suggestion for future researchers: in order to be able to compare the effects of basil seeds infused water with blood supplement tablets, it is necessary to add one more group that only consumes basil infused water without additional blood supplement tablets.

### References:

- Astuti, D., & Kulsum, U. (2020). Pola Menstruasi Dengan Terjadinya Anemia Pada Remaja Putri. *Jurnal Ilmu Keperawatan Dan Kebidanan*, 11(2), 314–327. <https://doi.org/10.26751/jikk.v11i2.832>

- Barret, K. E., Barman, S. M., Boitano, S., & Brooks, H. L. (2012). *Ganong's Review of Medical Physiology* (Vol. 24). Mc Graw Medical.
- Brown, J. E., Lechtenberg, E., Murtaugh, M. A., Splett, P. L., Stang, J., Wong, R., Kaiser, L. D., Bowser, E. K., Leonberg, B. L., & Sahyoun, N. R. (2016). *Sixth Edition Nutrition Through the Life Cycle*. www.cengage.com
- Calderón Bravo, H., Vera Céspedes, N., Zura-Bravo, L., & Muñoz, L. A. (2021). Basil Seeds as a Novel Food, Source of Nutrients and Functional Ingredients with Beneficial Properties: A Review. *Foods*, 10(7), 1467. <https://doi.org/10.3390/foods10071467>
- Chaudhary, S., Semwal, A., Kumar, H., Verma, H. C., & Kumar, A. (2016). In-vivo study for anti-hyperglycemic potential of aqueous extract of Basil seeds (*Ocimum basilicum* Linn) and its influence on biochemical parameters, serum electrolytes and haematological indices. *Biomedicine and Pharmacotherapy*, 84, 2008–2013. <https://doi.org/10.1016/j.biopha.2016.11.020>
- Kemendes RI. (2014). *Permenkes RI Nomor 25 Tahun 2014*. kemkes.go.id
- Kementerian Kesehatan RI. (2017). *Tabel Komposisi Pangan Indonesia*. kemkes.go.id
- Kirana, D. P. (2011). Hubungan Asupan Zat Gizi dan Pola Menstruasi dengan Kejadian Anemia pada Remaja Putri di SMAN 2 Semarang. *Universitas Diponegoro*, 21.
- Lestari, D. I. N. (2018). *Analisis Faktor yang Berhubungan dengan Upaya Pencegahan Anemia Saat Menstruasi pada Remaja Putri di Pondok Pesantren Wilayah Jenu Kabupaten Tuban* (Vol. 1, Issue 1).
- Lewa, A. F. (2016). Hubungan Asupan Protein, Zat Besi dan Vitamin C dengan Kejadian Anemia pada Remaja Putri di MAN 2 Model Palu. *Publikasi Kesehatan Masyarakat Indonesia*, 3(1), 26–31.
- Munir, M., Qayyum, A., Raza, S., Siddiqui, N. R., Mumtaz, A., Safdar, N., Shible, S., Afzal, S., & Bashir, S. (2017). Nutritional Assessment of Basil Seed and its Utilization in Development of Value Added Beverage. *Pakistan Journal of Agricultural Research*, 30(3). <https://doi.org/10.17582/journal.pjar/2017.3.0.3.266.271>
- RISKESDAS 2018. (n.d.). Retrieved September 6, 2022, from <https://kesmas.kemkes.go.id>
- RISKESDAS Jawa Timur 2018. (n.d.). Retrieved September 6, 2022, from <https://kesmas.kemkes.go.id>
- Soedijanto, S. G. A., Kapantow, N. H., & Basuki, A. (2015). Hubungan Antara Asupan Zat Besi dan Protein dengan Kejadian Anemia pada Siswi Smp Negeri 10 Manado. *Jurnal Ilmiah Farmasi*, 4(4), 327–332.
- Susiloningtyas, I. (2018). Pemberian Zat Besi (Fe) Dalam Kehamilan Oleh Majalah Ilmiah Sultan Agung, 50(128), 128. <http://lppm-unissula.com/jurnal/unissula.ac.id/index.php/majalahilmiahsultanagung/article/view/74>
- Tania, L. E. (2018). Hubungan Asupan Zat Besi, Protein Dan Vitamin C Dengan Kejadian Anemia Pada Remaja Putri Di Smk Yamas Jakarta Timur Tahun 2018. *Publikasi Kesehatan Masyarakat Indonesia*, 3(1), 26–31. <http://repository.binawan.ac.id/539/1/GIZI-2018-LINDAH-ELMA-TANIA-repo.pdf>
- Titsamudfa. (2021). *Pengaruh Tablet FE dan Vitamin C Terhadap Kadar Ferritin Dan Hemoglobin Pada Ibu Hamil Trimester II*. Universitas Hasanuddin.
- Triyonate, E. M., & Kartini, A. (2015). Faktor Determinan Anemia Pada Wanita Dewasa Usia 23-35 Tahun. *Journal of Nutrition College*, 4(2), 259–263. <http://ejournal-s1.undip.ac.id/index.php/jnc>
- United State Departement of Agriculture (USDA). (2018). *USDA National Nutrient Database for Standart Reference*. [www.nal.usda.gov/fnic/foodcomp/search/](http://www.nal.usda.gov/fnic/foodcomp/search/)
- United State Departement of Agriculture (USDA). (2019). *Food Data Central*.