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The Relationship of Vitamin A and Zinc Consumption on Ferritin Levels in First Trimester Pregnant Women in Agam District Health Center in 2019

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ABSTRACT

Background: Pregnant women are one of the groups prone to malnutrition, due to an increase in nutritional needs to meet the needs of the mother and fetus contained. Poor eating patterns in pregnant women have an impact on the occurrence of nutritional disorders including anemia. The cause of anemia is one of them lack of micronutrients intake consumed, disruption of the absorption ability of micronutrients such as iron, vitamins A, B, C, folic acid, and zinc.
Research Method: This study was an observational study with a cross-sectional approach, carried out in the working area of the Agam District Health Center. Data collection was conducted by interviewing FFQ (Food Frequency Questionnaire) to measure the consumption of vitamin A, and zinc in daily food, measuring ferritin levels using Enzyme-Linked Immunosorbent Assay (ELISA). Blood samples were taken during the study. Ferritin levels were examined at the Biomedical Laboratory of the Faculty of Medicine, Andalas University, with a sample of 60 people. Data were performed by Pearson correlation test, with p-value <0.05 considered to have a statistically significant relationship.
Research Result: The results showed that there was a significant relationship between vitamin A consumption and first trimester's pregnancy rates, with a correlation of 0.403 indicating a positive relationship and no significant relationship between zinc consumption and ferritin levels in first trimester with p-value = 0.415 (p> 0.05). The correlation value is -0,107 which indicates the direction of a negative relationship with very weak strength.
Research Conclusion: There is a significant relationship between vitamin A consumption and ferritin levels and there is no significant relationship between zinc consumption and ferritin levels in first trimester.

Keywords: Vitamin A, Zinc, Ferritin, Pregnant woman

INTRODUCTION

The welfare and nutritional status of the community can be measured through nutritional status especially in the nutritional status of children, toddlers, and pregnant women[1]. Pregnant women are one of the groups prone to malnutrition, due to an increase in nutritional needs to meet the needs of the mother and fetus. The wrong eating patterns in pregnant women have an impact on the occurrence of nutritional disorders including anemia, weight gain in pregnant women and fetal growth disorders. One of the most common nutritional problems in pregnant women is nutritional anemia, which is the biggest micronutrient problem and difficult to overcome throughout the world. World Health Organization reports that 52% of pregnant women have anemia in developing countries. In Indonesia[3,4]. Susenas also

reported that of around 4 million pregnant women, half had nutritional anemia and another one million suffered from iron deficiency[4]. Anemia often occurs due to iron deficiency because in pregnant women there is a doubling of iron needs due to an increase in blood volume without expansion of plasma volume, to meet the needs of the mother (preventing blood loss during childbirth) and fetal growth[5]. It is known in the world that anemia occurs in pregnant women where 75% are in developing countries and 25% in pregnant women in developed countries, it is seen that the most common cause of anemia is iron deficiency[6]. According to Basic Health Research data, the prevalence of iron anemia in pregnant women in Indonesia is 33.8%[7]. In 2017 the prevalence of anemia cases in pregnant women in West Sumatra Province was 7.32%. According to the Padang City Health Office, as many as 9.3% of pregnant women suffer from anemia and are scattered in various health center working areas in Padang City. In 2016 in the city of Bukittinggi, the incidence of anemia in pregnant women was 24% and was still below the target of <8.9%. The prevalence of iron anemia in pregnant women in Agam district in 2011, is known from 22 Health Center in Agam district, that Palembayan Health Center ranked first with the number of anemia pregnant women with iron deficiency (36.1%), then Bawan Health Center (31.5%), then ranked third in the Padang Luar Health Center (31.1%) 8. In 2015, there was 15.4% incidence of iron anemia in pregnant women in Agam Regency where this figure had increased from the previous year which was 14.7%[8].

Pregnant women are prone to nutritional deficiencies such as vitamin A and zinc because there is an increase in nutritional needs to meet the needs of the mother and fetus. Nutritional needs increase during pregnancy for fetal growth, placenta, increased blood volume, enlarged mammary, and increased metabolism. In the first trimester of pregnancy, 80% of pregnant women experience emesis (nausea, vomiting) so that quality nutritional intake is reduced, and it is feared that nutrition during pregnancy is insufficient[9].

LITERATURE REVIEW

Vitamin A has many roles in the body, including the growth and differentiation of erythrocyte progenitor cells, the body's immunity to infection and the mobilization of iron reserves from all tissues. Interaction of vitamin A with iron and iron reserves (ferritin) are synergistic, this is seen when the administration of vitamin A can reduce the prevalence of anemia and improve iron utilization compared to vitamin A supplementation alone or with iron alone[10]. Pregnancy is a condition that consumes a lot of iron reserves (ferritin) in women of childbearing age. In each pregnancy, a mother loses an average of 680 mg of iron. This amount is equivalent to 1300 ml of blood. According to Suprapto's research, proving between vitamin A serum, iron, and Hb during pregnancy, where during pregnancy blood levels of retinol decrease[11]. In women during pregnancy who experience iron deficiency with an iron deficiency cut off point is (<30 µg/L) and micronutrient anemia is given treatment in the form of iron (Fe) supplementation with the consumption of vitamin A and vitamin A tablets produce a good response and can prevent the occurrence of iron and micronutrient deficiency anemia. When vitamin A is needed by the body, Vitamin A will be mobilized from the liver in the form of retinol which will be transported through cell membranes to be bound to retinol-binding protein (RBP) to be carried to target cells[12].

Iron reserves in the body are stored in the form of ferritin. Serum ferritin levels with the total amount of iron reserves in the body have a positive correlation with the absence of inflammation, therefore if there is a decrease in serum ferritin levels, it can reflect the deficiency of iron reserves in the body will also cause anemia that is included with iron deficiency[13]. Siti Muslimatun's

research, that ferritin concentration decreased significantly in the group given iron vitamin A in the short term (r=0.67; p-value= 0.01) [14]. Giving vitamin A and iron every week increases the concentration of hemoglobin, serum retinol and iron status in the body. Based on existing studies that animals given low doses of vitamin A supplements will experience an increase in iron absorption in the small intestine and there is a buildup of iron in storage areas in the body such as the liver and spleen. Conversely, if given a high dose of vitamin A, it will experience a decrease in iron reserves in the liver.

The interaction between iron and zinc occurs in two mechanisms, both directly and indirectly. The interaction between iron and zinc directly occurs since absorption. If the high concentration of one micronutrient is disrupted, it will interfere with the absorption of fewer micronutrients. Another mechanism is in the transport path of the two micronutrients, namely iron and zinc which are transported by the same carrier which causes iron and zinc to compete with each other during the transportation process[15].

The serum ferritin level of the respondent before intervention correlated with the total amount of iron reserves in the body[16]. Ferritin serum less than 15 ng/ml indicates iron deficiency[17]. Zinc is also a cofactor of the amino acid levolenic dehydrase which plays a role in the synthesis of heme, so if zinc deficiency occurs it will cause interference with heme synthesis. Indirect interactions of zinc on iron occur in protein synthesis including iron-carrying proteins namely transferrin. Another interaction mechanism is through decreased immunity that occurs in conditions of iron deficiency. Decreased immunity will increase susceptibility to infections, which is known that infections can interfere with iron metabolism[18]. According to Fransisca's research in Manado, the interaction between zinc and iron and vitamin A has been shown to affect anemia at a metabolic level. Zinc plays a role in increasing the mechanism of vitamin A formation through RBP and its direct mechanism in anemia, as well as vitamin A plays a role in zinc synthesis and its direct mechanism in anemia so that vitamin A and zinc can work synergistically and can have a positive effect on iron therapy in anemia with anemia. (p-value= 0,000) which means that there is an effect of the Effectiveness of Zinc and Vitamin A Addition on the Treatment of Iron Deficiency Anemia[18].

MATERIALS & METHODS

Research Design & Sample

This study was an observational study with a cross-sectional approach, carried out in the working area of the Agam District Health Center. Initial data collection was conducted by interviewing FFQ (Food Frequency Questionnaire) to measure the consumption of vitamin A, and zinc in daily food, measuring ferritin levels using Enzyme-Linked Immunosorbent Assay (ELISA). Blood samples were taken during the study. Ferritin levels were examined at the Biomedical Laboratory of the Faculty of Medicine, Andalas University, with a sample of 60 people. Data were performed by Pearson correlation test, with a p-value <0.05 considered to have a statistically significant relationship.

Data Collection Technique

The sample in this study was carried out by sampling using simple random sampling techniques to obtained 60 first trimester pregnant women in the working area of the Agam District Health Center.

Statistical Analysis

The data recorded and then processed and analyzed statistically computerized and presented in tabular form. The results of the study were statistically processed and the Kolmogorov-Smirnov normality test (n>50), to see whether the data was normal or not. Furthermore the data is done by Pearson correlation test if the data is normally distributed, but if it is not normal the data is done by the non

parametric Spearman correlation test to see whether there is a significant relationship on the two variables to be tested and said to be related if the data p -value<0.05.

RESULT

Characteristics of Research Respondent

Table 1. Frequency Distribution of Research Respondent Characteristics

Characteristics	Sample (%)
Age (Year) (Mean ± SD)	29,28 ± 5,263
Education	
Elementary School	7 (11,7)
Junior High School	16 (26,7)
High School	21 (35,0)
Degree	16 (26,7)
Occupation	
Working	11 (18,3)
Not Working	49 (81,7)
Gestational Age (Weeks)	
9	3 (5,0)
10	9 (15,0)
11	23 (38,3)
12	25 (41,7)
Nausea and Vomiting	
Yes	29 (48,3)
No	31 (51,7)

Based on Table 1, the average age of respondents was (29.28 ± 5.263) years, the highest education level of respondents is high school (35.0%), as many as (81.7%) respondents were not working, and the most gestational age was 12 weeks (41, 7%). The average of respondents who experienced nausea and vomiting in the first trimester was 48.3%.

Based on Table 2, the average value of vitamin A consumption in first trimester pregnant women in the Agam Health Center is (1097.14 ± 245.07) µgRE. The median value is 1067.90 µgRE, a minimum value of 697.58 µgRE and a maximum of 1711.07 µgRE.

Table 2. Average of Vitamin A Consumption of First Trimester Pregnant Women

Variable	n	Mean ± SD (µgRE)	Median (Min – Max)
Vitamin A (µgRE)	60	1097,14 ± 245,07	1067,90 (697,58 – 1711,07)

Table 3. Mean of Zink Consumption Value of First Trimester Pregnant Women

Variable	n	Mean ± SD (mg)	Median (Min – Max)
Zinc (mg)	60	5,53 ± 1,78	5,79 (2,42 – 10,83)

Based on Table 3, the average value of zinc consumption in first trimester pregnant women in the Agam Health Center is (5.53 ± 1.78) mg. The median value is 5.79 mg, the minimum value is 2.42 mg and the maximum is 10.83 mg.

Table 4. Mean of Ferritin Levels Value of First Trimester Pregnant Women

Variable	n	Mean ± SD (µg/L)	Median (Min – Max)
Ferritin Levels (µg/L)	60	48,12 ± 26,87	45,58 (6,31 – 121, 60)

Based on Table 4, the average ferritin levels in first trimester pregnant women in the Agam Health Center are (48.12 ± 26.87) µg/L. The median value is 4.58 µg/L, the minimum value is 6.31 µg/L and the maximum is 121.60 µg/L.

Table 5. Relationship of Vitamin A Consumption with Ferritin Levels in First Trimester Pregnant Women

Variable	n	Mean ± SD	*p-Value*	Correlation (r)
AKG Vit A (µgRE)	60	1097,14 ± 245,07	0,001	0,403
Ferritin Levels (µg/L)	60	48,12 ± 26,87		

Based on Table 5 it was found that there was a significant relationship between consumption of vitamin A with ferritin levels in first trimester pregnant women with p-value = 0.001 (p <0.05). The correlation value is 0.403 which indicates the direction of a positive relationship with moderate strength.

Based on Fig. 1 it can be seen that the value of p-value = 0.001 (p <0.05) which means that there is a significant relationship between vitamin A consumption with ferritin levels in first trimester pregnant women, with a correlation value of 0.403 which indicates the direction of a positive relationship, meaning that the higher the mother consumes vitamin A, the higher the maternal ferritin level, where the strength of the relationship is moderate. Linear r^2 value = 0.162, which means that 16.2% of vitamin A consumption affects ferritin levels of first trimester pregnant women, while 83.8% is influenced by other factors.

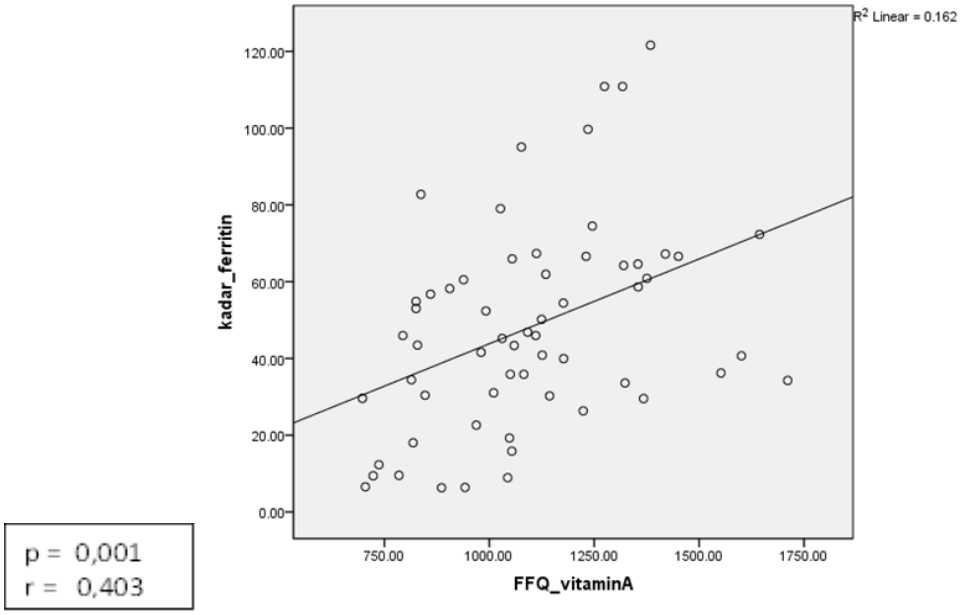

Fig 1.Scatter Plot Relationship between Vitamin A Consumption and Ferritin Levels

Table 6. Relationship of Zinc Consumption with Ferritin Levels in Pregnant Women

Variable	n	Mean ± SD	*p-value*	Correlation (r)
AKG Zink (mg)	60	5,53 ± 1,78	0,415	- 0,107
Ferritin Levels (µg/L)	60	48,12 ± 26,87		

Based on Table 6 it was found that there was no significant relationship between zinc consumption with ferritin levels in first trimester pregnant women with p-value=0.415 (p> 0.05). The correlation value is -0.107 which indicates the direction of the negative relationship with very weak strength.

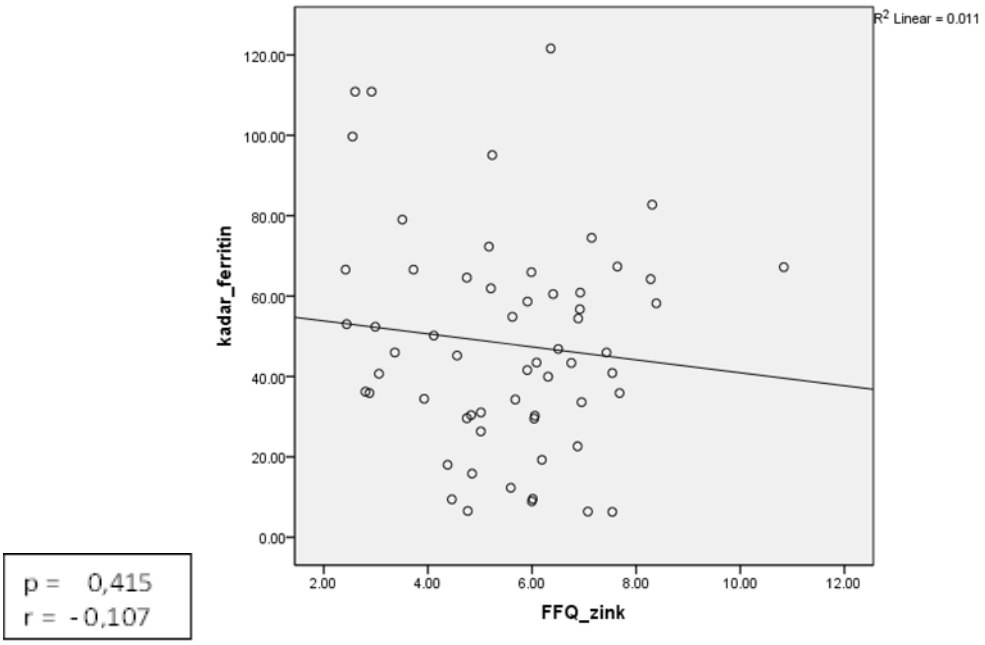

Fig 2.Scatter Plot Relationship between Zinc Consumption and Ferritin Levels

Based on Fig 2, it can be seen that the value of p-value=0.415 (p> 0.05) which means that there is no significant relationship between zinc consumption and ferritin levels in first trimester pregnant women, with a correlation value of -0.107 which

indicates the direction of a negative relationship. The results showed the value of maternal zinc consumption obtained low results but maternal ferritin levels showed high values (normal), where the strength of the relationship is weak. Linear r^2 value = 0.011 which means that only 1.1% of zinc consumption affects the ferritin levels of first trimester pregnant women, while 98.9% is influenced by other factors.

DISCUSSION

This research is an observational research with cross sectional approach. Sampling was carried out on First Trimester Pregnant Women in Agam District, after anamnesa and physical examination were carried out, 60 respondents were taken as pregnant women to be the subjects of the study according to inclusion and exclusion criteria. Initial data collection was conducted by interviewing the filling of FFQ (Food Frequency Questionnaire) to measure daily food consumption including Vitamin A and Zinc, measurement of ferritin levels using Enzyme Linked Immunosorbent Assay (ELISA). Blood samples were taken during the study. Ferritin levels were tested at the Biomedical Laboratory of the Faculty of Medicine, Andalas University.

Overview of Research Respondents

Based on table 1, the average age of respondents is (29.28 ± 5.263) years, the major education of respondents is high school (35%), as many as (81.7%) of respondents not working, and the most gestational age is 11-12 weeks (48, 3%). Pregnant women aged <20 years and> 35 years are very risky to get pregnant. The age of the mother who is still too young is related to the reproductive organs of the mother that have not been fully formed, this will also result in a high rate of maternal mortality due to the risk of bleeding and anemia. (MOH RI, 2010). The age factor is a factor that needs to be considered for a woman to get pregnant (MOH RI 2010). According to Gunaratna stated that in his study the average age was 25-30 years with p = 0.06 (p <0.05) [19]. This is also the same as the characteristics of the study conducted by Dairo and Lawoyin stating that maternal age between 20-29 years (p = 0.011) has a low risk of anemia during pregnancy, in this study all respondents were in the range of healthy reproductive age ie 29 years[20].

Average Consumption of Vitamin A in First Trimester Pregnant Women in the Agam Health Center in 2019

Based on Table 2, the average value of vitamin A consumption in first trimester pregnant women in the Agam Health Center is (1097.14 ± 245.07) µgRE. Vitamin A has many roles in the body, including the growth and differentiation of erythrocyte progenitor cells, the body's immunity to infection and the mobilization of iron reserves from all tissues. Interaction of vitamin A with iron and iron reserves (ferritin) are synergistic, this is seen when the administration of vitamin A can reduce the prevalence of anemia and improve iron utilization compared to vitamin A supplementation alone or with iron alone[10]. Vitamin A in the form of retinol levels is known to affect several processes that will affect iron and ferritin in the absorption of iron, especially non-heme iron, so pregnant women need intake containing vitamin A such as beef, duck meat, liver, egg yolks, cheese, milk, fish, green vegetables, nuts, fruits, light colored in order to help the process of hematopoiesis[13].

According to research conducted by Muslimatun, stating that consumption of vitamin A is also accompanied by vitamin A tablets every week can increase serum retinol and the concentration of iron status in the body[14]. According to another study, Zimmermman, one of the biological mechanisms of lack of vitamin A consumption can cause anemia because vitamin A (in retinol levels) helps the absorption of iron in the bone marrow, if in a state of deficiency, the absorption process will also be disrupted[21].

Average of Zinc Consumption in First Trimester Pregnant Women in the Agam Health Center in 2019

Based on Table 3, the average value of zinc consumption in first trimester pregnant women in the Agam Health Center is (5.53 ± 1.78) mg. Generally zinc is obtained from animal source foods such as meat, liver and chicken. Animal food ingredients obtained from the sea such as oysters, shellfish and fish contain zinc in very high amounts. Conversely the levels of zinc in plant foods such as nuts and grains are found to be low, they also contain phytic acid which inhibits zinc absorption. Zinc levels in fruits and vegetables are also low. Data from various countries shows that the zinc content in daily food is very low[22]. According to the results of the study, all pregnant women had a below average normal zinc AKG value of <20 mg. This is a concern because the study area is an area far from the coast where high food sources of zinc content such as oysters, shellfish and fish are difficult to ascertain freshness, because the research area is in the fertile hills producing food sources that contain a lot of phytic acid (inhibiting zinc absorbs). However, there are several conditions that cause zinc deficiency, namely decreased intake associated with eating disorders, decreased absorption such as high consumption of phytic acid (phytic acid), decreased utilization as in alcohol users, increased losses such as diarrhea and increased needs associated with growth , pregnancy and lactation (Mann J and Truswell S, 2005).

Average Ferritin Levels in First Trimester Pregnant Women in the Agam Health Center in 2019

Based on Table 4, the average ferritin levels in first trimester pregnant women in the Agam Health Center are (48.12 ± 26.87) µg/L. A total of 14 (23.3%) respondents with ferritin levels <30 µg/L and the rest with adequate ferritin levels (76.7%). Ferritin can be found in serum. In a stable state, serum ferritin levels correlate with the total amount of iron reserves in the body, therefore, serum ferritin is the most appropriate laboratory test for estimating iron reserve levels[16]. The amount of ferritin in adult human serum is 15-300 µg/L in healthy humans. Ferritin serum less 15 µg/L indicates iron deficiency[17]. A reliable method of examining serum ferritin is using the enzyme-linked immunosorbent assay method or ELISA[24].

According to research results found in the field, as many as 23.3% of pregnant women have ferritin levels below normal, which means the need to pay attention to iron consumption and intake during pregnancy to prevent anemia during and after pregnancy. Ferritin is a protein in cells that is used to store iron so that one day it can be used by the body. The amount of ferritin in the blood is directly related to the amount of iron stored in the body[25]. This study is in line with Sunarti's research data. This study also states that the percentage of pregnant women with ferritin levels below normal is still high, namely 30 people (39%). This shows that the research area is also prone to iron micronutrient deficiencies. Ferritin level is one indicator used to look at a person's iron status. However, high ferritin levels do not always indicate excess iron reserves. In someone in an acute infection, erythropoietin levels increase and can cause elevated ferritin levels, but after the infection disappear, erythropoietin levels will return to normal.[26]

CONCLUSION

There is a significant relationship between vitamin A consumption with ferritin levels in first trimester pregnant women with p-value=0.001 (p<0.05). Correlation value is 0.403 which shows the direction of a positive relationship with moderate strength, linear r^2 value = 0.162 which means that 16.2% of vitamin A consumption affects ferritin levels of first trimester pregnant women, while 83.8% is influenced by other factors, and there is no significant relationship significant between zinc consumption with ferritin levels in first

trimester pregnant women with p-value=0.415 (p>0.05). Correlation value is -0.107 which shows the direction of a negative relationship with very weak strength with r^2 value = 0.011 which means that only 1.1% of zinc consumption affects ferritin levels of first trimester pregnant women, while 98.9% is influenced by other factors.

Research Code of Ethics

This study was approved by the team of research ethics commission of Faculty of Medicine, Andalas University with ethics test number 111/ KEP/FK/2019.

REFERENCES

1. Departemen Kesehatan R.I. Program Penanggulangan Anemia Gizi pada Wanita Usia Subur (WUS); (Safe Motherhood Project: A Partnership and Family Approach). Direktorat Gizi Masyarakat. Jakarta: Direktorat Jenderal Bina Kesehatan Masyarakat Depkes, 2003.
2. Ojofeitimi EO, Ogunjuyigbe PO, Sanusi, et al. Poor Dietary Intake of Energy and Retinol among Pregnant Women: Implications for Pregnancy Outcome in Southwest Nigeria. Pak. J. Nutr. 2008; 7(3):480-484.
3. World Health Organization. (2010). World Health Statistics. France : WHO
4. Survey Ekonomi Nasional (Susenas). 2009
5. Samhadi, Sri. 2006. Malnutrisi, keteledoran sebuah bangsa.http://www.kompas.com/kompas-cetak/0610/07/Fokus/3006750.htm.1 Mei 2007.
6. Allen LH. 2000. Anemia and iron deficiency: Effects on pregnancy outcome. Am J Clin Nutr 71:1280S-4S.
7. Badan Penelitian dan Pengembangan Kesehatan. (2008). Riset Kesehatan Dasar(Riskesdas) 2007: Laporan Nasional. Jakarta: Badan Litbangkes Depkes.
8. Dinas Kesehatan Kabupaten Agam. Data Anemia Wanita Usia Subur Kabupaten Agam. 2017
9. Guyton dan Hall. 2008. Buku Ajar Fisiologi Kedokteran. EGC : Jakarta.
10. Scott, JM. 2007. *Nutritional anemia: B-vitamins*. Diakses dari https://www.dsm.com/content/dam/dsm/cworld/en_US/documents/salnutritional-anemia-book.pdf
11. Suprapto et al. 2002.Effect of Low-Dosage Vitamin A and Riboflavin on Iron-Folate Supplementation in Anaemic Pregnant Women.Asia Pacific J Clin Nutr. 2002; 11(4): 263–267.
12. Almatsier, S. 2009. Prinsip Dasar Ilmu Gizi. PT Gramedia Pustaka Utama, Jakarta.
13. Murray, R.K, Granner, D.K & Rodwell, V.W. Biokimia Herper, Jakarta : Buku Kedokteran EGC: 2009.
14. Muslimatun, Siti. Et al. 2001. "weekly Supplementation with iron and vitamin A during pregnancy increases hemoglobin concentration but decreases serum ferritin concentration in Indonesia pregnant women" J Nutr 85-90;131.
15. Linder, M.C, 2006. Nutritional Biochemistry and Metabolism with Clinical Application 2nd Ed. Appeton & Lange. USA
16. Longo, DL. (2013). *Harrison's Hematology And Oncology*. United stated. The McGraw-Hill Companies
17. Worwood M. Serum Ferritin. Crit Rev Clin Lab Sci. 2001; 10.171-204.
18. Kalibatu, Franciska 2008. Efektifitas penambahan seng dan vitamin A pada pengobatan anemia defesiensi besi. Sari pediatri. Vol. 10. No.1 Juni 2008.
19. Guraratna, H.A., (2009). Introductory Nutrition. Times Mirror/Mosby Colledge Publishing: USA.
20. Dairo MD, Lawoyin TO. 2004. Socio-demographic determinants of anaemia in pregnancy at primary care level: a study in urban and rural Oyo State, Nigeria. Afr J Med Med Sci 33(3):213-7.
21. Shils et al. (2006). Modern Nutrition in Health and Disease. 10th ed. Philadelphia : Lippincott Williams & Wilkins.
22. Truswell, Stewart. 2012. Buku Ajar Ilmu Gizi. Jakarta: Penerbit buku Kedokteran.
23. Brain GA, Paeratakul S, Popkin BM. Clinical and Epidemiological Studies. Physiol Behav; 83: 549-55.
24. Zimmermann, Machel B, Ralf Blebinger, Fabian Roher, Abdeljawad Dib,Richard F, Hurell and Nourredine Chaouki 2006 Vitamin A Supplementation in Children with poor Vitamin A and Iron Status Increases Erythropoitein and hemoglobin Concentration without Changing Total Body Iron" Am J Clin Nutr 560-566.

25. Hilman, N. (2006). Iron Prohylaxis in Pregnancy-General or Individual and in Wich Doses Annals Hematologi, 821 – 828
26. Sunarti, Annta. Status Korelasi Gizi, Asupan Zat Besi dengan Kadar Feritin pada Ibu Hamil di Kelurahan Semanggi Surakarta. 2014

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