Contents lists available at iocspublisher

**Science Midwifery**

journal homepage: www.midwifery.iocspublisher.org

# Relation Between Iron and Vitamin A Intake with Feritin Levels In Pregnant Women With Trimester III Iron Deficiency Anemia

Ririn [1], Yusrawati[2], Fika Tri Anggraini[3]

[1,2,3] Master Program of Midwifery, Faculty of Medicine,
[1,2,3] Andalas University, Indonesia

**ARTICLE INFO**

***Keywords***:

Ferritin,
Iron intake,
Vitamin A intake,
SQ-FFQ

**ABSTRACT**

Ferritin is an indicator that is frequently used to measure iron deficiency anemia, especially in the population of pregnant women. Ferritin functions as an iron storage protein that is non-toxic and will be mobilized when needed. Low ferritin levels can lead to iron deficiency anemia. This study aimed to determine the relation between iron and vitamin A intake with ferritin levels in pregnant women with iron deficiency anemia in trimester III. This research is an observational correlative analytic study with a cross sectional approach. The sample in this study was 37 pregnant women with iron deficiency anemia in trimester III with purposive sampling technique. Data on iron and vitamin A intake were taken by using a modified SQ-FFQ (Semi Quantitative Food Frequency Questionnaire) designed by Lipoeto conducted at BMC General Hospital and dr. M.Djamil Padang Hospital from July 2019 to May 2021. The normality test of the data was carried out by Shapiro Wilk test and data were analyzed by using Pearson correlation test. The results showed that the average iron intake was 34.33±3.36 mg/day, vitamin A intake was 888.86±109.95 mcg/day, and ferritin levels were 8.68±2.82 ng/mL. There was a significant relation between iron intake (p= 0.009), vitamin A intake (p= 0.003), and ferritin levels. The conclusion is that there is a relation between iron and vitamin A intake with ferritin levels in pregnant women with iron deficiency anemia in trimester III.

**E-mail:**
ririnsts@gmail.com



## 1. Introduction

Ferritin is one of the parameters to determine IDA in pregnant women. Iron deficiency anemia (IDA) is a disease related to nutrition. It can occur because the supply of iron for erythropoiesis is reduced so that hemoglobin formation is inhibited. Pregnant women need more iron than pre-pregnancy conditions for the formation of red blood cells which are increasingly needed for the mother, fetus and placenta (Waryana, 2010). Unmet iron needs during pregnancy can lead to premature birth, anemia, postpartum complications and bleeding. While the impact on the fetus causes an imbalance in fetal growth and development, and babies are born with low birth weight (Wu et al, 2012).

Ferritin is another protein that is essential in iron metabolism. Under normal conditions, ferritin stores iron which can be recovered for use as needed. If there is a lack of iron intake from food, there will be an iron imbalance in the body. The amount of iron reserves in the body decreases and is followed by iron deficiency which is characterized by a decrease in serum ferritin. Iron deficiency in pregnant women is mainly caused by inadequate intake (Oliver and Olufunto, 2012). In addition to iron, anemia is also caused by a lack of other nutrients such as vitamin B12, vitamin C, folic acid, and vitamin A (WHO, 2011).

Vitamin A and iron are two essential nutrients that must be fulfilled during pregnancy, because these two nutrients have unique characteristics. This uniqueness is due to the synergistic absorption

of vitamin A and iron. Vitamin A plays an important role in helping iron absorption so that it can overcome anemia, vitamin A can form complexes with iron, making it soluble in the intestinal lumen, and also prevents iron absorption inhibiting factors (Ridwan, 2012).

The objective of this study was to determine the relation between iron and vitamin A intake with ferritin levels in pregnant women with iron deficiency anemia in trimester III.

## 2. Method

This research is an observational correlative analytic study with a cross sectional approach. Data on iron and vitamin A intake were taken by using a modified SQ-FFQ (Semi Quantitative Food Frequency Questionnaire) questionnaire designed by Lipoeto carried out at BMC RSU and dr. M.Djamil Padang Hospital from July 2019 to May 2021. The sample in this study was Ms. There were 37 pregnant women with iron deficiency anemia in trimester III using purposive sampling technique.

## 3. Result and Analysis

### a. Average Intake of Iron, Vitamin A, and Ferritin Levels

The average intake of iron, vitamin A and ferritin levels of pregnant women with iron deficiency anemia in trimester III can be seen in table 1 below:

**Table 1**
Average Intake of Iron, Vitamin A and Ferritin Levels
of Pregnant Women with Trimester III Iron Deficiency Anemia in 2020

| Variables | Mean ± SD | Minimun | Maksimum |
|---|---|---|---|
| Iron Intake (mg/day) | 34,33 ± 3,36 | 25,95 | 40,6 |
| Vitamin A intake (mcg/day) | 888,86 ± 109,95 | 601 | 1108,5 |
| Ferritin Level (ng/mL) | 8,68 ± 2,82 | 4,46 | 14 |

The results showed that the average iron intake of pregnant women with iron deficiency anemia in trimester III was 34.33 mg/day, and the intake of vitamin A was 888.86 mcg/day, while the average ferritin level in pregnant women with iron deficiency anemia was in trimester III was 8.68 ng/mL. This showed that the amount of iron intake is still far below the standard recommended by the RDA for trimester III pregnant women aged 20-35 years 39 mg/day. Meanwhile, the intake of vitamin A has reached the standard recommended value for pregnant women in trimester III of 850 mcg/day.

**Table 2**
Frequency Distribution of Research Subjects Based on Adequacy Levels of Iron and Vitamin A Intake in Pregnant Women with Trimester III Iron Deficiency Anemia in 2020

| Variables | Frequency (n) | Percentage (%) |
|---|---|---|
| Iron Intake | | |
| Enough | 2 | 5,40 |
| Not enough | 35 | 94,60 |
| Total | 37 | 100 |
| Vitamin A intake | | |
| Enough | 27 | 73,0 |
| Not enough | 10 | 27,0 |
| Total | 37 | 100 |

In table 2, it can be seen that most pregnant women have inadequate intake of iron (94.60%) and vitamin A (27.0%)..

### b. The Relation between Iron Intake and Ferritin Levels in Pregnant Women with Trimester III Iron Deficiency Anemia.

Based on the results of the study, the relation between iron intake and ferritin levels can be seen in Figure 1 below:

Contents lists available at iocspublisher

Science Midwifery

journal homepage: www.midwifery.iocspublisher.org

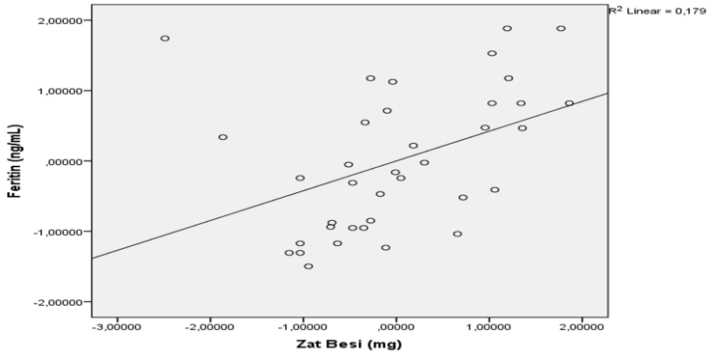


**Figure 1.** The relation between iron intake and ferritin levels in pregnant women with iron deficiency anemia in trimester III.

Based on Figure 1, it can be seen that there is a significant relation between iron intake and ferritin levels in pregnant women with iron deficiency anemia in trimester III with a p value = 0.009. Data analysis shows that the direction of the relation is positive and the relationship strength is moderate (r = 0.423). The lower the iron intake, the lower the ferritin level. R2Linear value = 0.179 means that iron intake contributes 17.9% to ferritin levels.

**c. The Relation between Vitamin A Intake and Ferritin Levels in Pregnant Women with Trimester III Iron Deficiency Anemia.**

Based on the results of the study, the relation between vitamin A intake and ferritin levels can be seen in Figure 2 below:

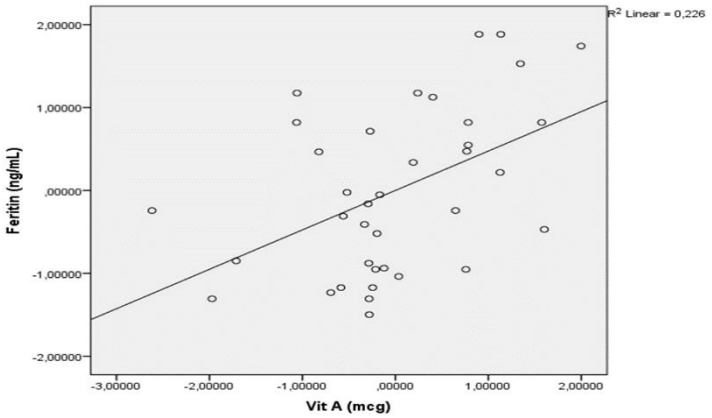


**Figure 2.** The Relation betwen Vitamin A Intake and Ferritin Levels in pregnant women with iron deficiency anemia in trimester III

Based on Figure 2, it can be seen that there is a significant relation between vitamin A intake and ferritin levels in pregnant women with iron deficiency anemia in trimester III with p value = 0.003. Data analysis showed that the direction of the positive relation with moderate strength (r = 0.475) means that the lower the intake of vitamin A, the lower the ferritin level where the value of R2 Linear = 0.226 means that the intake of vitamin A contributes 22.6% to the ferritin level..

**d. The Relation between Iron Intake and Ferritin Levels in Pregnant Women with Trimester III Iron Deficiency Anemia**

In this study, there is a statistically significant positive relation between iron intake and ferritin levels in pregnant women with Trimester III Iron Deficiency Anemia with moderate strength (p=0.009 r=0.423). This shows that the lower the iron intake, the lower the ferritin level.

Iron intake is the first line to determine a person's iron reserves in the process of erythropoiesis. If the amount of iron intake is small, the body will compensate to increase absorption which is described by increasing iron-binding capacity. However, if the intake is not fulfilled, the longer the iron reserves in the body, it will continue to decrease and even run out because it is used for erythropoiesis. This is marked by the depletion of iron stores and reduced transferrin saturation, at this stage there has been an iron deficiency condition that is not accompanied by anemia. If the iron reserves run out, the erythropoiesis will be disturbed, whereas in the process of erythropoiesis itself, it needs Fe which binds to protoporphyrin to form heme, because no Fe is bound. There is an increase

in free protophorphyrin followed by a decrease in serum ferritin levels (Sacher and McPherson, 2004). If this happens continuously, the amount of hemoglobin will decrease, resulting in iron deficiency anemia (Scholl, 2005). Iron deficiency anemia can arise because the supply of iron for erythropoiesis is reduced so that hemoglobin formation is inhibited. This can be indicated by the discovery of empty iron reserves on laboratory results, visible red blood cells that are smaller in size, and faded in color (Bakta, et al., 2015).

Gordeuk et al (2012) study explained that dietary iron intake has a significant relation with serum ferritin, where heme iron is the most dominant predictor (Beck et al, 2014). Gordeuk also explained that red meat consumption has a positive relation with increased ferritin levels in adults in Australia.

The results of this study showed that 94.6% of pregnant women with low levels of iron adequacy had low levels of ferritin. In line with research conducted by Sunarti (2014) aiming to see the correlation of nutritional status, iron intake with ferritin levels. The results show that there is a relation between nutritional status, iron intake, and ferritin levels. Ferritin is another protein important in iron metabolism. Under normal conditions, ferritin stores iron which can be recovered for use as needed. If there is a lack of iron intake from food, there will be an iron imbalance in the body. The amount of iron reserves in the body decreases and is followed by iron deficiency which is characterized by a decrease in serum ferritin. (Shao, 2012) Ferritin is also an iron storage protein that is mostly distributed in body tissues and is found in the reticuloendothelial system. Ferritin detected in the body is in balance with total body iron and functions as an indicator for iron storage (Jamali, 2017).

**e. The Relation between Vitamin A Intake and Ferritin Levels in Pregnant Women with Trimester III Iron Deficiency Anemia**

In this study, there is a statistically significant positive relation between vitamin A intake and ferritin levels in pregnant women with iron deficiency anemia in trimester III with moderate strength (r= 0.475 p= 0.003). This shows that the lower the intake of vitamin A, the lower the ferritin level.

Vitamin A is a fat soluble vitamin that can help the absorption and mobilization of iron for the formation of erythrocytes. The low status of vitamin A will make iron stores unable to be utilized for the erythropoiesis process. In addition, Vitamin A and -carotene will form a complex with iron to keep iron soluble in the intestinal lumen so that iron absorption can be helped (Kirana, 2011). 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 intakes containing vitamin A such as beef, duck meat, liver, egg yolks, cheese, milk, fish, green vegetables, nuts, brightly colored fruits to help the process of hematopoiesis (Murray, 2009).

The results of Bauti's research (2019) showed that there was a significant relation between consumption of Vitamin A and ferritin levels of pregnant women in trimester I with p = 0.001. The correlation value is 0.403 which indicates the direction of the positive relation with moderate strength. Kirana's research (2011) states that there is a relation between vitamin A intake and the incidence of anemia. The lack of vitamin A intake is thought to be caused by less consumption of vegetable and fruit, especially green vegetable. In general, vegetable is good sources of vitamins, so the consumption of vegetable will have an influence on the level of consumption of vitamin A. As with vitamin C, vitamin A also plays a role in the absorption of iron in the body so that adequate intake is needed to facilitate the absorption of iron, especially fruit consumption and vegetable that is rich in vitamins (Murray, 2009).

Vitamin A and iron are two essential nutrients that must be met during pregnancy, because these two nutrients have unique characteristics. This uniqueness is due to the synergistic absorption of vitamin A and iron. This can be seen when the administration of vitamin A can reduce the prevalence of anemia and improve iron utilization compared to vitamin A supplementation alone or iron alone. Then, a researcher also found that, when the body is in a state of vitamin A deficiency, the transport of iron from the liver and the incorporation of iron into erythrocytes is disrupted (Ridwan, 2012).

The results of this study indicate that as many as 27% of pregnant women with a low level of vitamin A adequacy and 73% of pregnant women with a sufficient level of vitamin A adequacy, although most pregnant women have a sufficient level of vitamin A adequacy, but mothers still experience anemia due to several reasons. One of the factors is the absorption of vitamin A. In the process of absorption of vitamin A, it depends on the level of protein consumption, because vitamin A is transported by the RBP so that when protein is low, the absorption of vitamin A is reduced even

Contents lists available at iocspublisher

Science Midwifery

journal homepage: www.midwifery.iocspublisher.org

though the intake of vitamin A is sufficient (Briawan, 2014). Almatsier (in Sahana, 2015) explained that one of the factors that can cause anemia even though the average respondent's vitamin A consumption quite sufficient is enough fat consumption. Vitamin A is one of the fat-soluble vitamins that the body absorbs along with other lipids so that its absorption will not be maximized when fat consumption is less (Gilbert, 2013).

The main cause of anemia in pregnant women is generally also caused by the amount of iron consumed is not in accordance with what is needed. The lack of iron intake results from the lack of iron consumed, as well as the effect of the ability to absorb iron (Pradanti, 2015). The enhancer and inhibitor factors are important concerns in assessing iron intake. There are several micronutrients that are used together with iron to increase the absorption of nutrients called driving factors including vitamin A, vitamin C, vitamin B12, and vitamin B6 (Sizer and Whitney, 2013). Some types of booster food sources can only work optimally on heme iron sources than non-heme sources in iron absorption (Mangels et al, 2011). As with vitamin A, vitamin A can help heme iron dissolve in the intestinal mucosa, so that iron can be absorbed. If the iron consumed is not heme iron, the role of vitamin A cannot work optimally (Webster et al. 2016).

## 4. Conclusion

Based on the results of this study, there is a relation between iron and vitamin A intake and ferritin levels in pregnant women with iron deficiency anemia in trimester III.

## 5. References

Adamson JW. (2014). Iron deficiency and other hypoproliferative anemia. Dalam: Fauci A, Braunwald E, Kasper D, Hauser S, Longo, Jameson J, et al. 2014.Harrison's principles of internal medicine. New york: MC Grawhill.

Ahenkorah, B., K. Nsiah, P. Baffoe, and E. O. Anto. (2018). Biochemicaland Hematological Changes Among Anemic and Non-Anemic Pregnant Women Attending Antenatal Clinic at The Bolgatanga Regional Hospital, Ghana. BMC Hematology 18 (1):1-7.

Alzaheb RA, Al-Amer O. (2017) The Dietary Iron Intake and Iron Status of Female University Students in Saudi Arabia. Australas Med J.;10 (4): 275-284

Bencaiova G, Breymann C. Mild. (2014). anemia and pregnancy outcome in a Swiss collective. J. Pregnancy.;1-8

Cakmak, B.D.U.A. Turker, S. Oztas, M.Arik, and E. Ustunyurt. (2018). The Effect of First Trimester Hemoglobin Levels on Pregnancy Outcomes. Turkish Journal of Obstetrics and Gynecology 15(3):165-170..

Checkley W, West KP, Wise RA. (2010). Maternal vitamin A supplementation and lung function in offspring. N Engl J Med. 362:1784–1794

Cunningham, F Gary, Kenneth J Leveno, Steven L Bloom, John C Hauth, Dwight J Rouse, and Catherine Y Spong., (2018). Obstetri William. 25rd ed. Translated by B.U.Jakarta : Pendit.EGC

Daru, J., J. Zamora, B.M. Fernandez-Felix, J. Vogel, O.T. Oladapo, N. Morisaki O, et al. (2018). Risk Of Maternal Mortality in Women with Severe Anaemia During Pregnancy and Post Partum: A Multilevel Analysis.Lancet Glob Health 6 (5):548-554.

Farrukh GM, Hasan Z, Ikram S, Tariq B. (2016). Iron Deficiency Anemia; Dietary Pattern of Iron Intake From Indigenous Iron Rich Food in Female IDA Patients and Corresponding Hematological Profiles : A Cross Sectional Study at a Tertiary Care Hospital in Karachi. Prof Med J. 2016 ;23(9):1092- 1098. doi:10.17957/TPMJ/16.3520

Gordeuk VR, Lovato L, Barton JC, Vitolins M, McLaren G, Acton RT, et al (2012). Dietary iron intake and serum ferritin concentration in 213 patients homozygous for the HFEC282Y hemochromatosis mutation. Can J Gastroenterol. 26(6):345–9.

Hamdy, A.M, A.A El-Shazly, and M.M Abdel Aleem. (2013). "Maternal Vitamin A Deficiency During Pregnancy and Its Relation With Maternal and Neonatal Hemoglobin Concentrations Among Poor Egyptian Families." ISRN Pediatrics.

Kavak, E.C., dan S.B. Kavak. (2017). The Association Between Anemia Prevalence, Maternal Age and Parity in Term Pregnancies in Our City. Perinatal Journal 25 (1) :6-10.

Michelazzo, FB. Oliveira, JM. Stefanello, J. Luzia, LA. Rondó, PH. (2013). The Influence of Vitamin

A Supplementation on Iron Status. Nutrients. Vol. 5. Pp. 4399-4413. doi:10.3390/nu5114399

Ogilvie, C & Fitzsimons, E. (2012). Primary Care at Glance: Serum Ferritin and iron studies laboratory Reporting and Clinical in Aplications in Primary care. Croatia: In Tech.

Sun, YY., Ma, AG., Yang, F., Zhang, FZ., Luo, YB., Jiang, DC., Han, XX.,Liang, HA. (2010). Combination Of Iron And Retinol Supplementation Benefits Iron Status, Il-2 Level And Lymphocyte Proliferation In Anemic Pregnant Women. Asia Pac. J. Clin. Nutr. 19:513–519 p.

Timmer TC, Groot R de, Rijnhart JJM, et al. (2019). Dietary Intake of Heme Iron is Associated with Ferritin and Hemoglobin Levels in Dutch Blood Donors: Results from Donor InSight. Haematologica. 2019 ; 104 : 1-25.

Terefe, B., Birhanu, A., Nigussie, P., Tsegaye, A. (2015). Effect of Maternal Iron Defeciency Anemia on The Iron Store of Newborns in Etiophia. Hindawi Publishing. pp. 1-6

Visnjevac, N. Segedi, LM. Curcic, A.Visnjevac, J. Stajic, D. (2011). Blood Ferritin Level in Pregnant Woment and Prediction of the Development of Fetal Intrauterine Growth Restriction. Journal of Medical Biochem. Vol. 30, no. 4. Pp 317-322. DOI : 10.2478/V10011-011-0019-1

Young I, Parker HM, Rangan A, Prvan T, Cook RL, Donges CE, et al. (2018) Association between haem and non-haem iron intake and serum Ferritin in healthy young women. Nutrients. 10(1):1–13.