CORRELATION OF ENERGY INTAKE, PROTEIN AND MICRONUTRIENTS WITH HEMOGLOBIN LEVELS OF PREGNANT WOMEN IN PUSKESMAS KECAMATAN KEBON JERUK

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ABSTRACT

Pregnant women of third trimester suffers from anemia due to changes in the circulation increasing the placenta. Malnutrition in this period will inhibits the growth that cannot be rectified in the future. This study was cross-sectional design, the sample consisted pregnant women of third trimester as many as 61 people were selected by purposive sampling. Hemoglobin levels measured by the hemocue method. Energy and protein intake used by recall 2x24 hours, the intake of iron, folic acid, vitamin B12, vitamin C and calcium used by SQ-FFQ questionnaire. The bivariate analysis Perason Product Moment and multavariat test used Multiple Linear Regression. Mean hemoglobin levels 11.60g/dL, the average intake compared AKG: energy 1436.42 kcal (56.3%), protein 53.56 g (70%), iron 19.95 mg (52.5%), folic acid 545.4 mcg (91%), vitamin B12 4.95 mcg (190%), 174.53 g of vitamin C (205%), 704.16 mg calcium (56.3%). Bivariate test obtained intake of energy, protein, iron, folic acid, vitamin B12, and calcium with hemoglobin level ($p<0.05$). Multivariate analysis found the variables most associated with hemoglobin levels was energy intake ($p=0.010$, $\beta=0.390$), increased in energy intake of one kcal will increased the hemoglobin level of 0.390 g/ dl. Significant correlation among energy, protein, iron, folic acid, calcium with vitamin B levels of hemoglobin, but not with the vitamin C.

Keywords: hemoglobin level, intake of energy, protein, micronutrients

INTRODUCTION

Pregnant women are one easiest group suffer health problems due to malnutrition. Based Health Profile of Jakarta in 2012 the number of maternal deaths are 97 people. One possible cause is bleeding (31%) are caused by factors anemia in pregnant mothers.

Riskesdas data shows an increase in anemia between pregnant women from 11.9% (2007) increased to 37.1% (2013). The prevalence of anemia in Jakarta by 15% exceeds the average national prevalence (11.9%). Based on the data obtained, the prevalence of pregnant women in Puskesmas Kecamatan Kebon Jeruk in 2015 amounted to 4,295 people, as many as 1249 people or 29% of them are anemic.

Anemia is a condition in decreased levels of hemoglobin (Hb), hematocrit and red cell count below normal. Shortage of hemoglobin levels in pregnant women are one of the health problems that occur during pregnancy. Hemoglobin levels less than 11 g/dl shows pregnant women suffer from anemia. World Health Organization (WHO) recommends to the normal level of hemoglobin in pregnant women are ≥

11 g/dl and no less than 10.5 g/dl (Setiawan, Lipoeto, and Zati, 2013).

Low hemoglobin levels during pregnancy due to hemodilution is an increased density of blood more fluid than blood cells, so that the levels of hemoglobin (Hb) is reduced. Maternal blood volume increased to about 150% of normal to meet the needs of the fetus, but the red blood cells only increased by 20-30%. As a result, the ratio of red blood cells to the blood volume decreases (Almatsier, 2009).

Pregnant women in the third trimester is prone to anemia due to changes in the circulation increasing the placenta and during the third trimester fetus horde reserves of iron for himself as an inventory of the first month after birth so that the need for nutrients mothers also increased (Setyawati & Syauqy, 2014).

Decreased levels of hemoglobin caused by lack of nutrients that play a role in the formation of hemoglobin, either under consumption or malabsorption. Nutrients are concerned, protein, iron, folic acid, vitamin B12 and vitamin C (Setyawati & Syauqy, 2014). Proteins serve as the transport of iron in the body. Iron absorption that occurs in the small intestine aided by transport means the protein transferrin and ferritin. Transferrin iron-containing form of ferro functioning transports iron to the bone marrow for the formation of hemoglobin (Setiawan, Lipoeto, and Zati, 2013).

Intake of folic acid deficiency in pregnant women are a risk factor for anemia. Folic acid in the formation of red blood cells, while vitamin B12 is required to begin folic acid. Pregnant women need iron intake more than before pregnancy. Low levels of hemoglobin in pregnant women can be overcome by eating foods that contain iron (Nurhidayati & Hapsari, 2014).

Iron absorption can be increased by the consumption of vitamin C. Vitamin C helps the absorption of non-heme by converting ferric. Iron in ferrous is more easily absorbed in duodenum (Zijp, Korver O, & Tijburg LB, 2000).

Nutrients that can inhibits the absorption of iron in the formation of hemoglobin such as calcium, tannin, phytate and oxalate. Calcium absorption inhibitor of heme and non-heme iron. Calcium inhibited both nonheme and heme-iron absorption, and they proposed that, because the two iron forms likely have different apical mucosal receptors, calcium inhibition likely occurred in the final steps of transport from the mucosal cell to plasma, after the two forms of iron had entered a common cellular iron pool (Roughead, Zito, & Hunt, 2005).

Walczyk et al. (2014) found that the consumption of foods containing iron together with calcium, the calcium salts will inhibit the absorption of both heme and non-heme iron. In this study, the addition of 100-200 mg of calcium may decreased the absorption of iron from casein/whey-based beverage 6 mg iron fortified by 10-25%.

SUBJECTS AND METHODS

This research was conducted in Puskesmas Kecamatan Kebon Jeruk in December 2016 to January 2017. This research is descriptive analytic cross sectional design. Pupulation were all pregnant woman in Puskesmas Kecamatan Kebon Jeruk, the samples were of pregnant women during their pregnancy to Puskesmas Kecamatan Kebon Jeruk for 3 weeks of the study.

Energy and protein intake was measured by recall 2x24 hours, the intake of iron, folic acid, vitamin B12, vitamin C and calcium were measured

by semi-quantitative food frequency questionaire (SQ-FFQ). The bivariate analysis used correlation and multivariate analysis used linear regression.

RESULTS AND DISCUSSION

The sample in this study is the third trimester pregnant women as many as 61 people. Characteristics of the sample are shown in Table 1.

Table 1. Distribution of Respondents by Age Pregnancy in Puskesmas Kecamatan Kebon Jeruk

Characteristics	n	%
Maternal age		
< 20 years	4	6.6
20 – 35 years	50	82.0
> 35 years	7	11.5
Gestational age		
28 – 31 weeks	10	16.4
32 – 35 weeks	14	23.0
36 – 39 weeks	37	60.7
LLA		
< 23.5 cm	3	4.9
≥ 23.5 cm	58	95.1
Iron Supplement		
No	5	8.2
Yes	56	91.8
Folate Acid Supplement		
No	6	9.8
Yes	55	90.2
Calcium Supplement		
No	15	24.6
Yes	46	75.4

This results were known that most pregnant women age 20-35 years (82.0%), 58 people (95.1%) of pregnant women have LLA ≥ 23.5 cm. Maternal nutritional status is measured through LLA reflect reserves of nutrients and conditions of maternal nutritional status in pre pregnant (Fatimah, Hadju, and Bahar, 2011).

Most pregnant women consumption iron supplements as many as 56 people (91.8%), folic acid supplements 55 people (90.2%) and calcium supplementation as many as 46 people (75.4%). Iron and folic acid supplementation is effective to prevent anemia and iron deficiency, where pregnant women who received daily iron supplements had a lower risk of anemia (Fitri, Briawan, tanzih, and Amalia, 2015).

The World Health Organization recommends calcium supplementation 1500-2000 g/day in populations with low calcium intake as part of the ANC for the prevention of pre-eclampsia in pregnant women, beside that, the need for calcium tablets taken separately from iron supplements as it appears a negative affect on the absorption of calcium and iron if taken together (Purnasari, Briawan, & Dwir, 2016).

Table 2. Distribution of respondents by Hemoglobin, Intake Energy, Protein, Iron, Folate, Vitamin B12, Vitamin C and Calcium

Variabel	Mean ± SD	Min – Max
Hemoglobin (g/dL)	11.60 ± 1.01	10.10–13.80
Energy (kcal)	1436.42 ± 321.83	962.80 –2184.30
Protein (g)	53.56 ± 11.16	35.65 – 75.75
Iron (mg)	19.95 ± 5.07	9.5 – 31.0
Folate (mcg)	545.4 ± 180.22	52.0 – 902.0
Vitamin B_{12} (mcg)	4.95 ± 3.25	0.20 – 10.20
Vitamin C (mg)	174.53 ± 76.06	39.90 – 494.90
Calcium (mg)	704.16 ± 208.48	254.5 – 1202.4

The average hemoglobin levels of pregnant women are 11.60±1.01 g/dL, hemoglobin levels lowest of 10:10 g / dL and a highest of 13.80 g/dL. The average intake of energy 1436.42 kcal, protein 53.56 g, iron 19.95 mg, folic acid 545.4 mcg, vitamin B12 4.95 mcg, vitamin C 174.53 g and calcium 704.16 mg.

Table 3. correlation of energy intake, protein and micronutrients with hemoglobin levels of pregnant women in Puskesmas Kecamatan Kebon Jeruk

Variables	correlation coefficient (r)	*p-value*
Energy	0.659	0.0001
Protein	0.649	0.0001
Iron	0.494	0.0001
Folic acid	0.543	0.0001
Vitamin B_{12}	0.426	0.001
Vitamin C	0.162	0.213
calcium	0.397	0.002

Table 4. Multivariate analysis Intake of Energy, Protein, iron, folic acid, vitamin B $_{12}$, and Calcium with Hemoglobin Pregnancy in Kebon Jeruk District Health Clinics

Model	B	Std. Error	β	T	*Sign*
(Constan)	8.376	0.446		18.77	0.000
Energi	0.001	0.000	0.390	2.65	0.010
Protein	0.029	0.012	0.350	2.37	0.021

Dependent Variables: Hemoglobin

Based on table 4 known that energy intake p=0.010 that the variables most associated with hemoglobin levels energy intake. Regression coefficient β=0.390 can be interpreted that each increase of 1 kcal of energy intake will increase the hemoglobin levels of 0,390 g/dL.

Correlation of Energy Intake with Hemoglobin

This study found that the average intake of energy 1436.42 kcal, compared with pregnant women of energy sufficiency is 2,550 kcal/day, then the adequacy of energy amounted to only 56.3% of the RDA. This suggests that energy intake is still relatively low, based on the food recall 2x24 hours is known that the energy shortage is caused

because most pregnant women consume a snack such as biscuits and fruit. Snack consumed by pregnant mothers not energy intensive.

Correlation energy intake with hemoglobin levels have a value of r = 0.659 means that the variable energy intake has the power relationship strong, positive correlation coefficient shows that the higher energy intake, the greater the hemoglobin level is obtained. Correlation test results showed the value of p = 0.0001 (p <0.05), which means there is a significant relationship among energy intake and levels of hemoglobin in pregnant women in sub-district Puskesmas Kebon Jeruk.

Anggraini (2013) found significant relationship among energy sufficiency with a hemoglobin level of third trimester pregnant women in Puskesmas Desa Lalang Kecamatan Medan Sunggal, as many as 40.0% had the hemoglobin levels were normal and 60.0% of anemia.

Formation of hemoglobin relating to the adequacy of energy, protein and iron. The process of formation of red blood requires the availability of sufficient energy. In the process of transporting oxygen, protein must bind with iron to form myoglobin in the muscle fibers then form an enzyme that plays a role in the formation of energy in cells. When enough energy in cells, the protein and iron to form hemoglobin and transports oxygen from the blood (Humeid, 2013).

Correlation of Protein Intake with Hemoglobin

Based on the Recommended Dietary Allowances (RDA) of protein adequacy of pregnant women aged 19-29 years is 76 g / day and pregnant women aged 30-49 years is 77 g / day, while the results of this study, the average protein intake of 53.56 g / day , When compared with the RDA, then the adequacy of protein intake of pregnant women at 70% of the RDA.

The results of food recall 2x24 hours pregnant mothers rarely consume animal side dish, pregnant women more frequent consumption of tofu and tempe with frequency 1-6x/day, while the consumption of animal side dish such as chicken eggs and chicken meat 4-6x /week, chicken liver, and mackerel 1-3x/week. Consumption 70 grams tofu, 30 grams tempe, 40 grams chicken meat, 55 grams chicken eggs, and 40 grams mackerel. Based on materials exchanger unit, in a presentation should the consumption of 110 grams, tempe 50 grams, 55 grams of chicken meat, chicken eggs 55 grams, 40 grams mackerel. Based on the unit exchanger materials, should consume in one presentation: tofu 110 grams, tempe 50 grams, 55 grams of chicken meat, chicken eggs 55 grams, 40 grams mackerel.

Relations with hemoglobin levels of protein intake has r = 0649, meaning that protein intake has a strength of a strong, positive correlation coefficient indicates that the higher the protein intake, the higher the hemoglobin level is obtained. The results of Pearson Product Moment correlation test showed the value of p = 0.0001 (p <0.05), meaning there is a significant relationship between the intake of protein and hemoglobin levels in pregnant women in Puskesmas Kecamatan Kebon Jeruk.

Setyawati & Syauqy (2014) found the median (min-max) for protein intake was 37.4 (25.6 to 79.6) g/day anemia group and 43.7 (29.4 to 67.8) g / day not anemic group, through statistical test Mann Whitney test shows that there are differences between the mean intake of protein between third trimester pregnant women anemia and no anemia (p = 0.032).

Arisman (2009) protein known to play a role in the transport of iron in the form of transferrin, an iron requires protein transferrin, transferrin and ferritin receptors that act as providers and storage of iron in the body and iron regulatory proteins (IRPS) to adjust the supply of iron. Consumption source of protein in sufficient quantities every day such as fish, chicken, eggs, tempe and tofu. Lack of protein will affect the poor growth, decreased immune system, are more susceptible to disease, as well as the power of creativity and decreases working power (Matayane et al. 2014).

Correlation of Iron Intake with Hemoglobin

Based on the Recommended Dietary Allowances (RDA) of 2013 the adequacy of iron for pregnant women is 39 mg / day, while this study found an average iron intake amounted to 19.95 mg / day. Adequacy iron intake 51% of the RDA. It is still relatively low, but the adequacy of iron not only from the intake, pregnant women are also consuming Fe tablet provided by the health center.

The results of research used form semi-quantitative food frequency questionaire (SQ-FFQ) found that pregnant women more frequent consumption of non-heme iron sources such as tofu and tempe frequency 1-2x/day. Sources of heme iron that is often consumed: chicken eggs and chicken meat frequency 4-6x/week, mackerel, fish and chicken liver frequency 1-3x/week.

Relationships iron intake with hemoglobin levels r = 0494, meaning that the intake of iron have the moderate relationship, the value of a positive correlation indicates that higher iron intake, the greater the hemoglobin level is obtained. The results of Pearson Product Moment correlation test showed the value of p = 0.0001 (p <0.05), which means there is a significant relationship between the intake of iron and hemoglobin levels in pregnant women in Puskesmas Kecamatan Kebon Jeruk.

This research same with Cendani & Murbawani research (2011) that there is a positive relationship for iron intake means higher iron intake, the greater the level of hemoglobin value obtained. Multiple regression analysis showed that the intake of iron (p = 0.007) can predict the levels of hemoglobin. Regression coefficient β = 0.480, it can be interpreted that increase 1 mg of iron intake will increase 0.480 g% of hemoglobin level.

Lack of iron causes disruption of the synthesis of hemoglobin, if dietary intake is inadequate, then the iron is not enough for the synthesis of hemoglobin for defiensi iron in the diet, although erythrocytes still be produced in the usual amount but its content is lower than normal and is smaller so less able transports oxygen. Thus the less content of iron contained in the food likelihood of anemia will be even greater (Nurhidayati & Hapsari, 2014).

Correlation of Folat Acid intake with Hemoglobin

Based on the Recommended Dietary Allowances (RDA) of 2013 the adequacy of folic acid for pregnant women is 600 mcg/day, while based on the results, the average intake of folic acid amounted 545.4 mcg/day. Adequate intake of folic acid that is 91% of the RDA. Pregnant women consume folic acid supplements as many as 55 people (90.2%). Maternal intake of folic acid is already quite good, other than the consumption of food sources containing folic acid, pregnant women taking folic acid tablets given by the health center.

The results of research used form semi-quantitative food frequency questionaire (SQ-FFQ) found that pregnant women are often the consumption of nuts, especially tofu and tempe frequency 1-2x/day, green beans 1-3x/week. Consumption of green vegetables such as spinach, kale, beans and bean sprouts frequency 4-6x / week, it was evident that the consumption of folic acid pregnant women is good.

Relations folic acid intake with hemoglobin levels obtained r = 0543, meaning that the variable intake of folic acid has strong force, positive correlation coefficient indicates that the higher the intake of folic acid, the greater the hemoglobin level is obtained. The results of Pearson Product Moment correlation test showed the value of p = 0.0001 (p <0.05), which means there is a significant relationship between intake of folic acid and hemoglobin levels in pregnant women in Puskesmas Kecamatan Kebon Jeruk.

This research same with Cendani & Murbawani research (2011), Spearman rank test was p=0.0001, so that there is a relationship of folic acid intake with hemoglobin levels.

Folic acid is needed for the formation of red blood in the bone marrow and their maturation. Folate plays a role as the sole carbon carrier in the formation of heme. Folic acid deficiency in pregnancy will cause interference maturation nucleus erythrocytes, making it appear red blood cell size and shape of abnormal known as megaloblastic anemia, further impaired metabolism of folic acid will cause interference with DNA replication and cell division process, and this will affect the entire working the cells of the body, including in iron metabolism (Darwanty & Antini, 2012).

Correlation of Vitamin B_{12} Intake with Hemoglobin

Based on the Recommended Dietary Allowances (RDA) of 2013 the adequacy of vitamin B_{12} in pregnant women is 2.6 mcg/day, while based on the results, the average intake of vitamin B_{12} of 4.95 mcg / day. Based on the RDA, intake of vitamin B12 by 190%. Intake of vitamin B_{12} have been classified as pregnant women over the nutritional adequacy rate for pregnant women.

The results of research used the form a semi-quantitative food frequency questionaire (SQ-FFQ) in the last month showed that maternal consumption of chicken liver, eggs, fish, mackerel frequency 1-6x/week. Relations intake of vitamin B_{12} with hemoglobin levels have a value of r = 0426 means that the variable intake of vitamin B_{12} have the power relationship being, a positive correlation value. The results of Pearson Product Moment correlation test showed the value of p = 0.001 (p <0.05), which means there is a significant relationship between the intake of vitamin B_{12} and hemoglobin levels in pregnant women in Puskesmas Kecamatan Kebon Jeruk.

According to Ma et al. (2004), there is a correlation between the decrease in hemoglobin concentration is accompanied by a decrease in serum levels of vitamin A, ascorbic acid, folic acid and vitamin B_{12}. Based on research Setiyawati & Syauqi (2014) concluded that there are differences in vitamin B_{12} (p = 0.03) between the third trimester pregnant women anemia and anemia.

Vitamin B_{12} functions in the synthesis of hemoglobin and red blood cells through the metabolism of fat, protein and folic acid. In bone marrow coenzyme vitamin B_{12} is necessary for DNA synthesis. If DNA is not produced, erothrombast not divide but grow to megablast then go deep into the blood

sirkuasi. Besides iron, bone marrow needs vitamin B_{12} and folic acid to produce red blood cells. If the lack of one of them common megaloblastic anemia. Vitamin B_{12} deficiency is usually due to the lack of absorption and lack of food consumed (Ma AG, XC Chen, Wang Y, Xu RX, Zheng MC, & Li JS, 2004).

Correlation of Vitamin C Intake with Hemoglobin

Based on the Recommended Dietary Allowances (RDA) of 2013 the adequacy of vitamin C for pregnant women is 85 grams day, this result found the average intake of vitamin C of 174.53 grams / day. Adequate intake of vitamin C for pregnant women 205% of the RDA, it is classed as over nutrition adequacy rate for pregnant women.

Sources of vitamin C found in vegetables (cassava leaves, papaya mustard greens) and fruits (guava, papaya, kiwi). The results using a form of semi-quantitative food frequency questionaire (SQ-FFQ) in the last month showed that pregnant women often consume fruits such as oranges, mango, melon, banana, and papaya with a larger portion than the portion in units of exchange material , while vegetables are often consumed namely bean sprouts, tomatoes, carrots, green beans, spinach, cabbage, kale, and sweet corn with frequency 1-6x/week with a share of average consumption below 100 grams / serving.

Consumption 200 grams of orange, 135 grams mango, banana 100 grams, 200 grams papaya and melon 190 grams. Meanwhile, in exchange for a unit material consumption of 110 grams should be orange, mango 90 grams, 50 grams of banana, papaya 100 grams and 190 grams of melon. Relations intake of vitamin C with hemoglobin levels have a value of r = 0162 means that the variable intake of vitamin C has a weak connection strength, a positive correlation coefficient indicates that a higher intake of vitamin C, the greater the hemoglobin level is obtained.

The results of Pearson Product Moment correlation test showed the value of p (sign) = 0.213 (sig> 0.05), which means there is no significant relationship between the intake of vitamin C and hemoglobin levels in pregnant women in Puskesmas Kecamatan Kebon Jeruk. The results by used form of semi-quantitative food frequency questionaire (SQ-FFQ) in the past month is found that the consumption of vitamin C is derived from the fruit in pregnant women does not coincide with the consumption of animal side dish, pregnant women are more likely to make fruit as snack.

This study is same with research Cook & Ready (2001) showed that there was no significant difference in iron absorption between the three diet periods despite various average daily intake of dietary vitamin C 51-247 mg / d5. Research conducted by Guntur (2004), the consumption of vitamin C was also not significantly associated with hemoglobin levels (p = 0.754).

The average intake of vitamin C was 174.5 mg / day. Such consumption has exceeded the requirement of vitamin C in pregnant women is 85 mg / hr. According Broek (2003), decreased hemoglobin levels in pregnant women due to a lack of compliance mother in taking iron with vitamin C. Consumption of iron gives form positive relationships with hemoglobin levels where there is a tendency of the higher consumption of iron and hemoglobin levels higher intake of vitamin C can served to increase iron absorption. According to Kaur & Order (2016), one of the efforts that can be

done is by extension. Counseling can increase the consumption of Fe and vitamin C.

Vitamin C reduces the ferry into the ferrous iron in the small intestine so easily absorbed. Vitamin C inhibits the formation of hemosiderin difficult mobilized to liberate the iron when needed. Absorption of iron in the form nonhem increased four-fold when no vitamin C. Vitamin C plays a role in the transport of iron from transferrin to ferritin in the liver plasma (Almatsier, 2009).

According Argana et al. (2004), the frequency of consumption of vitamin C was significantly associated with higher levels of hemoglobin. It explains that, more frequent consumption of food sources of vitamin C along with Fe resources would be more in touch than the amount consumed. That is, the magnitude of the dose of vitamin C consumed would not be related if not frequently consumed. Vitamin C will be instrumental if taken at the right time is when together with the consumption of non-heme sources.

Correlation of Calcium Intake with Hemoglobin

Based on Recommended Dietary Allowances (RDA) of 2013 the adequacy of calcium for pregnant women is 1250 mg / day, while based on the results, the average intake of calcium amounted to 704.16 mg / day. Adequate intake of calcium amounted to 56.3% of the RDA, it is still relatively low compared RDA for pregnant women.

Relations of calcium intake with hemoglobin levels had a correlation coefficient r = 0397 means that the variable intake of calcium has a strength of the relationship, the value of r is positive indicating that the higher the calcium intake, the greater the hemoglobin level is obtained. This is contrary to the theory that calcium as an inhibitor of iron. *Pearson* correlation test results showed the value of *p (sign)* = 0.002 (sig <0.05), which means there is a significant relationship between calcium intake with the level of hemoglobin pregnant women in Puskesmas Kecamatan Kebon Jeruk.

Based on research results by using *the form of semi-quantitative food frequency questionaire* (SQ-FFQ) in the last month showed that maternal consumption of dairy 1-2x / day before bed or be used as a snack, the type of milk consumed varies comprising maternity milk, soy milk, and sweetened condensed milk. Consumption of milk in pregnant women does not coincide with the consumption of food sources of iron, so that calcium does not inhibit iron absorption.

Calcium absorption inhibitor of heme and non-heme iron. Inhibit calcium absorption than the initial mucosal serosal transfer heme iron, calcium inhibition occurred in the final steps of the mucosal cells transport to the plasma, after both these forms of iron and calcium that enters enterocytes serosal inhibit the transfer of iron in the blood, even with differences in apical receptors for heme and non-heme iron. In mice, calcium inhibits iron absorption by delaying the entry of non-heme iron into the microvilli of intestinal epithelial cells (Roughead, Zito, & Hunt, 2005).

Based on Research Walczyk *et al. (2014)* said enhance calcium into food or drink iron fortified negative effect on iron absorption. calcium salt will inhibit the absorption of both heme and non-heme iron when the consumption of foods that contain iron along with calcium.

Based on research Mulyani (2015) found that increasing age of the woman (mother), the concentration of Fe, Zn, Ca, and Cu greater in the fetus. Regression modeling in the study also showed that young women, age> 12 years, living in rural areas, and medium as well as calcium intake <1000 mg / day then iron intake increased by 16 369. This shows the interaction between calcium intake and small can increase iron intake amounted to 16 369.

Additionally linked to evidence that calcium can inhibit the absorption of iron, there is research literature study found that through direct measurement of the absorption of iron, calcium consumption is high and for a long time can inhibit iron absorption. This can be seen in serum ferritin levels in the blood. From these studies it can be concluded that the consumption of calcium is much amounts in food can inhibit the absorption of Fe heme and non-heme. Therefore, pregnant women with high iron requirements, adolescents, and women of childbearing age (menstruation) needs to consume calcium a gap or limiting with main meals that contain mostly iron. If necessary, the calcium intake should be going to sleep (Mulyani, 2015)

CONCLUSION AND SUGGESTION

This reseacrh found are significant correlation between energy, protein, iron, folic acid, vitamin B12 and calcium with hemoglobin levels in pregnant women ($p<0.05$), but not with the intake of vitamin C ($p> 0.05$).

Should be given counseling to pregnant women in order to get used to eating the balance foods.

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