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## **Relationship between Characteristics and Nutrient Intake with Anemia among Pregnant Women at Kebon Jeruk Public Health Center, Jakarta**

**Nadiyah<sup>1\*</sup>, Elsy Meilinda br Sembiring Meliala<sup>1</sup>, Acnes Cristina Simanjuntak<sup>1</sup>,  
Frisella Misalsalina Perangin-Angin<sup>1</sup>**

<sup>1</sup>Nutrition Departement, Esa Unggul University, Jakarta, Indonesia

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#### **Correspondence author:**

Nadiyah, Esa Unggul University, Jl.  
Arjuna Utara No.9, Jakarta Barat,  
Indonesia

E-mail:

[nadiyah@esaunggul.ac.id](mailto:nadiyah@esaunggul.ac.id)

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**Abstract.** The number of anemia pregnant women in Indonesia increased to 48.9% in 2018. The number of maternal deaths in DKI Jakarta (2018) risen from 53 out of 100,000 live births, with 25% of them due to bleeding and infection. Anemia increases the risk of bleeding and infection. This study aimed to explore the characteristics, nutrient intake among pregnant women, and their relationships with anemia in Public Health Center Kebon Jeruk, West Jakarta. This cross-sectional study was carried out with 60 pregnant women. Two non-consecutive-24 hours dietary recalls assessed energy and protein intake. Micronutrient intakes (iron, folate, vitamins C, B6, B12, E, copper, calcium) were assessed using a semi-quantitative food frequency questioner. Independent t-test or Mann-Whitney and chi-square tests were applied, according to the type of data and interpretation need, to analyze the relationship between characteristics, nutritional intakes, and anemia. The result showed that trimester, mother's education, husband's income, nutritional status, intake of energy, protein, vitamins C, B6, B12, E, folate, iron, copper, and calcium were significantly related to anemia. A well-planned Communication, Information, and Education (IEC) are needed to improve the quality of nutrient intakes and increase adherence to iron tablet consumption.

**Keyword:** Anemia, Characteristics, Energy, Intake, Pregnant Women

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## INTRODUCTION

Based on the 2018 Riskesdas (Basic Health Research) data, the percentage of pregnant women with anemia in Indonesia (48.9%) increased compared to 2013 (37.1%). From the results of the 2018 Riskesdas, the percentage of anemia in pregnant women based on the age group is as follows: 84.6% anemia occurs in the 15-24-year age group, 33.7% in the 25-34 year age group, 33.6% in the group age 35-44 years and 24% occurred in the age group 45-54 years. The prevalence of anemia between rural and urban areas in Indonesia is not much different, 49.5% and 48.3%, respectively (1,2).

Based on the Health Profile of DKI Jakarta Province, the number of maternal deaths increased from 44 people per 100,000 live births in 2017 to 53 people in 2018. The maternal mortality rate in Jakarta is higher than the maternal mortality rate in Singapore and Malaysia, which is 7 and 24 per 100,000 live births, respectively. As much as 25% of maternal deaths are caused by bleeding and infection (3). The risk of maternal bleeding and infection increases due to anemia (4). The rising prevalence of anemia in Indonesia can result in a rise in the risk of maternal death.

Anemia is an abnormal size or number of red blood cells or a low hemoglobin level in the blood. Anemia itself is divided into two, nutritional anemia and non-nutritional anemia. Non-nutritional anemia is due to bleeding, accidents, or chronic disease. Nutritional anemia can be caused by various things, from lack of intake for the formation of red blood cells and hemoglobin, increased demand but not accompanied by adequate intake, especially in the children who are still in the growth stage and pregnant women. Some causes of anemia are reduced red blood cell production, increased red blood cell destruction, and blood loss. Pregnant women are the most prone group to anemia due to increased blood volume and the need for more nutrients than usual to support fetal growth and development. The criteria for anemia set by WHO for pregnant women are  $<11.0$  gr/dl (5).

Anemia in pregnant women significantly affects the growth and development, and health of the fetus. Anemia is the cause of low birth weight (LBW). Besides that, LBW is the dominant factor of stunting in children and tends to increase the severity of stunting at later ages (6). Both low birth weight and stunting and anemia can reduce intelligence and productivity levels in adulthood. LBW that occurs in children also increases the risk of non-communicable diseases in adulthood.

Iron deficiency is not the sole cause of iron deficiency anemia. Still, it is also influenced by absorption assisting factors (enhancers) such as vitamin C and iron absorption inhibiting factors such as tannins, phytates, oxalates, and calcium (7). Vitamin B12 is needed to activate folic acid and cell metabolism, especially gastrointestinal cells, bone marrow, and nerve tissue (8). Folic acid plays a role in the metabolism of amino acids, which are needed to form red blood cells (9). The part of vitamin E in cells is an antioxidant for fatty acids, which is very useful for creating cell membranes. The fragile state of red blood cells makes iron supplementation less effective (10).

Vitamin B6 is needed in protein metabolism, which is also required for heme synthesis to form hemoglobin. Vitamin B6 is essential in pyridoxal phosphate phosphorylation (PLP). PLP plays a role in developing alpha-aminolevulinate, the precursor of heme in hemoglobin (11). Copper is also related to the iron oxidation process for the formation of hemoglobin (12).

Apart from intake factors, socio-economic factors such as education and the working status of pregnant women are associated with anemia (13). Most pregnant women in the Kebon Jeruk District Health Center do not work (73%). Research on the relationship between husband's income and the incidence of anemia in wives will provide a broader picture of the incidence of anemia in pregnant women at the Kebon Jeruk District Health Center.

The Public Health Center (PHC) Kebon Jeruk, West Jakarta, is the health center with the most pregnancy services (120-150 observations for pregnant women per day). The average number of pregnant women noted to have anemia and consultations with the nutritional clinic is 50-60 people per month. The prevalence of pregnant women in the Kebon Jeruk District Health Center in 2015 was 4,295 people, of which 1249 people or 29% of them had anemia. The highest prevalence of anemia in pregnant women was September 2019 (60.5%) (14–16).

## **OBJECTIVE**

Based on the explanation above, this study aims to analyze the relationship between characteristics and nutrient intake and anemia in pregnant women at Public Health Center (PHC) Kebon Jeruk, West Jakarta.

## **METHOD**

### **Study Design and Sampling**

This cross-sectional study was conducted from May to August 2019 at the PHC Kebon Jeruk, West Jakarta. The sample selection used the purposive sampling technique. The inclusion criteria are pregnant women registered at the PHC Kebon Jeruk, who checked their hemoglobin at the time of the study, were not undergoing specific diets, and were willing to become respondents. Based on the sample calculation, the minimum sample size is 49 respondents. Considering adding 10% in anticipation of a dropout sample, the total number of respondents was 60 pregnant women. This research has obtained ethical approval from the Esa Unggul University Code of Conduct Enforcement Council Number 0514-19.496 / DPKE-KEP / FINAL-EA / UEU / XI / 2019.

### **Data Collection**

The dependent variable was anemia, and the independent variables studied were the dimensions of the characteristics and nutrient intake of pregnant women. Characteristics of pregnant women included age, trimester, parity, education, working status, husband's income, nutritional status using upper arm circumference (UAC), height. The nutrient intakes that were studied included energy, protein, vitamin B6, folate, vitamin B12, vitamin C, vitamin E, iron, copper, and calcium intake.

Data collection of hemoglobin levels was carried out using analysis of the Hemocue method at the PHC Kebon Jeruk. Data on the characteristics of respondents, including age, husband's income, education of pregnant women, parity, were obtained by interviewing a structured questionnaire. Micronutrient intake data, including iron, vitamin C, folate, vitamin B6, vitamin B12, copper, calcium, and vitamin E, were obtained using a Semi-Quantitative Food Frequency Questioner (SQ-FFQ). In contrast, energy and protein intake data were collected using the 2 x 24-hour food recall consecutively.

Nutrient intake data were processed using nutrisurvey software and completed with various sources from the Indonesian Food Composition List, the Food and Agriculture Organization (FAO) Food Composition List Database for Indonesia, and various journals and book references. Adequacy levels of energy, protein, and micronutrient intake were obtained by comparing the respondent's actual intake with the latest Recommended Adequacy Rate (RDA) based on Regulation of the Minister of Health of the Republic of Indonesia No. 28 of 2019.

The selected respondents have explained the purpose of the research and the procedure of data collection. The willing respondents were required to sign an informed consent form. Furthermore, as many as five respondents were not present in the process of data collection

due to being referred to the hospital. Thus re-selection was carried out to 5 other respondents according to the inclusion and exclusion criteria to meet the required minimum number of respondents.

### Data Analysis

Data were analyzed using statistical software. Descriptive statistics were frequency and percentage that were tabulated respectively in the anemia and non-anemia groups. An independent t-test was used for normally distributed data. On the other hand, an alternative non-parametric Mann-Whitney and chi-square test were performed according to the data interpretation need.

### RESULTS

The number of pregnant women who participated in this study was 60 mothers. This study indicated that the average hemoglobin (Hb) levels are 11.49 g/dL with the lowest 8.8 gr/dL and the highest level of 13.9 g/dL. Of the total 60 pregnant women, 38% had anemia. In general, most pregnant women (40%) were between 25-30 years old and in the 3rd trimester period (42%). Most (73%) pregnant women do not work with a high school education level (70%), and the majority (63%) of the husband's income is above the Regional Minimum Wage (RMW). Nutritional status, based on the parameters of the upper arm circumference (UAC), showed that generally (78%) pregnant women do not experience chronic energy deficiency and have a height above 150 cm (92%) (Table 1).

Table 1. Characteristics of Pregnant Women at Public Health Center Kebon Jeruk, West Jakarta

Characteristics	n	%
Age (years)		
19-24	16	27
25-30	24	40
31-36	14	23
37-42	6	10
Trimester		
1	17	28
2	18	30
3	25	42
Pregnancy		
1	20	33
2	26	43
> 2	14	23
Working status		
Yes	16	27
No	44	73
Education		
Junior high school	14	23
Senior high school	42	70
College	4	7
Husband's income		
Under RMW	22	37

UAC	Above RMW	38	63
	<23,5 cm	13	22
	≥23,5 cm	47	78
Height	< 149 cm	5	8
	≥ 150 cm	55	92
	Anemia		
	Yes	23	38
	No	37	62

Table 2 showed that more than 90% of pregnant women did not meet energy intake needs. More than 60% of pregnant women did not meet protein intake needs as recommended by the Recommended Nutrition Adequacy Rate (RDA) for pregnant women. Most (78%) pregnant women lacked folate intake. More than a third of pregnant women (33%) lacked vitamin B6 intake, and nearly a quarter (22%) of pregnant women lacked vitamin B12. Nearly half (40%) of pregnant women lacked copper intake, and it was still found that 10% of all pregnant women were deficient in iron intake.

Table 2.  
Energy and nutrient intake of pregnant women at Public Health Center Kebon Jeruk,  
West Jakarta

	Intake	n	%
Energy	<70% RDA	29	48
	70-79% RDA	16	27
	80-89% RDA	9	15
	90-110% RDA	6	10
	>110% RDA	0	0
Protein	<70% RDA	13	22
	70-79% RDA	14	23
	80-89% RDA	9	15
	90-110% RDA	12	20
	>110% RDA	12	20
Vitamin B6	<77% RDA	20	33
	≥77% RDA	40	67
Folate	<77% RDA	47	78
	≥77% RDA	13	22
Vitamin B12	<77% RDA	13	22
	≥77% RDA	47	78
Vitamin C	<77% RDA	3	5
	≥77% RDA	57	95

Vitamin E	<77% RDA	1	2
	≥77% RDA	59	98
Iron	<77% RDA	6	10
	≥77% RDA	54	90
Copper	<77% RDA	24	40
	≥77% RDA	36	60
Calcium	<77% RDA	5	8
	≥77% RDA	55	92

Table 3 showed that trimester, education, husband's income, and nutritional status (UAC) have significant relationships with anemia incidence. The higher the gestational age, the higher the incidence of anemia in pregnant women. It was found that only one pregnant woman experienced anemia in the 1st trimester, then increased to six pregnant women in the 2nd trimester, and rose sharply to 16 pregnant women who experienced anemia in the 3rd trimester of pregnancy.

Table 3.  
Characteristics and anemia incidence among pregnant women at Public Health Center Kebon Jeruk, West Jakarta

Characteristics	Normal		Anemia		Total		<i>P</i>
	n	%	N	%	n	%	
Age							
19-24	11	69	5	31	16	100	0.778 <sup>a</sup>
25-30	11	46	13	54	24	100	
31-36	11	79	3	21	14	100	
37-42	4	67	2	33	6	100	
Trimester							
1	16	94	1	6	17	100	0.006 <sup>b</sup>
2	12	67	6	33	18	100	
3	9	36	16	64	25	100	
Pregnancy							
1	14	70	6	30	20	100	0.713 <sup>b</sup>
2	17	65	9	35	26	100	
> 2	6	43	8	57	14	100	
Working status							
Yes	12	75	4	25	16	100	0.200 <sup>b</sup>
No	25	57	19	43	44	100	
Education							
Low	3	21	11	79	14	100	0.001 <sup>b</sup>
High	34	74	12	26	46	100	
Husband's income							
Under RMW	6	27	16	73	22	100	0.000 <sup>b</sup>
Above RMW	31	82	7	18	38	100	

UAC	<23,5 cm	12	92	1	8	13	100	0.011 <sup>b</sup>
	≥23,5 cm	25	53	22	47	47	100	
Height	< 149 cm	3	60	2	40	5	100	0.375 <sup>a</sup>
	≥ 150 cm	34	62	21	38	55	100	

<sup>a</sup> Mann-Whitney test, <sup>b</sup> chi-square test

## DISCUSSION

The majority of pregnant women who checked their pregnancies at the PHC were mothers with the first pregnancy (48%). As many as 29% were the second pregnancy, 23% were the third or more pregnancies.

There were no pregnant women at risky ages and mainly did not experience chronic energy malnutrition (CEM), although around 22% of women have CEM. From a social perspective, most pregnant women have high education levels and a husband's income above RMW. However, the anemia problem is high. Almost 40% of pregnant women in the Public Health Center (PHC) Kebon Jeruk had anemia. The issue of anemia is considered an elevated public health problem if the percentage reaches above 20% (17). Based on the level of anemia (18), anemia among pregnant women was classified as mild anemia, where the lowest hemoglobin level was 8.8 gr/dL.

Out of a total of 60 respondents, only 13 pregnant women complied taking the iron-folic acid (IFA) tablet provided by the PHC every day. As many as 78% of pregnant women at the PHC Kebon Jeruk District did not comply with taking IFA tablets every day for various reasons such as forgetfulness, lazy and dislike. This study did not use a structured questionnaire related to information on the grounds to not comply with the IFA tablet consumption. The reasons found were not different from the findings of the 2018 Riskesdas in DKI Jakarta. Most of them forgetfulness (26.1%), 22.0% was boredom, and third most (17.3%) due to nausea and vomiting due to pregnancy, 14.6% due to nauseous and constipation because of the side effects of IFA tablet, and 13.9% due to dislike.

The consequence of this low compliance to consuming IFA tablets containing folate also indicated the majority (78%) of pregnant women lacked folate intake. The increasing folate requirement and the sensitivity of folate nutrients to the cooking process (heat and dilution) make it challenging to meet the folate need from daily food alone. Deficiency of folate causes impaired red blood cell synthesis (19).

When reaching the 3rd trimester, the anemia percentage increased 27% from the 1st trimester. Pregnant women are prone to decreased hemoglobin levels due to hemodilution or increased blood volume. Although physiology generally decreases hemoglobin levels in the 3rd trimester, anemia in the 3rd trimester significantly increases the risk of low birth weight / LBW (20).

A pregnant mother's education has a significant relationship with the incidence of anemia. Among pregnant women with high education, only 26% of pregnant women had anemia. Meanwhile, among pregnant women with low education, it was found that up to 79% of them had anemia. Although the research conducted by Shofiana et al. (2018) (21) at the PHC Maron, Probolinggo Regency, showed that education does not affect ( $p = 0.419$ ) Compliance with the consumption of iron tablets. This study strengthens the research conducted by Widiasih et al. (2019) (22), where the formal education of pregnant women is one of the factors associated with anemia. The possible relationship between formal education and the incidence of anemia is moderated by factors such as adherence to IFA tablet consumption and the quality of nutritional intake.

In this study, the economic description studied was only the income of the head of the family/husband because most pregnant women did not work. The Regional Minimum Wage (RMW) in DKI Jakarta when the research took place was Rp. 3,394,000.00. The difference in the husband's income (below and above the RMW) has a significant relationship with anemia incidence. As many as 73% of pregnant women whose husband's income below the RMW had anemia. This percentage is much higher than the anemia percentage (18%) in the above RMW group.

A husband's income is a proxy for a pregnant woman's household economic profile. The higher the household income, the more diversified the food consumed. On the other hand, households with low incomes will only consume certain food products, mainly starch sources (23).

Based on a preliminary study conducted by researchers at the PHC Kebon Jeruk to 50 pregnant women, extraordinary expenditures on fish and meat was 18% of the total food expenditure, including spending on cigarettes. This figure (18%) is still slightly above the average of fish and meat expenditures among urban households in West Java in 2015 (13%) (23). The most significant percentage of fish and meat expenditure was found at 58%. Fish and meat are sources of protein and hem iron and have higher bioavailability than non-animal protein sources (19).

In the last week, the median value of fish and meat expenditure among the households was Rp. 89.000,00. There were still some households that did not consume fish and meat at all in the last week. The most significant expenditure for fish and meat was found as Rp. 550.000,00 - per week. Generally, the expenditure for meat increases with increasing household income. Bennet's Theory states that the richer a society, they will change the consumption pattern initially dominated by simple starchy plants to become more varied (Miranti et al., 2016).

Interestingly, the anemia of pregnant women with normal nutritional status (UAC >23.5 cm) was 47%, higher than the women group with CEM (8%). This study measured nutritional status using the UAC indicator. Upper Arm Circumference (UAC) is a proxy indicator of the risk of chronic energy deficiency for pregnant women (24). The nutritional status obtained from UAC measurement cannot describe the problem of anemia. High energy intake often reduces the quality of a person's intake. Diets that are dominated by food sources of energy are usually not rich in micronutrients. When pregnant women have normal UAC, it indicates that pregnant women do not experience a lack of energy intake. Still, in this study, 47% of pregnant women with normal UAC had anemia/low hemoglobin levels.

In Table 4, the relationship between calcium intake and the incidence of anemia is statistically significant and showed that most (80%) pregnant women who are deficient in calcium have anemia, and only 35% of pregnant women with sufficient calcium intake have anemia. This study only counted the average total calcium intake of pregnant women per day. It did not assess the timing of the calcium and iron intake, whether consumed simultaneously or not. The result of this study was unable to describe the nature of calcium inhibitors against iron absorption.

Cook et al. (1991) (25) explained that the inhibitory effect of iron absorption occurs when the availability of iron in the diet is low while the calcium content is high (55%). Furthermore, taking any type of calcium supplement at mealtime hinders iron absorption. Consumption of calcium supplements outside mealtime has different effects on iron absorption depending on the ratio of iron to calcium and the type of calcium source. When the iron to calcium ratio is above 1:40, calcium interferes with iron absorption. The form of calcium source in the supplement also influences the inhibiting effect. When calcium carbonate and iron are consumed simultaneously with iron to calcium ratio of 1:33, it does not inhibit iron absorption. However, when the form is calcium citrate or calcium phosphate in



the same proportion, it reduces the bioavailability of iron by 49% and 62%, respectively (25).

Generally, pregnant women at the PHC Kebon Jeruk still did not meet the needs of energy, protein, and folate intake. Many pregnant women still had deficits in their intake of vitamins B6, B12, copper, and iron. Pregnant women who lacked the nutrients studied (including vitamin C and vitamin E) generally had low hemoglobin levels.

## CONCLUSION

The anemia problem at the PHC Kebon Jeruk is categorized as a high public health problem. Nearly 40% of pregnant women at the PHC Kebon Jeruk had anemia, and all of them were classified as mild anemia. Most pregnant women at PHC Kebon Jeruk did not comply with consuming IFA tablets every day.

More than 90% of pregnant women did not meet the energy requirement, and more than 60% of pregnant women did not meet the protein requirement. Most (78%) pregnant women lacked folate intake. More than a third of pregnant women (33%) lacked vitamin B6 and nearly a quarter (22%) of pregnant women lacked vitamin B12. Nearly half (40%) of pregnant women were deficient in copper intake, and it was still found that 10% of all pregnant women are deficient in iron intake.

Trimester, mother's education, husband's income, energy, and nutrient intake studied (protein, vitamin B6, folate, vitamin B12, vitamin C, vitamin E, iron and copper, and calcium) were significantly related to the incidence of anemia in pregnant women at the PHC Kebon Jeruk. A well-planned and structured Communication, Information and Education (IEC) is needed to improve the nutrient intake quality and increase the adherence in IFA tablet consumption among pregnant women at the PHC Kebon Jeruk.

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