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Determinants of Anemia in Pregnant Women in Semarang City in 2023

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Abstract

Anemia during pregnancy can lead to serious complications, such as bleeding and premature birth. The prevalence of anemia in Semarang in 2022 reached 15.4%, exceeding the WHO target. This study aims to analyze factors influencing the occurrence of anemia among pregnant women in Semarang in 2023. The study was conducted at five public health centers in Semarang with 183 pregnant women, consisting of 61 with anemia and 122 without anemia. Data were collected from January to July 2024, with analysis using Chi-Square and logistic regression tests. Significant factors associated with anemia included age (p=0.006), employment status (p=0.005), gravidity (p=0.047), ANC history (p=0.036), compliance with iron supplementation (p=0.003), tea/coffee consumption habits (p=0.024), iron intake from food (p=0.033), nutritional status (KEK) (p=0.041), and knowledge about anemia (p=0.009). Multivariate analysis showed that age (OR=3.09), employment status (OR=0.395), and KEK status (OR=2.99) were higher risks for anemia. Age, employment status, and nutritional status (KEK) are significant factors affecting anemia in pregnant women in Semarang, highlighting the importance of nutritional interventions and health education for pregnant women.

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INTRODUCTION

Anemia during pregnancy is a common health issue that can pose significant risks to both the mother and the fetus. This condition is a leading cause of complications and maternal deaths, particularly in low- and middle-income countries. According to the World Health Organization (WHO), approximately 38% of pregnant women worldwide experience anemia, with the highest prevalence found in areas with limited access to adequate nutrition and healthcare (WHO, 2017). The prevalence of anemia among pregnant women in Indonesia has continued to rise, from 37% in 2013 to 48.9% in 2018 (Ministry of Health of the Republic of Indonesia, 2019)

Anemia during pregnancy, characterized by low levels of hemoglobin or red blood cells, can lead to various complications, including premature birth, low birth weight (LBW), and maternal or fetal death. Iron deficiency is the most common cause of anemia. Deficiencies in folic acid or vitamin B12, parasitic infections, and chronic diseases can also contribute to the occurrence of pregnancy-related anemia (Sari et al., 2021).

The prevalence of anemia among pregnant women can be influenced by various factors, including socio-economic status, nutritional intake, cultural practices, and access to healthcare. For instance, younger women (under 20 years) or older women (over 35 years) may be more vulnerable due to higher nutritional needs and less optimal nutrient absorption. Employment status, income, education level, and dietary habits also play an important role in determining the nutritional status of pregnant women (Afriyanti, 2020; Hailu et al., 2019). In addition, education about anemia to increase pregnant women's knowledge about the condition and the quality of prenatal care services can affect the likelihood of adherence to iron supplementation and maintaining a balanced diet.

The prevalence of anemia among pregnant women in Semarang exceeds the target prevalence of 15.4% set by WHO. This has become a serious public health issue in Semarang. This study aims to explore the factors associated with anemia among pregnant women in Semarang by identifying sociodemographic characteristics, nutritional status, and other health factors that may contribute to the risk of anemia. This research is expected to provide insights for more targeted public health interventions to reduce the prevalence of anemia among pregnant women and improve maternal and fetal health outcomes in the region.

METHOD

This case-control study involves 61 pregnant women with anemia (cases) and 122 pregnant women without anemia (controls). Data were collected through structured interviews and nutritional status assessments using maternal weight indicators. The dependent variable is anemia, defined as a hemoglobin level of <11 g/dL recorded in the Puskesmas. The independent factors analyzed include maternal age (at risk if <20 or >35 years), employment status (working or not), education level (low or high), family income (poor or not), family size (large or small), gravidity (at risk for multigravida and grandemultigravida), parity (at risk for multipara and grandemultipara), birth interval (too close or not), gestational age (at risk in the second and third trimesters), ANC history (compliant or non-compliant with Ministry of Health standards), adherence to iron supplementation (compliant or non-compliant), tea or coffee consumption habits (yes or no), iron intake (deficient or normal), nutritional status (malnourished or not), and maternal knowledge about anemia (poor or good). Data were collected through questionnaires, interviews, and medical records at the Puskesmas. Univariate and multivariate analyses were performed using chi-square tests and logistic regression.

RESULTS AND DISCUSSIONS

Based on table 1, most of the study samples were in the age category of 20-35 years (70.5%), had a high school education and above (85.8%), had a family income <UMK (73.2%), number of family members <5 people (76.5%), included in the primipara category (77.6%), and pregnant women at a gestational age of >20

Table 1. Univariate Analysis Result

Variables	Case		Control		Amount	
	N	%	N	%	N	%
Age of Pregnant Mother						
At risk	26	42.62	28	22.95	54	29.5
No Risk	35	57.38	94	77.05	129	70.5
Working Status of Pregnant Women						
Work	21	34.43	69	56.56	90	49.1
Doesn't work	40	65.57	53	43.44	93	50.9
Pregnant Women Education						
Low	10	16.39	16	15.09	26	14.2
Tall	51	73.61	106	74.91	157	85.8
Pregnant Mother's Family Income						
< UMK	42	68.85	92	75.41	134	73.2
≥UMK	19	31.15	30	24.59	49	26.8
Number of Family Members of Pregnant Mother						
Lots	15	24.59	28	22.95	43	23.49
Not many	46	75.41	94	77.05	140	76.51
Gravidity of Pregnant Women						
Multigravida	35	57.37	51	41.80	86	46.99
Primigravida	26	42.63	71	88.20	97	53.01
Parity of Pregnant Women						
Multipara	15	24.59	26	21.31	41	22.4
Primipara	46	75.41	96	78.69	142	77.6
Pregnant Women's Delivery Distance						
At risk	21	34.43	32	26.23	53	28.9
No Risk	40	65.57	90	73.77	130	71.1
Pregnant Mother's Gestational Age						
≤ 20 Weeks	6	9.84	11	9.02	17	9.2
> 20 Weeks	55	90.16	111	90.98	166	90.8
Pregnant Women's ANC History						
Not Up to Standard	23	37.70	28	22.95	51	27.8
According to Standard	38	62.30	94	77.05	132	72.2
Compliance with Pregnant Women's TTD Consumption						
Not obey	29	47.54	31	25.40	60	32.78
Obedient	32	52.46	91	74.60	123	67.22
Tea/Coffee Consumption Habits of Pregnant Women						
Yes	26	42.62	29	23.77	55	30.05
No	35	57.38	93	76.33	128	69.95
Iron Intake from Pregnant Women's Food						
Deficit (<70%)	53	86.89	89	72.95	142	77.5
Normal (≥70%)	8	13.11	33	27.05	41	22.5
Nutritional Status (KEK) of Pregnant Women						
KEK	16	26.23	17	13.93	33	18.0
No KEK	45	73.77	105	86.07	150	82.0
Level of Knowledge of Pregnant Women About Anemia						
Less (≤50%)	26	42.62	29	23.77	55	30.05
Good (>50%)	35	57.38	93	76.23	128	69.95

weeks (90.8%). In the variable of employment status of pregnant women, most of the case samples (65.57%) were unemployed, in contrast to the control sample which was more balanced

between working and unemployed pregnant women. While in the gravidity variable, most of the control samples were in the primigravida category (88.20%), in contrast to the case sample which had a more balanced percentage between the multigravida and primigravida categories. In the variable of delivery interval, the case sample had a larger percentage (34.43%) in the risky delivery interval category, compared to the control sample (26.32%). In the variable of ANC history of pregnant women, the percentage of ANC history that did not meet the standard was

Table 2. Bivariate Analysis Results

Variables	OR (95% CI)	p-value
Age of Pregnant Mother		
At risk	2.49 (1.28 - 4.82)	0.006
No Risk		
Pregnant Women's Employment Status		
Work	0.43 (0.21 – 0.76)	0.005
Doesn't work		
Pregnant Women Education		
Low	1.29 (0.55 – 3.06)	0.549
Tall		
Pregnant Mother's Family Income		
< UMK	0.72 (0.36 – 1.42)	0.345
≥UMK		
Number of Family Members of Pregnant Mother		
Lots	1.09 (0.53 – 2.24)	0.805
Not many		
Gravidity of Pregnant Women		
Multigravida	1.87 (1.00 – 3.49)	0.047
Primigravida		
Parity of Pregnant Women		
Multipara	1.20 (0.58 - 2.48)	0.616
Primipara		
Pregnant Women's Delivery Distance		
At risk	1.47 (0.76 - 2.87)	0.249
No Risk		
Pregnant Mother's Gestational Age		
≤ 20 Weeks	1.10 (0.38 - 3.13)	0.857
> 20 Weeks		
Pregnant Women's ANC History		
Not Up to Standard	2.03 (1.04 - 3.96)	0.036
According to Standard		
Compliance with Pregnant Women's TTD Consumption		
Not obey	2.66 (1.39 - 5.08)	0.003
Obedient		
Tea/Coffee Consumption Habits of Pregnant Women		
Yes	2.38 (1.23 – 4.59)	0.024
No		
Iron Intake from Pregnant Women's Food		
Deficit (<70%)	2.45 (1.05 - 5.71)	0.033
Normal (≥70%)		
Nutritional Status (KEK) of Pregnant Women		
KEK	2.19 (1.02 - 4.72)	0.041
No KEK		
Level of Knowledge of Pregnant Women About Anemia		
Less (≤50%)	2.38 (1.23 - 4.59)	0.009
Good (>50%)		

greater in the case sample (37.70%) compared to the control sample (22.95%). In the variable of compliance with TTD consumption in pregnant women, respondents who were not compliant were found more in the case sample (47.54%) compared to the control sample (25.40%). In the variable of tea and/or coffee consumption habits in pregnant women, the case sample had a higher percentage (42.62%) compared to the control sample (23.77%). In the variable of iron consumption in pregnant women, the case sample had a higher percentage of deficit iron consumption (86.89%) compared to the control sample (72.95%). In the nutritional status (KEK) of pregnant women, the percentage of KEK was found more in the case sample (26.23%) compared to the control sample (13.93%). In the variable of knowledge of pregnant women about anemia, the case sample had a higher percentage of respondents with less knowledge (≤50%) compared to the control sample. The percentage of respondents with less knowledge in the case sample was 42.62% and the control sample was 23.77%.

In table 2, it can be seen that there are 9 variables that are statistically related to cases of anemia in pregnancy. The nine variables are; 1) age of pregnant women (p-value 0.006); 2) employment status of pregnant women (p-value 0.005); 3) gravidity of pregnant women (p-value 0.047); 4) history of ANC of pregnant women (p-value 0.036); 5) compliance of TTD consumption of pregnant women (p-value 0.003); 6) habits of tea/coffee consumption of pregnant women (p-value 0.024); 7) iron intake from food of pregnant women (p-value 0.033); 8) nutritional status (KEK) of pregnant women (p-value 0.041), and; 9) level of knowledge of pregnant women about anemia (p-value 0.01). While the other 6 variables are not statistically related because they have p-values > 0.05. The six variables are; 1) education of pregnant women (p-value 0.549); 2) income of pregnant women's families (p-value 0.345); 3) number of family members of pregnant women (p-value 0.805); 4) parity of pregnant women (p-value 0.616); 5) spacing of pregnant women's deliveries (p-value 0.857), and 6) gestational age of pregnant women (p-value 0.857).

Based on table 3, it can be seen that after multivariate analysis, there are three main variables related to the incidence of anemia in pregnancy, namely; 1) age of pregnant women (p-value 0.003); 2) employment status of pregnant women (p-value 0.011), and; 3) nutritional status (KEK) of pregnant women (p-value 0.016). While the other six variables are not significantly related to the incidence of anemia in pregnancy.

Table 3. Multivariate Analysis Results

Variables	*p-value*	AOR (95% CI)
Age of Pregnant Mother	0.003	3.09 (1.45 – 6.58)
Working Status of Pregnant Women	0.011	0.395 (0.19 – 0.81)
Gravidity of Pregnant Women	0.084	1.85 (0.92 – 3.71)
Pregnant Women's ANC History	0.277	1.74 (0.63 – 4.77)
Compliance with Pregnant Women's TTD Consumption	0.253	3.16 (0.43 – 22.87)
Pregnant Women's Tea/Coffee Consumption Habits	0.922	1.07 (0.26 – 4.27)
Iron Intake from Pregnant Women's Food	0.059	2.51 (0.96 – 6.53)
Nutritional Status (KEK) of Pregnant Women	0.016	2.99 (1.23 – 7.27)
Pregnant Women's Knowledge about Anemia	0.645	0.55 (0.46 – 6.72)

Pregnant women under 20 years or over 35 years are at a higher risk of anemia. At younger ages, the mother's body is still developing, so the demand for iron is shared between her own growth and the fetus, potentially leading to iron deficiency. Meanwhile, at older ages, decreased metabolic functions and possible comorbidities like hypertension or diabetes may affect iron absorption and metabolism. Additionally, pregnancies at these ages carry a higher risk of complications that may worsen nutritional

status. Pregnant women under 20 years old or over 35 years old are three times more likely to suffer from anemia compared to those aged 20-35. This finding is consistent with previous studies which suggest that younger women require more nutritional intake to support their own growth and the development of the fetus, while older women are at a higher risk of impaired immune function (Sari et al., 2022; Ernawati et al., 2018).

Working pregnant women may experience greater physical fatigue and stress, which can negatively impact dietary intake and adherence to health maintenance, including iron supplement consumption. Limited time and access to healthcare services can also lead to irregular antenatal visits. Conversely, unemployed mothers may have more time to maintain proper nutrition and monitor their health conditions more closely. Pregnant women who are employed have a 2.5 times lower risk of anemia compared to those who are not employed. This finding aligns with research by Aulia et al. (2022), which demonstrated a significant relationship between employment status and anemia during pregnancy. It is also supported by Ernawati's (2018) study, which states that employed pregnant women tend to have better knowledge and purchasing power regarding pregnancy-related needs.

High gravidity, particularly in multigravida and grand multigravida women, is associated with reduced iron reserves. Repeated pregnancies increase nutritional demands, especially for iron, calcium, and protein. Without adequate spacing between pregnancies and proper nutritional recovery, the mother's body may not replenish its nutrient stores, raising the risk of anemia. Non-standard ANC—in terms of frequency and quality—can result in undetected anemia during pregnancy. Regular ANC allows healthcare workers to monitor nutritional status, provide education, and distribute iron supplements. Mothers who do not attend ANC regularly miss out on these vital interventions, increasing their risk of anemia. Adherence to iron and folic acid (IFA) tablet consumption plays a crucial role in preventing anemia. These supplements meet the increased iron demands during pregnancy, especially in the second and third trimesters. Non-compliance often results from side effects (e.g., nausea, constipation), lack of understanding, or limited tablet availability, all contributing to a higher risk of anemia.

Excessive tea or coffee intake, especially with meals, inhibits the absorption of non-heme iron from food. Tannins in tea and caffeine in coffee bind with iron in the digestive tract, reducing its absorption. This is particularly problematic for women with already limited dietary iron intake or those who do not take supplements. Low dietary iron intake increases the risk of anemia. Iron from animal sources (heme iron) is more readily absorbed than from plant sources (non-heme iron), which requires vitamin C to aid absorption. Limited intake of red meat, liver, or green vegetables and a monotonous diet are key contributors to insufficient iron intake among pregnant women. Chronic Energy Deficiency (CED) reflects long-term deficiencies in macro- and micronutrients, including iron. Pregnant women with CED lack sufficient nutrient stores to support fetal growth and increased maternal blood volume. Moreover, CED weakens the immune system, indirectly affecting the body's ability to absorb and utilize iron efficiently. A mother's knowledge significantly influences health behaviors, such as IFA compliance, dietary choices, and ANC visits. Women with good knowledge of anemia are more likely to adopt preventive practices and maintain a healthy lifestyle during pregnancy. On the other hand, poor knowledge results in a lack of awareness about anemia risks, low compliance with IFA intake, and neglect of dietary needs.

Pregnant women with chronic energy deficiency (KEK) are three times more likely to suffer from anemia compared to those with normal nutritional status. This finding is consistent with the research by Amarasinghe (2022), which shows that the consumption of milk and dairy products is related to nutritional status and anemia during pregnancy. KEK, caused by malnutrition, can reduce the body's iron stores, thus increasing the risk of anemia (Harna et al., 2022; Kabthymer & Birhane, 2020a).

Other factors, such as education and family income, were not significantly associated

with anemia. While education and knowledge may enhance understanding of the importance of nutrition, other factors such as eating habits and broader socio-economic support may have a stronger influence in reducing the risk of anemia.

CONCLUSION

This study aims to provide a comprehensive understanding of the factors associated with anemia in pregnant women in Semarang City, Indonesia, by examining a combination of socio-demographic, behavioral, nutritional, and health-related factors. Anemia during pregnancy remains a significant public health concern, and identifying modifiable risk factors is crucial for developing effective interventions.

The findings of this study are expected to reveal the extent to which various socio-demographic factors (e.g., age, education, and income), behavioral factors (e.g., iron supplementation adherence and dietary habits), and health-related factors (e.g., pre-existing conditions and nutritional deficiencies) contribute to the prevalence of anemia in pregnant women.

This research will also provide insights into the barriers to adequate iron intake and supplementation, as well as potential gaps in maternal health education and healthcare access.

By understanding the multifaceted causes of anemia in pregnancy, this study will contribute valuable data to the local healthcare system and inform public health strategies aimed at reducing anemia prevalence. Such strategies may include improving access to iron supplements, promoting dietary diversity, and enhancing maternal health education to raise awareness about the importance of iron-rich foods and adherence to supplementation guidelines.

Ultimately, the results of this study could serve as a foundation for targeted interventions, aimed not only at reducing anemia rates but also at improving overall maternal and child health outcomes in Semarang City and beyond. Continued research in this area is essential to further refine prevention and treatment strategies, and to ensure that pregnant women receive the necessary care to maintain optimal health throughout their pregnancies.

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