Journal of Midwifery and Nursing, 7 (2) (2025) pp. 293-300

Published by: IOCSCIENCE

Journal of Midwifery and Nursing

Journal homepage: www.iocscience.org/ejournal/index.php/JMN

Determinants of anemia in pregnant women: Nutrition status, birth interval, parity

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ARTICLE INFO

Article history:

Received Mar 9, 2025
Revised Mar 12, 2025
Accepted May 27, 2025

Keywords:

Anemia;
Birth Interval;
Haemoglobin;
Nutrition Status;
Parity.

ABSTRACT

Anemia in pregnancy is a serious health problem that can adversely affect both mother and fetus. The prevalence of anemia among pregnant women in Indonesia increased from 37.1% in 2013 to 48.9% in 2018, well above the national target of 28%. Factors such as nutritional status, birth spacing, and parity are known to contribute to the incidence of anemia. This study aims to analyze the effect of nutritional status, birth spacing, and parity on anemia in pregnant women based on a literature review. The method used was literature review from electronic sources such as Google Scholar, PubMed, BioMed Central (BMC), and SINTA with inclusion criteria of articles published between 2019-2024. The results showed that poor nutritional status increased the risk of anemia up to 6 times, pregnancy spacing <2 years related to decreased hemoglobin levels, and high parity increased the risk of anemia due to lack of iron recovery. In conclusion, nutritional status, pregnancy spacing, and parity affect the incidence of anemia in pregnant women.

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1. Introduction

When hemoglobin (Hb) levels in the first and third trimesters are below 11 g/dL or less than 10.5 g/dL in the second trimester, it is considered anemia during pregnancy (Prawirohardjo, 2020). The condition can have serious repercussions, both for the mother and the unborn child.

Based on the Indonesian Central Bureau of Statistics (2021), revealed that the prevalence of anemia in pregnancy increased from 37.1% in 2013 to 48.9% in 2018, suggesting that the objective of 28% has not been met. This statistic demonstrates that attempts to enhance mother and child health continue to face significant obstacles due to anemia in pregnant women.

According to research by Harna et al (2020), showed that Anemia is more common in the third trimester of pregnancy. This is related to physiological changes during pregnancy, where blood and plasma volume increases by 30-40%, especially in the 32nd to 34th week. This increase in volume results in hemodilution which decreases hemoglobin levels. Factors affecting anemia in pregnant women are gestational age, SEZ status, and parity.

Anemia can result from inadequate nutrition, which can negatively affect the fetus's growth and development. The mother's nutritional state is crucial for this process. In line with research conducted by Harna et al. (2020), claimed that compared to mothers with good nutritional condition, pregnant women with SEVERITY are three times more likely to develop anemia.

Preventing anemia in pregnant women involves maintaining the parity (number of births) that a mother experiences. Because the mother's body hasn't had enough time to replenish iron and energy stores following the prior pregnancy, high parity—especially more than three births—can raise the risk of anemia (kemenkes RI, 2024). This is in line with the results of research by Ririn Riyani et al (2020), This demonstrates how parity and the prevalence of anemia in expectant mothers are related.

An ideal pregnancy is a pregnancy that is planned, desired, and maintained for good development, one of which is by maintaining pregnancy spacing. According to the results of Windi Restuti's research (2020), Pregnancy spacing is one of the factors of high risk pregnancy, the ideal pregnancy spacing is more than 2 years, if less than 2 years then the pregnancy should be postponed until the child is 2 years old.

The Strategic Plan of the Ministry of Health 2015-2019 states that one of the factors that can cause unhealthy conditions for pregnant women is "too close a distance of 2 years". Pregnancies that are too close together can increase the risk of anemia in pregnant women because the body has not fully recovered and replenished the iron reserves lost during the previous pregnancy and childbirth (Kemenkes RI, 2015). In line with the results of Gusnidarsih Vevi's research (2020) showed that there is a relationship between the distance of pregnancy and the incidence of anemia during pregnancy.

Given this context, the researcher is eager to investigate the "Determinants of Anemia in Pregnant Women," as determining the causes of anemia in pregnant women is crucial. It is anticipated that the findings of this study will support initiatives to prevent and treat anemia in expectant mothers and serve as the foundation for creating more potent intervention plans.

2. Methods

This study uses a literature review method with a systematic review approach to identify, evaluate, and interpret the results of research related to factors that cause anemia in pregnant women. The literature search was conducted systematically in several electronic databases, namely Google Scholar, PubMed, BioMed Central (BMC), and SINTA (Science and Technology Index), and official websites such as the Ministry of Health, WHO that have been updated.

The search strategy used a combination of Indonesian and English keywords. Indonesian keywords included "Anemia in pregnant women", "risk factors for pregnancy anemia", "causes of pregnancy anemia", "determinants of maternal anemia", and "Anemia in pregnancy". Meanwhile, English keywords include "Anemia in pregnancy", "maternal Anemia risk factors", "causes of Anemia during pregnancy", "maternal Anemia determinants", and "pregnancy Anemia factors".

In determining the eligibility of articles, several inclusion and exclusion criteria were set. Inclusion criteria included articles published within 2019-2014, available in Indonesian or English, and were original research articles, systematic reviews, or meta-analyses. Articles used must be available in full text format and published in reputable national or international journals. Selected articles must discuss at least one factor causing anemia in pregnant women and use a cross-sectional, case-control, or cohort research design. While the exclusion criteria include articles published before 2019, articles that cannot be accessed in full text, articles in abstract only.

3. Results and Discussion

Table 1.
Selected Articles

No	Author/year	Journal/ Level/ Design	Sample	Results
1.	Diah Mutiara Sari/ 2019	Jurnal Kesehatan Tadulako/ Sinta 4/ cross sectional	Population data of all pregnant women who visited the Tinggede Health Center in the period January 1 - December 31, 2017 amounted to 151 people.	There is a relationship between nutritional status and the incidence of anemia. This is shown p-value is smaller than alpha (0.012<0.05). Oddratio is 6.500 with 95% CI at 1.316-32.097. This shows that nutritional status is a risk

No	Author/year	Journal/ Level/ Design	Sample	Results
			Based on the above calculation of the sample size with the slovin formula, the sample size was 61 people according to the inclusion and exclusion criteria.	factor, where good nutritional status will tend to risk not having anemia as much as 6,500 times compared to poor nutritional status.
2.	Risma Putri Utama / 2021	jurnal ilmiah kesehatan sandi husada / sinta 5/ cross sectional.	sample size of 78 people with non-random sampling technique.	Shows that out of 78 respondents 28 people (35.9%) with good nutritional status 17 people (60.7%) experienced anemia 11 people (39.3%) did not experience anemia. while 50 people (64.1%) with poor nutritional status 47 people (94.0%) experienced anemia, and 3 people (6.0%) did not experience anemia. After conducting a chi-square statistical test, the value of P = 0.000 was obtained, the value of x^2 calculated (13.503) this means that there is a relationship between poor nutritional status in pregnant women with the incidence of anemia in pregnant women.
3.	Sobhna Pradhan et all/ 2023	Journal of Family Medicine and Primary Care/ A descriptive cross-sectional study	Anemia was classified using the criteria set out by the Indian Council of Medical Research (ICMR), and data was collected from 52 pregnant women using a self-structured questionnaire..	From October 11, 2022, to November 11, 2022, a total of 52 pregnant women who were admitted to the hospital were chosen to be a part of the study. Here is a breakdown of the rates of anemia among pregnant women treated at PBM hospital: In this study, 33% had mild symptoms, 7% moderate, and 4% severe. Based on the results of this study, the leading causes of anemia in pregnant women were hepatitis O infection (21%), chronic malaria (15%), hookworm (27%), and the time between pregnancies (42%).
4.	Aguscik/ 2019	jurnal kesehatan poltekkes palembang/ Sinta 4/ penelitian cross sectional	The research subjects were pregnant women who are in malaria endemic areas	The results showed that the nutritional status (LILA) of pregnant women averaged 21.54 ± 0.884. (at risk), 60% of pregnant women suffer from SEZ and those who are not at risk of SEZ 40% where the pvalue is 0.003.
5.	Vevi Gusnidarsih / 2020	Jurnal Kebidanan / Sinta 3/ cross sectional	All 58 participants were pregnant women who participated in the study between February and March of 2019. This study used a complete sampling technique to generate its sample.	The findings indicated that the occurrence of clinical anemia during pregnancy was associated with both age (ρ-value: 0.002) and gestational age (ρ-value: 0.003).
6.	Amrina	Jurnal	Based on the calculation	The findings revealed that 26% of

No	Author/year	Journal/ Level/ Design	Sample	Results
	Octaviana/ 2021	kebidanan malahayati/ sinta 4/ Crossectional.	of the minimum sample of 100 respondents, with sample inclusion criteria, namely Pregnant women who meet the sampling criteria, Aged 20 - 45 years old, pregnant women who are willing to be a respondent	pregnant women suffered from anemia, Elements Within Anemia in pregnant women is most strongly correlated with maternal parity (p=0.017), maternal age (p=0.017), and birth spacing (p=0.000), all of which are internal variables. When looking at the correlation between anemia in pregnant women and external causes, no significant association was found.
7.	Ramla Hussein Ahmed et all/ 2021	BMC Pregnancy and Childbirth/ cross-sectional study	This includes 383 homes in the most densely populated areas of Mogadishu. Women in these households who were pregnant and willing to be studied were	The study found that 44.4% of the individuals had anemia (95%CI: 39.5-49.3%), with 11.8 and 47.0% of those people suffering from severe and moderate anemia, respectively. Furthermore, microcytic hypochromic anemia was the underlying cause of every episode of anemia. Pregnancy complications include: a young mother's age, a low family income, a low or nonexistent parity, the third or second trimester, not attending prenatal appointments, not taking iron supplements, and drinking tea right after meals..
8.	Ari weiss et all/ 2021	European Journal of Obstetrics & Gynecology and Reproductive Biology/ A retrospective computerized database study	Each woman who gave birth for the first time at one tertiary care facility throughout the past 20 years (1999-2019). The results for both the mother and the baby were compared in three groups: those with repeated short IPI (<6 months between the first and second pregnancy and the second and third pregnancy), those with repeated optimal IPI (18-48 months), and those with a single short IPI (<6 months between the first and second pregnancy followed by optimal IPI of 18-48 months between the second and third pregnancy). If the repeated short IPI group wanted to find the sweet spot for adjusting to background variables,	Among the 10,569 women who gave birth in three consecutive visits to our clinic during the research period, 338 (3.2% of the total) experienced recurrent short IPI and 1,021 (9.7% of the total) had recurrent optimum IPI. The study found that compared to women who had repeated optimal IPI, those who had recurrent short IPI increased the likelihood of maternal anemia (Hb < 10gr%) at labor admission (aOR 3.4 [95% CI 1.09-10.65], p = 0.04) and the likelihood of babies being small for their gestational age (aOR 10.4 [95% CI 2.32-46.93], p < 0.01). Additionally, these women had a significantly higher rate of low neonatal birth weight (2500 gr) and Anemia (Hb < 10gr%), as well as a lower rate of operative vaginal delivery compared to women who had a single baby short IPI followed by optimal IPI. The rate of caesarean section and anemia in labor (Hb < 10gr%) at admission was considerably greater

No	Author/year	Journal/ Level/ Design	Sample	Results
			they compared the results of the second and third pregnancies.	in the third delivery of the repeat short IPI group compared to the second delivery. Maternal anemia and small-for-gestational-age newborns are connected with repeated brief intravenous hemodialysis (IPI).
9.	Nishal Sharma et all/ 2024	Cureus/ cross-sectional study	The study was conducted on July 11, 2022, with 430 pregnant women in their second and third trimesters who visited the antenatal clinics of Vardhman Mahavir Medical College and Safdarjang Hospital in New Delhi, India, between January 2023 and September 2023.	26.2 years, 2 years, and 22.4 kg/m 2 were the mean age, median parity, and mean body mass index, respectively. 30% of the patients belonged to a lower socioeconomic group. In 250 women (48.84%), anemia was found to be mild in 25.81%, moderate in 15–8%, and severe in 7.04%. Vegetarians made up 49.3% of the patients. Patients with anemia had lower average dietary calories, protein intake, and iron intake.
10	Lia Novianti / 2022	jurnal Ilmiah Universitas Batanghari Jambi / Sinta 4/ cross sectional	With a sample size of 65 respondents, the sampling method employs systematic random sampling.	However, there is a correlation between parity and the incidence of anemia (p value 0.004 and odd ratio 5,200), pregnancy distance and the incidence of anemia (p value 0.007 and odd ratio 11,250), and age and the incidence of anemia (p value 0.052 and odd ratio 3,267).
11	Rifatolistia Tampubolon / 2021	Jurnal Sains dan Kesehatan / Sinta 3/ Cross Sectional	The study's participants comprised 348 pregnant women from the Amahai District region (Amahai Village, Rutah, Soahuku, Yainuelo) of Central Maluku Regency. The sampling technique in this study used Purposive Sampling technique, the criteria were pregnant women of Trimester II and Trimester III gestational age with Anemia in the Amahai District area.	Numerous factors influenced the study's findings, including the fact that 81% of pregnant women were between the ages of 20 and 35, 71% had a high school diploma, and 84% were housewives. Eighty-one percent of pregnant women know enough. Seventy-four percent of pregnant women taking Fe pills did not comply. Sociocultural beliefs or dietary limitations (68%), as well as anemia prevention and treatment (90%). Pregnancy history category of gestational age trimester II (77%), trimester III (23%), Hb levels less (100%), parity status Primigravida (48%), pregnancy complications (13%).
12	Ririn riyani dkk/ 2020	Binawan Student Journal/ Sinta 5/ cross sectional	Chi Square non-parametric correlation test for categorical data, on 50 respondents..	The majority of pregnant women were in the non-risk age category of 20.0%, in the risky parity category of 58.0%, and in the non-anemia category of 62.0%. Researchers found that the risk of anemia in pregnant women increased with increasing parity and maternal age.
13	Chaterine smith	OBSTETRICS &	every pregnant woman	Anemia affected 65,906 (12.8%) of

No	Author/year	Journal/ Level/ Design	Sample	Results
	et all/ 2019	GYNECOLOGY/ e cohort study	in British Columbia who gave birth by natural means (live or stillborn) after the twentieth week of her pregnancy from 2004 to 2016. Two criteria were used to diagnose anemia in women: a hemoglobin value during the third trimester or a diagnostic of admission anemia, which was made before birth.	the 515,270 females surveyed; 11.8% had moderate anemia, 0.43% had severe anemia, and 0.02% had no severity rating at all; and 0.58% had no severity rating at all. Preeclampsia, pla centa previa, and cesarean sections were more common in anemic women, and they stayed in the hospital longer and were admitted more frequently during their pregnancies.
14	Fernanda Scherer dkk/ 2020	REVISTA DE SALUD PÚBLICA/ cross-sectional	No discrimination was made based on maternal age or gestational age; all pregnant women who sought prenatal care in 2012 were invited to take part. Of the 255 pregnant women who were assessed, none were not receiving ongoing prenatal care.	The results showed that 43.2% of the pregnant women (n=110) were overweight when they started the pregnancy, whereas 4.3% (n=11) were underweight. While pregnant, 51% of women (n=130) acquired more weight than what is considered healthy. Women with a pregestational BMI of 25 kg/m² or above had a substantially older mean age compared to those with a BMI of 25 kg/m² or below (p<0.001).
15	Desi mailan sari/ 2022	Malahayati Nursing Journal/ sinta 4/ cross sectional	Using the purposive sampling technique, 273 patients were chosen for the sample.	As many as 253 moms (92.7% of the total) were not at danger due to parity, 225 mothers (82.4%) were in the 20-35 age bracket, and 55 mothers (20.1% of the total) had anemia. A p value of 0.012 and an odds ratio (OR) of 2.38 (CI: 1.19-4.76) indicate a correlation between age and the occurrence of anemia. With an OR of 2.92 (CI: 1.13-7.54) and a p-value of 0.037, there is a correlation between parity and the occurrence of anemia.

Anemia

Anemia is a condition characterized by lower than normal hemoglobin (Hb) levels in the blood (Kemenkes RI, 2023). Anemia is often experienced by women due to a lack of intake or consumption of iron-containing foods, incorrect dietary arrangements, menstrual disorders / abnormal menstruation, and other diseases (such as helminthiasis, malaria, and others). Especially in pregnant women, it is said to be anemia if Hb levels in Trimester 1 and 3 < 11g/dl, or in Trimester 2 < 10.5 g/dl (Kemenkes RI, 2022).

Data from the Indonesian Central Bureau of Statistics (Badan Pusat Statistik, 2021) rises from 37.1% in 2013 to 48.9% in 2018, indicating an increase in the frequency of anemia among pregnant women. The high prevalence of anemia during pregnancy reflects a serious challenge in maternal health in Indonesia.

The condition of Anemia in pregnant women if not resolved will have various impacts including the risk of bleeding complications that increase the risk of maternal mortality, decreased immune function so that it is easily infected. While the impact on the fetus is inhibiting fetal growth, namely

babies born prematurely, low birth weight (LBW, risk of illness and Anemia in infants which can cause death,) and low birth length (Stunting), the risk of stunting in infants and children less than 2 years of age (1000 HPK) and in the long term has an impact on reducing intelligence and increasing the risk of non-communicable diseases (hypertension, diabetes, heart disease, and stroke) which will have an impact on 3 generations from mother to grandchildren (Kemenkes RI, 2023).

Anemia is a related pregnancy symptom that develops as a woman's blood undergoes hemodelution, also known as tightening, due to a volume increase of 30–40% that reaches its peak between weeks 32 and 34. Symptoms of anemia in pregnant women typically include weakness, pale skin, extreme exhaustion, and cloudy vision. There are a minimum of two blood tests performed during pregnancy, one in the first trimester and again in the third (Reni Yuli Astutik, 2018). Iron, folic acid, vitamin B12, and protein deficiencies all have a role in preventing the body from making enough hemoglobin, which is why anemia is a common symptom among pregnant women. In pregnant women, there is an enlargement of various organs such as breasts, uterus, and placenta formation as well as an increase in the amount of blood. The growing fetus also increases the need for nutrients, if not fulfilled, pregnant women will be at risk of developing anemia, or if they already had anemia before pregnancy, it will worsen their anemia condition (Kemenkes RI, 2023).

Nutritional Status

Pregnant mothers need to eat well so that their babies can grow quickly and easily. Pregnant women who have chronic malnutrition, also known as Chronic Energy Deficiency (CED), are afflicted with a long-term imbalance in their protein and energy intake.

The ideal nutritional status for pregnant women is 18.5 - 24.9 (normal), LiLA> 23.5 cm, if BMI is less than 18.5 cm and LiLA < 23.5 (SEZ) then postpone pregnancy, and immediately refer to the health facility, if BMI is more than 25.0 - 27.0 (mild excess weight, and more than 27.0 means severe excess weight / obesity then postpone pregnancy and immediately refer to the health facility (Kemenkes RI, 2021).

Pregnant women typically need an extra 180–300 kcal and 30 grammes of protein daily. Women with SEZ need to increase their daily caloric intake by 500 kcal, with less than 25% of that total coming from protein, in order to achieve a weight gain of half a kilogram every week.

Pregnant women with SEZ are more likely to have babies with low birth weight (LBW), have complications during delivery, have heavy bleeding, have a hard time recovering after giving birth because of their weakness and the ease with which they can get sick, have anemia in their newborns, be more likely to get infections, have an abortion, and stunt the development of their brains (kemenkes RI, 2024). This is in line with Diah Mutiara Sari's research (2019) which shows that there is a relationship between nutritional status and the incidence of anemia. This is indicated by a p-value smaller than alpha (0.012<0.05). Oddratio is 6,500 with 95% CI at 1,316-32,097, meaning that pregnant women with poor nutritional status have 6 times more risk of developing anemia compared to pregnant women whose nutritional status is normal.

Several reasons contribute to pregnant women experiencing chronic energy insufficiency, one of which being the family's income, mother's education, mother's age, food consumption patterns, parity (kemenkes, 2024), this is in line with the results of Fitrianingtyas' research (2018) The association between the frequency of SEZ in pregnant women and their understanding of nutrition, infectious illnesses, pregnancy, and ANC exams is significant.

Handling SEZ in pregnant women can be done by providing knowledge such as through audio-visual media and booklets that aim to provide knowledge of pregnant women about nutrition in preventing SEZ so that mothers get better knowledge, there are several benefits contained in learning media, namely making it easier for someone to remember visual media has a relationship between visualization of images and thoughts, the use of images can also make someone more focused, because images can focus attention. Therefore, audiovisual media and booklets are very influential on the knowledge of pregnant women about nutrition (Suryani et al., 2022).

Birth Distance

An ideal pregnancy is one that is planned, desired, and maintained for good development, one of which is by maintaining pregnancy spacing. According to the results of Windi Restuti's research (Restuti et al., 2020) One of the factors that increases the likelihood of a risky pregnancy is the distance between the parents. Ideally, the distance should be more than two years, but if it's less than that, the pregnancy should be delayed until the child is at least two years old.

According to the Ministry of Health (2019) The indirect causes of high-risk pregnancies are called the 4Ts, which are too young (giving birth under the age of 20), too old (giving birth over the age of 35), too close (giving birth too close together), and too many (giving birth too often). According to Rahman Nurwan Nugraha's research (2019) which states that the number of parities is not related to the incidence of SEZ in pregnant women with a value of p = 0.968, while the distance of pregnancy is related to the incidence of SEZ in pregnant women with a value of p = 0.000. One of the complications of high-risk pregnancy is anemia.

Parity

The term "parity" refers to the total number of children a mother has given birth to, counting both the first and last. There are three levels of parity: primipara, multipara, and grande multipara. A primipara is a first-time mother whose unborn child is at least 28 weeks gestational age. If a woman has given birth to the offspring of two or more pregnancies, each lasting at least 28 weeks, she is considered a multipara. Contrarily, a grande multipara is a woman who has given birth more than five times during her pregnancy, with each delivery occurring at a minimum gestational age of 28 weeks.

Maintaining the parity (number of births) experienced by a mother is an important factor in preventing anemia in pregnant women. High parity, especially more than three births, might heighten the likelihood of anemia due to the mother's body lacking the time to replenish iron and energy stores from prior pregnancies (kemenkes, 2024). Findings from studies conducted by Ririn Riyani et al. (2020), It demonstrates the correlation between parity and the prevalence of anemia in pregnant women.

4. Conclusion

Based on the literature review that has been made, it is found that poor Pregnant women are six times more likely to develop anemia depending on their dietary state compared to mothers with good nutritional status. Spacing pregnancies too close (<2 years) is associated with a significant decrease in hemoglobin levels, while high parity (≥3 children) enhances the likelihood of anemia as a result of insufficient replenishment of iron stores following prior pregnancies.

Health care providers are encouraged to take a more proactive role in educating pregnant women about the significance of parity in pregnancy planning, optimal spacing between pregnancies, and nutritional status maintenance. The following study of the research will likely go on to discuss other potential causes of anemia in pregnant women, including the extent to which the women take their blood supplement pills as prescribed and any dietary restrictions they may have..

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