



DETERMINANTS OF ANEMIA IN PREGNANCY: A SYSTEMATIC REVIEW

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Abstract: Anemia is characterized by a low concentration of hemoglobin in the blood. Anemia is a worldwide public health problem that affects people of all ages and has significant implications for human health, as well as social and economic development. Anemia is a common health problem among pregnant women in poor countries, with a higher prevalence than in developed countries. The impact of anemia on pregnant women causes babies to be born with low birth weight, as well as maternal and perinatal mortality and morbidity. Identifying the factors associated with anemia is very important in controlling and preventing anemia and its adverse effects. Therefore, the purpose of this study was to determine the risk factors for anemia in pregnant women. This research is a literature study that uses Google Scholar, ResearchGate, NCBI, PubMed, and Web of Science as search engines. From this literature study, the results of the analysis of risk factors for anemia in pregnant women are age, education level, place of residence, type of profession, parity, gestational age, antenatal care visits, intake of iron tablet supplementation and body mass index (BMI). Based on the study conducted, there is a strong relationship between age, education level, place of residence, type of profession, parity, gestational age, antenatal care visits, intake of iron tablet supplementation and body mass index (BMI).

Keywords: Anemia, Pregnant Women, Risk Factors, Social Demographic Factors.

1. INTRODUCTION

As referenced by World Health Organization (WHO), anemia is portrayed as hemoglobin (Hb) levels under 12.0 g/dL in ladies and under 13.0g/dL in men. Anemia is the situation where the red platelet number or their oxygen conveying limit is missing to resolve physiologic issues and is generally taken as a hemoglobin (Hb) regard that is under two standard deviations (SD) under the middle incentive for solid composed people by age, sex, height, smokers, pregnancy status. By insinuating the pregnancy status, frailty in pregnancy is an overall medical problem.^{1,2}

A person's body encounters basic changes when they become pregnant. The proportion of blood in the body augments by around 20 to 30% which grows the effortlessly of iron and supplements that the body needs to make hemoglobin. Hemoglobin is the protein in the red platelets that passes on oxygen to various cells in the body. Considering Center of Disease Control (CDC) portrays iron deficiency as pregnancy hemoglobin under 11g/dL

(Hematocrit; {Hct} < 33%) in the first and third trimester and under 10.5g/dL (Hematocrit; {Hct} < 32%) in the ensuing trimester. However, considering World Health Organization (WHO), they depict iron deficiency in pregnancy as Hb regards under 11gm/DL.^{3,4}

According to World Bank information it is clearly communicates that in the hour of 2010, the perusing of pervasiveness for paleness was 35.3 of complete people for pregnant women. In the hour of 2012, the perusing was 37% of complete people of pregnant women and it additions to 39.2% in the hour of 2014 and the latest, perusing was 42% of outright in the hour of 2016.⁵

In between, risk factors of anemia play an essential part in relating with comorbidities among pregnant women. Anemia can have a serious collision on the healthcare system and pregnant women's daily life. The presence of characteristics of risk factors of anemia among pregnant women with the described comorbidities, so it is easier to give measures on handling it So, the researcher interested to conduct research on "Risk Factors of Anemia among Pregnant Women".

2. MATERIALS AND METHODS

The information in this study came from a variety of sources connected to the topics mentioned. Scientific journals provide the majority of the main types of references used. All journals that matched the keywords were thoroughly examined with the goals of (1) determining the risk factors for anemia in pregnant women; (2) identifying the sociodemographic characteristics that are relevant to the research study; and (3) concluding the risk factors that have been proven to affect pregnant women's lifestyle. Using the keywords anemia, pregnant women, risk factors, sociodemographic features, prevalence of anemia, factors associated to anemia, meta-analysis, and review, we searched in PubMed®, Web of Science®, and NCBI®.

Literature review is the research method in this study. Information was gathered from a variety of sources and collated based on the findings of the studies. The goal of writing is to be coherent and relevant to the topic of conversation while minimizing the chance of bias. The method of data analysis is descriptive.

3. RESULTS

Study Characteristic

There were 15 studies in all, 14 cross-sectional studies and one retrospective research from 2014 to 2021. The 15 publications included in this literature review were studied, a total of 6 nations were represented. Six studies were conducted in Ethiopia. Furthermore, two investigations were conducted in Indonesia, two in Nepal, two in Ghana, one in Uganda, one in Nigeria, and one in Africa. Interviews, questionnaires, and clinical tests were among the data collection methods employed. Table 3.1 lists the characteristics of the publications used in this investigation

Table 1: Characteristics of The Studies Reviewed.

First Author, Year	Region	Type of Study	Risk Factors	Number of Cases	Sample Control
Lestari et.al., (2018) ⁶	Indonesia	Cross-sectional study	Socio-demographic characteristics	140	140
Solomon et.al., (2019) ⁷	Ethiopia	Cross-sectional study	Socio demographic characteristics, Obstetrics, dietary habits and nutritional status	417	417
Angesom et.al., (2018) ⁸	Ethiopia	Cross-sectional study	Socio-demographic characteristics	284	284
Teshager et.al., (2021) ⁹	Ethiopia	Cross-sectional study	Socio-demographic characteristics	14100	15683

Arif et.al., (2020) ¹⁰	Indonesia	Cross-sectional study	Socio-demographic characteristics	176	176
Naimo et.al., (2020) ¹¹	Uganda	Cross-sectional study	Socio-demographic characteristics	345	345
Benjamin et.al., (2016) ¹²	Ghana	Cross-sectional study	Socio-demographic characteristics, Obstetrics, dietary habits and nutritional status	400	400
Aklilu et.al., (2016) ¹³	Ethiopia	Cross-sectional study	Socio-demographic characteristics, Obstetrics, dietary habits and nutritional status	360	360
Anlaakuu et.al., (2017) ¹⁴	Ghana	Cross-sectional study	Socio-demographic characteristics,	316	316
Dim et.al., (2017) ¹⁵	Nigeria	Retrospective study	Socio-demographic characteristics	530	530
Kefiyalew et.al., (2014) ¹⁶	Ethiopia	Cross-sectional study	Socio-demographic characteristics,	258	258
Getahun et.al., (2017) ¹⁷	Ethiopia	Cross-sectional study	Socio-demographic characteristics,	217	217
Prakash et.al., (2015) ¹⁸	Nepal	Cross-sectional study	Socio-demographic characteristics	200	200
Hakizimana et.al., (2019) ¹⁹	Africa	Cross-sectional study	Socio-demographic characteristics	6680	6680
Umesh et.al., (2021) ²⁰	Nepal	Cross-sectional study	Socio-demographic characteristics, Dietary habits and nutritional status	287	287

Individual Related Risk Factors

According to the research mentioned, there are about 8 risk factors for anemia in pregnant women. These include the following such as socio-demographic characteristics, obstetrics, dietary habits of nutritional status, anthropometric characteristics, hygiene and sanitation related factors, disease related factors and hemoglobin level concentration. Of all studied variables, socio demographic characteristics is the most compatible risk factor compared to other risk factors. Socio-demographic risk factors includes such as age (OR: 1.7, p value = 0.001), residence (rural areas) (OR: 1.636, p value = 0.001), occupation (housewife) (OR: 4.76, p value = 0.001), parity (numbers of children between 2 to 4) (OR: 1.07, p value = 0.001), gestational age at the 3rd trimester (OR: 4.38, p value = 0.001), antenatal care (less than 4 visits) (OR: 2.28, p value = 0.001), absence of iron supplementation during pregnancy (p value = 0.000). The chances ratio between risk variables and anemia among pregnant women is shown in the table below.

Table 2: Odds ratios for the association between socio-demographic characteristics, prevalence of anemia, obstetric and dietary habits of nutritional status with anemia among pregnant women

Risk Factor (Socio-demographic characteristics)	OR	P-Value	Sample size		Study	Design
			Cases	Control		

Age group						
< 18	1		25	25		
18-24	1.8	0.761	251	251		
25-29	1.7	0.001	121	121	Solomon et.al ⁷	Cross-sectional
30-34	0.7	0.561	9	9		
≥ 35	2.4	0.007	11	11		
Education						
≤ Junior high school		0.001	33	37	Teshager et.al ⁹	Cross-sectional
≥ Junior high school			24	46	Arif et.al ¹⁸	Cross-sectional
					Hakizimana et.al ¹⁹	Cross-sectional
Residence Urban	1		135	16	Umesh et.al ²⁰	Cross-sectional
Rural	1.636	0.001	226	5580	Benjamin et.al ¹²	Cross-sectional
					Teshager et.al ²¹	Cross-sectional
Occupation Housewife	4.76	0.001	54	33	Benjamin et.al ¹²	Cross-sectional
Working	0.14	0.0012	135	133		
Parity (No. of children)						
0	1		134	134	Solomon et.al ⁷	Cross-sectional
2-4	1.07	0.001	211	211	Lestari et.al ⁶	Cross-sectional
≥ 5	2.07	0.003	72	72	Naimo et.al ¹¹ Dim et.al ¹⁵	Cross-sectional
Gestational Age 1st trimester	1		29	47	Naimo et.al ¹¹	Cross-sectional
2nd trimester	2.43	0.002	46	119	Benjamin et.al ¹²	Cross-sectional
3rd trimester	4.38	0.001	78	83	Aklilu et.al ¹³ Dim et.al ¹⁵	Cross-sectional
Antenatal Care						
<4 times	2.28	0.001	153	53	Umesh et.al ²⁰	Cross-sectional
≥ 4 times	1		39	42	Anlaakuu et.al ¹⁴	Cross-sectional
					Getahun et.al ¹⁷	Cross-sectional
Iron supplementation during pregnancy						
Yes	1		15	47	Arif et.al ¹⁸	Cross-sectional
No	1.30	0.000	109	109	Solomon et.al ⁷	Cross-sectional
					Angesom et.al ⁸	Cross-sectional
BMI						
≤ 18.5	1.47	0.001	134	134	Solomon et.al ⁷	Cross-sectional
18.5-25	2.07	0.045	15	47	Arif et.al ¹⁸	Cross-sectional
25-30	1				Kefiyalew et.al ¹⁶	Cross-sectional
					Prakash et.al ¹⁸	Cross-sectional

Risk of Study Bias

The Joanna Briggs Institute (JBI) Critical Appraisal Checklist Reporting Prevalence Data from the year 2014 was used and there were 15 publications that were compatible with the literature review, and to identify the study quality of each article that was determined as the source of literature review. In this literature review, the following are the conclusions of the literature that were researched and determined:

Table 3: The Joanna Briggs Institute (JBI) Critical Appraisal Checklist

Citation	Criteria										Result
	1	2	3	4	5	6	7	8	9	10	
Lestari et.al., 2018 ⁶	✓	✓	✓	✓	✓	✓	✓		✓	✓	9/10
Solomon et.al., 2019 ⁷	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
Angesom et.al, 2018 ⁸	✓	✓	✓	✓	✓		✓	✓	✓	✓	9/10
Teshager et.al., 2021 ⁹	✓	✓		✓	✓	✓			✓	✓	7/10
Arif et.al., 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
Naimo et.al., 2019 ¹¹	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
Benjamin et.al., 2016 ¹²	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
Aklilu et.al., 2018 ¹³	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
Umesh et.al., 2021 ²⁰	✓	✓	✓	✓	✓	✓	✓	✓	✓		9/10
Anlaakuu et.al, 2017 ¹⁴	✓	✓	✓	✓	✓	✓	✓	✓			8/10
Dim et.al, 2017 ¹⁵	✓		✓	✓			✓	✓	✓	✓	7/10
Getahun et.al, 2017 ¹⁷	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
Hakizimana et.al, 2019 ¹⁹	✓		✓	✓	✓	✓	✓	✓	✓	✓	9/10
Kefiyalew et.al, 2014 ¹⁶	✓	✓	✓	✓	✓		✓	✓	✓		8/10
Prakash et.al, 2015 ¹⁸	✓	✓	✓	✓	✓	✓	✓	✓	✓		9/10

The table below shows the results of the 14 cross-sectional studies and 1 retrospective study that met the 10 criteria for this literature review (Table 3.3). The 10 criteria are:

1. Was the example illustrative of the objective populace?
2. Were concentrate on members selected in a proper manner?
3. Was the example size satisfactory?
4. Were the review subjects and the setting depicted exhaustively?
5. Was the information investigation directed with adequate inclusion of the recognized example?
6. Was level headed, standard rules utilized for the estimation of the condition?
7. Was the condition estimated dependably?
8. Was there fitting factual examination?
9. Are terrifically significant bewildering variables and subgroups contrasts distinguished and represented?
10. Were subpopulations recognized utilizing objective standards?

After a critical assessment using the JBI critical appraisal approach, the cohort research was assigned a total quality score of seven to ten points on the checklist based on these findings. Almost every study examined produced significant data analysis and assessment findings on anemia risk factors in pregnant women. Other factors that lead to anemia risk factors among pregnant women are blamed for the higher risk of bias, which is a complicating issue in the study.

4. DISCUSSION

Summary of Evidence

Anemia in pregnant women has a number of risk factors that were discovered in this research. Because of its negative consequences on the mother and the fetus during pregnancy, anemia has gotten a lot of attention around the world. The most vulnerable group to anemia is pregnant women, according to a significant body of evidence. In this systematic review, the researcher discovered that socio-demographic factors, anemia prevalence, and obstetric factors, which include sub-risk factors like age, education, residence (urban or rural), mother's occupation, parity, gestational age, number of antenatal visits, iron supplementation during pregnancy, and body mass index (BMI), were all linked to anemia risk.

A risk factor is a factor that influences the likelihood of a person having an illness. Those with anemia are more likely than women with non-anemia to have one or more risk factors. Anemia risk is significantly linked with age ($0.005 < p \text{ value} < 0.001$). The researcher discovered that the age 35 and above are more prone to anemia than people under the age of 18. Solomon et al, discovered similar results as well. In this study, women over the age of 35 who became pregnant for the first time had a strong link to anemia.⁷ Banarjee et al. in India did a study that revealed a clear correlation between age and anemia. It's possible that as people get older, they lose micronutrients, resulting in vitamin deficiency and anemia.²¹

According to the Arif et al study, pregnant women with lower education levels had a considerably increased risk of anemia.¹⁰ The findings are comparable to those of Teshager et al, who found that education below junior high school has a significant impact on pregnant women ($p \text{ value} < 0.001$).¹⁸ Women with less than a junior high school degree were three times more likely to have anemia than other women. This is consistent with the results of other studies that have found an inversely proportional relationship between anemia and maternal education. This could be because of the advantages of education. Advanced education, for instance, can prompt expanded efficiency and earnings, which might goodly affect ladies' dietary patterns. Absence of information about anemia and its belongings during pregnancy could be a significant explanation in pregnant ladies becoming iron deficient. A study conducted in India revealed a similar conclusion.

Pregnant women without a high school diploma were 2.25 times more likely to be anemic than those with a high school diploma.^{22,23}

Benjamin et al, observed that pregnant women are more likely to be housewives than those who work ($p \text{ value} < 0.001$), and the link is significant. Joblessness and pregnancy result are a subject of interest for an assortment of reasons, including that it is a proportion of financial position, a potential pressure marker, and a sign of poor physical or psychological well-being. At the point when the mother was jobless, there were critical changes in maternal wellbeing conduct, including postponed antenatal consideration, not going to classes for work planning, not knowing the date of the past period, and smoking all through pregnancy.¹² Both parents' unemployment has been linked to a twofold increase in the chance of a very premature birth. Jobless ladies have a higher extent of low birth weight and preterm newborn children, just as a higher perinatal death rate.²⁴

According to Umesh et al and Benjamin et al,^{12,20} there is sufficient evidence that type of residency increases the risk of anemia in pregnant women ($p \text{ value} < 0.001$). Pregnant women in rural areas were 3.72 times more likely to be anemic than those in urban areas, according to the Umesh et al study.²⁰ Benjamin et al., reported similar findings in their research. Low financial position, an absence of appropriate data about diet during pregnancy, admittance to medical services offices, and lack of education could all be factors.^{1,2}

According to Lestari et al.,⁶ there is a relationship between parity and the risk of anemia in pregnant women ($p \text{ value} < 0.001$). Similarly, as per Naimo et al., the more kids a woman has, the greater the likelihood of anemia among pregnant women. Anemia was over two times as prone to create in pregnant ladies with equality. The more

pregnancy and delivery a woman have, the greater her risk of developing anemia.¹¹ This research backs up Solomon's findings, which indicated a higher prevalence of anemia among pregnant women with higher parity.⁷ Each birth results in a loss of blood, which can lead to a reduction in iron stores.²⁵

The obstetric characteristics of a pregnant woman are significant in this investigation. This study found a substantial correlation between risk factors and anemia in pregnant women. Gestational age is one of the risk factors, since it has been shown to be substantially associated to anemia in pregnant women (p value <0.001) can be identified from the research of Naimo et al.¹¹ Pregnant ladies in the second and third trimesters are bound to be anemic, particularly when contrasted with those in the first trimester. This could be attributed to the fetus's increasing food needs throughout the third trimester as it keeps growing. Benjamin et al., and Aklilu et al., found that third trimester women are more likely to be anemic than first trimester women.^{12,13} This could be on the grounds that the interest for calories and supplements increments during pregnancy to help expanded maternal digestion, blood volume, and nourishment conveyance to the embryo, with this interest expanding considerably more in the second and third trimesters. The ingestion of iron decreases drastically in the first trimester, inferable from diminishing iron necessities and the suspension of period. Nonetheless, iron ingestion from an eating routine with a high iron bioavailability increments significantly in the second and third trimesters.^{3,4}

According to Umesh et al., there is sufficient evidence that antenatal care visits increase the risk of anemia in pregnant women (p value <0.001). Furthermore, in this study, fewer ANC visits were linked to a higher risk of anemia in the participants. This can be clarified by the way that ladies who look for ANC late or inconsistently might be denied or deferred iron-folic acid supplementation, deworming medicine, and additionally intestinal sickness prophylaxis, while ladies who look for ANC as often as possible are bound to profit from sustenance advising and guidance, just as preventive wellbeing practices and sound dietary practices.²⁰ Our findings are in line with earlier research that has found a link between infrequent ANC visits and anemia. To lessen anemia in pregnant women, growing the insurance and frequency of prenatal visits is deemed critical.²⁶

According to research by Angesom et al., the chance of having anemia rose in pregnant women who did not take iron supplements throughout pregnancy (p value <0.000) compared to those who did.⁸ This may be due to an increased need for iron to supply the mother's expanding blood volume, as well as iron deficiency during pregnancy due to the rapid development of the fetal and placenta.⁸ Solomon et al found similar results in their research.⁷ Daily iron supplementation has larger benefits for the mother, since it lowers the risk of maternal anemia and iron deficiency at term by 70% and 57%, respectively.⁵ The heart works harder during pregnancy in order to deliver appropriate nutrition to the fetus. The body expands its blood volume by 30 to 50%. Because of this increase in blood volume, pregnant women should also increase their folic acid and iron intake. The red blood cells are unable to deliver oxygen to the body's tissues when iron levels are insufficient. Although mild anemia is common during pregnancy due to the increased blood volume, severe anemia can put the mother and baby at risk for early birth and low birth weight.²⁷

This study found that pregnant women's body mass index (BMI) was strongly associated with anemia (p -value 0.001). In pregnant women with anemia, being underweight is a common risk factor. Anemia is more likely to occur in women who are underweight or malnourished during pregnancy. Females were divided into weight classes based on BMI, a measure of body fat that takes into account height and weight. Solomon et al., concluded that pregnant women with a BMI of less than 18.5 were statistically more likely to be anemic (p -value 0.001). BMI was found to be a significant predictor in anemia in various research conducted in Ethiopia, Tanzania, and Egypt.⁷ The outcome could be explained as people with a lower BMI being malnourished, which can lead to anemia.²⁸

Limitation

There is a danger of mistake in estimating the risk of bias from diverse research when compiling this systematic review. A few restrictions, for example, a restricted example size or case and control determination, can influence how the discoveries are interpreted. Albeit the outcomes can't be summed they up, do show that specific recognized weakness among pregnant ladies' hazard factors can have various connections. Furthermore, due to the small number of researches examining anemia among pregnant women risk factors, the literature search can reveal the possibility of bias.

5. CONCLUSION

According to the findings and discussion in this systematic review, the majority of anemia among pregnant women cases occurred in pregnant women aged 35 and above. Education, occupation, residency, parity, gestational age, antenatal care visits, iron supplementation and BMI are all linked to an increased risk of anemia among pregnant women in this study.

6. RECOMMENDATION

Later on, productive and powerful arrangement changes and wellbeing drives on modifiable danger elements will be fundamental in forestalling iron deficiency among pregnant ladies.

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