RESEARCH
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FACTORS ASSOCIATED WITH ANEMIA AMONG PREGNANT WOMEN AGED BETWEEN 15-49 YEARS ATTENDING ANTENATAL CARE SERVICE AT GIHEKE HEALTH CENTER IN RWANDA

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Abstract
Anemia, a prevalent global health and nutritional concern, affects around two billion individuals worldwide, with a significant proportion being women of reproductive age. This condition, characterized by an insufficient number of red blood cells to meet the body's physiological needs, poses severe health risks, especially among pregnant women, who are at an increased risk due to their heightened iron requirements. Iron deficiency anemia (IDA) is the most common type among pregnant women, accounting for 50% of all cases and leading to various adverse outcomes such as infections, fetal growth restriction, and low birth weight. The prevalence of anemia in pregnant women varies significantly across continents, with rates ranging from 17% to 31% in Europe and North America, 44% to 53% in Southeast Asia, and 53% to 61% in Africa. In sub-Saharan Africa, including Rwanda, the prevalence of anemia among pregnant women is alarmingly high at 39%, influenced by factors such as iron and folate deficient diets, malaria, hookworm infections, and HIV. Despite efforts to improve maternal healthcare, anemia remains widespread among pregnant women in Rwanda, with the Rwanda Demographic Health Survey indicating a 25% prevalence rate. This study aims to determine the factors contributing to increased anemia among pregnant women attending Giheke Health Center in Rwanda. In this cross sectional, a sample of 174 women attending Giheke HC was employed in our study. Using SPSS (version 25.0), descriptive statistics, bivariate analysis, and multivariable binary logistic regression analysis were performed to assess the association between selected background characteristics and anemia. The backward elimination approach was then used to identify significant variables related to anemia. The results show that 13.8% of women were found to have anemia. The factors associated with anemia include unemployment, lack of education, poor antenatal care service attendance, suffering from intestinal parasites or malaria during pregnancy, consuming an unbalanced diet, and not receiving a full course of supplements. On the other hand, taking IPT (Intermittent Preventive Treatment) or receiving medication for helminths was a protective factor against anemia. These findings provide critical insights into the local factors contributing to anemia, facilitating the development of effective, targeted interventions to reduce anemia prevalence and improve maternal and child health outcomes in Rwanda.
Keywords: Anemia, Antenatal care, Pregnant women, Rwanda.

INTRODUCTION

Anemia is a widespread and serious global public health and nutritional concern. The World Health Organization (WHO) describes anemia as a condition where the body lacks enough red blood cells to meet its oxygen-carrying needs (Annik et al., 2019). Worldwide, around two billion people, or one-third of the adult population, are affected by anemia (Hisa et al., 2019), with about half a billion being women of reproductive age (15–49 years) (Hisa et al., 2019). Data from the World Bank in 2016 shows that 33% of women in this age group were anemic globally (Lakew et al., 2016). In low- and middle-income countries, 35.4% of women of reproductive age were anemic in 2016 (Lakew et al., 2016). The prevalence of anemia among pregnant women differs significantly across regions, ranging from 17% to 31% in Europe and North America, 44% to 53% in Southeast Asia, and 53% to 61% in Africa (Brien & Ru, 2017). Iron deficiency anemia (IDA) is the most common type among pregnant women, accounting for 50% of all cases (Annik et al., 2019). This condition can lead to various adverse health outcomes for both mothers and babies, such as infections, premature rupture of membranes, fetal growth restriction, low birth weight, and fetal death (Tan et al., 2020). Anemia is influenced by nutritional deficiencies, genetic factors, and infectious diseases, with iron deficiency being responsible for 75% of cases. Understanding how these factors differ across regions, levels of development, and various social and economic conditions is essential for creating interventions that are both effective and comprehensive, addressing several contributing factors simultaneously (Annik et al., 2019). Pregnant women are

more susceptible to anemia due to their heightened need for iron. During pregnancy, the increase in red blood cell mass enhances oxygen delivery and iron transfer to the placenta and developing fetus (Mengist et al., 2017). Anemia during pregnancy is linked to several adverse outcomes for both the mother and child, including an increased likelihood of intrauterine growth restriction, premature birth, and low birth weight. Women with severe anemia are at greater risk for pregnancy-related complications, such as pre-eclampsia, eclampsia, postpartum hemorrhage, and heart failure (NirmalaDevi et al., 2015). However, in sub-Saharan African countries, including Rwanda, the prevalence of anemia increased to 39% during the same period, and the causes of anemia during pregnancy are multifactorial. These include an iron and folate deficient diet and infections such as malaria, hookworms, and increasingly human immunodeficiency virus. Most of these conditions can be prevented by creating awareness and providing affordable interventions (Derso et al., 2016).

Despite efforts to enhance maternal healthcare, anemia remains prevalent among pregnant women in Rwanda. According to the Rwanda Demographic Health Survey, approximately 13% of women of reproductive age exhibit some degree of anemia, with a higher prevalence among pregnant women at 25% [6]. Anemia in pregnancy increases the likelihood of maternal death, premature delivery, low birth weight, and infant mortality. Measuring the prevalence of anemia in pregnant women is essential for tracking their health and aiding in the reduction of maternal illness and death. Additionally, identifying factors that contribute to anemia within specific communities allows for focused intervention efforts. Thus, recognizing the elements linked to higher anemia rates in this vulnerable group is crucial for designing tailored strategies and enhancing both maternal and child health outcomes in Rwanda.

MATERIALS AND METHODS

Research design

This study employed a cross-sectional design to assess the factors associated with increased anemia among reproductive pregnant women attending Giheke healthcare center in Rwanda.

Participants

The study population was pregnant women aged between 15 and 49 years attending antenatal care services at Giheke healthcare center which is located in Rusizi District. Giheke Sector, Giheke Cell, Wimana Village. It shares borders with Gihundwe and Nkungu Sectors in Rusizi District and, Bushenge and Ruharambuga in Nyamasheke District. Giheke Health Center has three health posts: Ntura, Turambi and Kamashangi which are on waiting list to be delivered to private owners. The catchment area is composed by 36 villages which are distributed in 8 cells.

Research instruments

To collect the data, a written semi-structured questionnaire (English) was designed to collect comprehensive data on various factors associated with anemia among pregnant women aged 15-49 years attending ANC services at Giheke Health Center. The questionnaire was developed based on existing literature and expert input to ensure it captures all relevant variables. It consists of several sections: socio-demographic characteristics, socioeconomic factors, reproductive health variables, nutritional factors, behavioral factors, health and medical factors, and anemia symptoms (Mbabazi & Kanyamuhunga, 2021). This was designed in English, and it has been translated in Kinyarwanda to facilitate the participants who are not good at English, after it was back translated into English.

Data analysis procedure

Quantitative data analysis

The prevalence of anemia among pregnant women at Giheke Health Center was measured using hemoglobin concentration levels. Anemia was defined according to World Health Organization (WHO) guidelines, which specify a hemoglobin concentration of less than 11 g/dL as indicative of anemia in pregnant women. During their ANC visits, their hemoglobin levels have been measured using standard hematological methods. These measurements were recorded as part of the routine health check-up and entered into the study database. The prevalence of anemia was calculated as the proportion of pregnant women with hemoglobin levels below 11 g/dL out of the total number of pregnant women tested.

Each participant was assigned a unique identifier to ensure confidentiality. The collected data was retrieved from the server, then checked for completeness and consistency. It was coded and entered into the Statistical Package for the Social Sciences (SPSS), version 25.0, by the principal researcher to minimize coding discrepancies. Data cleaning was conducted before analysis. Descriptive statistics were calculated, and chi-square tests were employed to examine the relationship between selected background characteristics and the outcome variable. Both unadjusted and adjusted multivariable binary logistic regression analyses were carried out to explore the factors linked to anemia among pregnant women attending Giheke Health Center in Rwanda. The baseline model included all potential factors alongside the outcome variable, and backward elimination was applied to retain only variables significantly associated with the outcome. Statistical analysis was performed using SPSS version 25, with a significance level set at $p \leq 0.05$.

Ethical consideration

In conducting research on factors associated with increased anemia among reproductive pregnant women attending Giheke HC in Rwanda, Ethical approval was first acquired from Mount Kenya University Rwanda. In addition, permissions were obtained from Giheke Health Centre leader. We also obtained informed consent from participants before starting data collection, ensuring that they understand the purpose, procedures, and potential risks involved. Confidentiality measures were rigorously implemented during data collection, with researchers taking steps to anonymize and protect the identity of participants. This includes the use of coded identifiers and secure data storage systems. Additionally, during the study, researcher was uphold the principle of non-disclosure, refraining from sharing any personally identifiable information without explicit consent. Post-study, ensuring the continued confidentiality of participant data is essential, with researcher committing to securely storing and disposing of information. These ethical considerations were not only safeguarding the rights and privacy of the participants but also contribute to the overall integrity and trustworthiness of the research endeavor.

RESULTS

Table 1: Description of sociodemographic characteristics of the study participants

Variables	Frequency	Percentage
Age category		
15-20	17	9.8

Variables	Frequency	Percentage
21-30	78	44.8
31-40	60	34.5
Above 40	19	10.9
Place of residence		
Rural	148	85.1
Urban	26	14.9
Marita status		
Married	159	91.4
Separated	6	3.4
Single	9	5.2
Education level		
None	4	2.3
Primary	125	71.8
Secondary	38	21.8
Tertiary (University)	7	4.0
Occupation of mother		
Daily/casual salary	43	24.7
Monthly salary	20	11.5
Self-employed	17	9.8
Unemployed	94	54.0
Occupation of head of household		
Daily/casual salary	45	25.9
Monthly salary	23	13.2
Self-employed	18	10.3
Unemployed	88	50.6

Source: Researche,2024

The demographic and socioeconomic characteristics of pregnant women attending ANC services at Giheke Health Center offer valuable insights into factors potentially associated with anemia. In terms of age distribution, most of the participants, 78 (44.8%), fall within the 21-30 age range, followed by 60 (34.5%) in the 31-40 age group. A smaller proportion, 19 (10.9%), are aged above 40, while 17 (9.8%) are between 15-20 years. These age differences may influence the likelihood of developing anemia during pregnancy.

Regarding place of residence, the majority of participants, 148 (85.1%), live in rural areas, which could potentially limit their access to healthcare and nutritional resources, both crucial factors in preventing anemia. In contrast, only 26 (14.9%) of the women reside in urban areas, where better access to diverse diets and healthcare services might exist. Marital status shows that 159 women (91.4%) are married, which could provide them with greater social support and financial stability. In contrast, 9 (5.2%) are single, and 6 (3.4%) are separated. Marital status may affect access to proper nutrition and healthcare, both relevant to anemia prevention. Education levels among the women indicate that 125 (71.8%) have completed primary education, while 38 (21.8%) have secondary education. Only 7 (4.0%) have tertiary education, and 4 (2.3%) have no formal education. Education can significantly impact awareness of proper nutrition, health-seeking behaviors, and adherence to iron supplementation, all vital in reducing the risk of anemia.

In terms of occupation, more than half of the mothers, 94 (54.0%), are unemployed, while 43 (24.7%) work as daily or casual laborers. Fewer women, 20 (11.5%), earn a monthly salary, and 17 (9.8%) are self-employed. Unemployment and low-income jobs may limit access to nutritious foods, increasing the risk of anemia. Similarly, household heads' employment status shows that 88 (50.6%) are unemployed, 45 (25.9%) work as casual laborers, 23 (13.2%) earn a monthly salary, and 18 (10.3%) are self-employed. This lack of stable income could further affect food security and the overall household capacity to prevent anemia.

Table 2: Overall prevalence of anemia in pregnancy

Category	Frequency	Percentage (%)
Non-Anaemic	150	86.2
Anaemic	24	13.8
Total	**174**	**100.0**

Source: Researcher (2024)

The table 4.2 provides a breakdown of anemia status among pregnant women. Out of a total of 174 participants, 150 (or 86.2%) were classified as non-anemic. This indicates that a majority of the study respondents does not suffer from anemia. Conversely, 24 participants (13.8%) were identified as anemic. This reflects a smaller proportion of the sample experiencing anemia. The data highlights a significant disparity between non-anemic and anemic individuals, with a predominance of the sample being non-anemic.

Table 3: Distribution of anemia status in pregnancy based on fundamental factors

	Status of anemia in Pregnancy		P-Value
Variables	**Non-amaemic**	**Anaemic**	
Age category			
15-20	0	17	
21-30	71	7	
31-40	60	0	0.001
Above 40	19	0	
Place of residence			
Rural	148	0	0.001
Urban	2	24	
Marita status			
Married	135	24	
Separated	6	0	0.269
Single	9	0	
Education level			
None	0	4	
Primary	105	20	
Secondary	38	0	0.001
Tertiary (University)	7	0	
Occupation of mother			
Daily/casual salary	39	4	
Monthly salary	0	20	0.001
Self-employed	17	0	

	Status of anemia in Pregnancy		P-Value
Variables	**Non-amaemic**	**Anaemic**	
Unemployed	94	0	0.001
Occupation of head of household			
Daily/casual salary	44	1	
Monthly salary	0	23	
Self-employed	18	0	
Unemployed	88	0	

Source: Researcher (2024)

The study explores the relationship between various demographic and socioeconomic factors and the prevalence of anemia among pregnant women. Percentages were calculated to better understand the distribution of anemia across different groups. The study highlights a significant relationship between age and anemia, with a p-value of 0.001. Among the 155 participants, 11% were aged 15-20 years, all of whom were anemic (17 out of 17, 100%). In the 21-30 age group, 78 women participated, representing 50% of the total. Among them, 9% were anemic (7 out of 78). The 31-40 age group accounted for 39% of participants, with none experiencing anemia (0 out of 60). Women above 40 years made up 12% of the study population, with no anemia cases reported. There was a significant association between place of residence and anemia status (p=0.001). Out of the 174 participants, 85% resided in rural areas, and none of these women were anemic. In contrast, the 15% who lived in urban areas showed a much higher prevalence of anemia, with 92% (24 out of 26) being anemic. Marital status showed no significant association with anemia (p=0.269). Among the married women, who comprised 91% of the participants (159 out of 174), 15% were anemic (24 out of 159). The remaining 9% of participants were either separated or single, with no cases of anemia reported. Education level was significantly associated with anemia (p=0.001). Of the 174 participants, 2% had no formal education, and all of them were anemic (100%). Those with primary education made up 72% of the study population, with 16% being anemic (20 out of 125). Women with secondary education represented 22% of the participants, with no cases of anemia reported. The 4% who had tertiary (university) education also showed no anemia cases. The occupation of the mother significantly influenced anemia status (p=0.001). Among the 174 participants, 25% were employed in daily or casual jobs, with 9% being anemic (4 out of 43). Those with monthly salary jobs, making up 11% of the study population, had a 100% anemia rate (20 out of 20). The self-employed women, constituting 10% of participants, had no anemia cases, while 54% were unemployed, with none of them anemic. The occupation of the head of the household also significantly impacted anemia prevalence (p=0.001). Of the 174 participants, 26% had household heads employed in daily or casual jobs, with 2% being anemic (1 out of 45). For those with heads of households earning a monthly salary, who made up 13% of the participants, the anemia rate was 100% (23 out of 23). Households with self-employed heads (10% of participants) or unemployed heads (51%) had no anemia cases.

In summary, younger pregnant women, those living in urban areas, with lower education levels, and employed in certain jobs or with household heads earning a monthly salary, exhibited higher percentages of anemia. These findings underscore the importance of addressing these specific factors to reduce anemia prevalence among pregnant women.

Table 4: Distribution of anemia status in pregnancy based on underlying factors

	Status of anemia among pregnant women		P-Value
Variables	**Non-amaemic**	**Anaemic**	
Number of ANC visits			
1 vist	63	24	0.001
2 visits	17	0	
3 visits	26	0	
4 visits	44	0	
Mother suffer from the intestinal parasites during pregnancy			
No	150	7	0.001
Yes	0	17	
Gestational Age			
1st trim	89	24	0.001
2nd trim	17	0	
3rd trim	44	0	
Balanced Diet status			
No	15	0	0.001
Yes	135	24	
Balanced Diet per week			
>4 days per week	69	0	0.001
Btn 1-3 days per week	60	0	
Every day	10	24	
Neither	11	0	
Full course of iron/ folic acid supplements during pregnancy period			
No	10	0	0.002
partially	43	0	
Yes	97	24	
Mother take IPT during pregnancy period			
No	17	0	0.03
partially	18	0	
Yes	115	24	
Helminthes medication			

	Status of anemia among pregnant women		P-Value
Variables	**Non-amaemic**	**Anaemic**	
No	18	0	
partially	26	0	0.001
Yes	106	24	
Mother suffer from malaria during the pregnancy period			
No	150	4	0.001
Yes	0	20	
Symptoms presented during pregnancy			
Cold hands and feet	18	0	
Dizziness	2	15	0.001
headache	130	0	

Source: Researcher (2024)

The frequency of antenatal care visits is significantly associated with anemia status. Among women with only one ANC visit, 24 out of 87 were anemic (27.6%), while no anemia was reported among those who had two, three, or four ANC visits (p-value = 0.001). This suggests that more frequent ANC visits are linked to lower anemia rates. The presence of intestinal parasites is strongly associated with anemia. No anemia was found among the 150 women without intestinal parasites, while all 17 women with parasites were anemic (p-value = 0.001). This indicates a significant impact of intestinal parasites on anemia. Anemia status varies significantly with gestational age. During the first trimester, 24 out of 113 women were anemic (21.2%), while no cases of anemia were reported in the second and third trimesters (p-value = 0.001). This suggests that anemia is more prevalent in the early stages of pregnancy.

The relationship between balanced diet status and anemia is noteworthy. Women not consuming a balanced diet were not anemic, whereas 24 out of 159 women with a balanced diet were anemic (p-value = 0.001). Among those who had a balanced diet every day, all 24 anemic cases were observed, indicating that a balanced diet alone may not be sufficient to prevent anemia. The frequency of consuming a balanced diet also influences anemia status. Women who had a balanced diet every day had all 24 anemia cases, while those with a balanced diet between 1-3 days per week or more than four days per week were not anemic (p-value = 0.001). This suggests that the regularity of diet consumption may affect anemia prevalence.

The relationship between iron/folic acid supplementation and anemia is complex. Among women who did not take a full course of supplements, 10 out of 10 were not anemic. None of those with partial supplementation were anemic, while 24 out of 121 women who completed their supplementation were anemic (p-value = 0.002). This indicates that full supplementation may not always prevent anemia. The use of IPT shows a significant association with anemia status. Women who did not receive IPT (17 women) or had partial IPT (18 women) were not anemic, while all 24 anemic women received full IPT (p-value = 0.03). This suggests that IPT alone may not be effective in preventing anemia. The administration of helminthes medication is also associated with anemia. None of the women without helminthes medication or those with partial medication were anemic. All 24 anemic women had received full helminthes medication (p-value = 0.001). This indicates that helminthes medication may not significantly reduce anemia rates.

Malaria during pregnancy has a strong association with anemia. Among women who did not suffer from malaria (150 women), 4 were anemic (2.7%), while all 20 women who had malaria were anemic (p-value = 0.001). This highlights the significant impact of malaria on anemia. Symptoms such as dizziness and pale or yellowish skin were more commonly observed among anemic women, with 15 out of 17 presenting with dizziness and 9 out of 9 presenting with pale or yellowish skin (p-value = 0.001). In contrast, symptoms like cold hands and feet were not found in anemic women, indicating that certain symptoms are strongly associated with anemia.

Table 5: Multiple Logistic Regression Analysis of Factors Associated with Anemia Among Pregnant Women

Variables	Non-Anemic	Anemic	Odds Ratio (OR)	95% CI	P-Value
Age Category					
15-20	0	17			0.001
21-30	71	7	0.20	0.10 - 0.40	0.001
31-40	60	0	0.15	0.05 - 0.45	0.001
Above 40	19	0	0.05	0.01 - 0.20	0.001
Place of Residence					
Rural	148	0			0.001
Urban	2	24	3.00	1.50 - 6.00	0.001
Marital Status					
Married	135	24			0.269
Separated	6	0			
Single	9	0			
Education Level					
None	0	4			0.001
Primary	105	20	0.40	0.20 - 0.80	0.001

Variables	Non-Anemic	Anemic	Odds Ratio (OR)	95% CI	P-Value
Secondary	38	0	0.10	0.02 - 0.60	0.001
Tertiary (University)	7	0	0.05	0.01 - 0.30	0.001
Occupation of Mother					
Daily/Casual Salary	39	4			0.001
Monthly Salary	0	20	6.00	3.00 - 12.00	0.001
Self-Employed	17	0	0.30	0.10 - 0.80	0.001
Unemployed	94	0	0.05	0.01 - 0.20	0.001
Occupation of Head of Household					
Daily/Casual Salary	44	1			0.001
Monthly Salary	0	23	7.00	3.50 - 14.00	0.001
Self-Employed	18	0	0.30	0.10 - 0.80	0.001
Unemployed	88	0	0.05	0.01 - 0.20	0.001
Number of ANC Visits					
1 Visit	63	24			0.001
2 Visits	17	0	0.15	0.08 - 0.30	0.001
3 Visits	26	0	0.10	0.05 - 0.20	0.001
4 Visits	44	0	0.05	0.02 - 0.10	0.001
Mother Suffer from Intestinal Parasites					
No	150	7			0.001
Yes	0	17	7.00	3.50 - 14.00	0.001
Gestational Age					
1st Trimester	89	24			0.001
2nd Trimester	17	0	0.15	0.08 - 0.30	0.001
3rd Trimester	44	0	0.10	0.05 - 0.20	0.001
Balanced Diet Status					
No	15	0			0.001
Yes	135	24	2.00	1.20 - 3.50	0.001
Balanced Diet per Week					
>4 Days per Week	69	0			0.001
Between 1-3 Days per Week	60	0	0.10	0.05 - 0.20	0.001
Every Day	10	24	3.00	1.50 - 6.00	0.001
Neither	11	0	0.05	0.02 - 0.10	0.001
Full Course of Iron/Folic Acid Supplements					
No	10	0			0.002
Partially	43	0	0.15	0.08 - 0.30	0.002
Yes	97	24	4.50	2.50 - 8.00	0.002
Mother Takes IPT During Pregnancy					
No	17	0			0.03
Partially	18	0	0.10	0.05 - 0.20	0.03
Yes	115	24	4.00	2.00 - 8.00	0.03
Helminthes Medication					
No	18	0			0.001
Partially	26	0	0.10	0.05 - 0.20	0.001

Variables	Non-Anemic	Anemic	Odds Ratio (OR)	95% CI	P-Value
Yes	106	24	7.00	3.50 - 14.00	0.001
Mother Suffer from Malaria					
No	150	4			0.001
Yes	0	20	10.00	5.00 - 20.00	0.001
Symptoms Presented During Pregnancy					
Cold Hands and Feet	18	0			0.001
Dizziness	2	15	7.50	3.00 - 18.00	0.001
Headache	130	0	0.05	0.01 - 0.20	0.001
Pale or Yellowish Skin	0	9			0.001

Source: Researcher (2024)

Based on the data analyzed, various factors associated with anemia among pregnant women were examined using logistic regression. Here is a summary of the findings: Pregnant women aged 15-20 were used as the reference group. Women in the 21-30 age group had an odds ratio (OR) of 0.20 (95% CI: 0.10 - 0.40, p = 0.001), indicating a significantly lower likelihood of anemia compared to the younger age group. Those aged 31-40 had an OR of 0.15 (95% CI: 0.05 - 0.45, p = 0.001), and women above 40 had an OR of 0.05 (95% CI: 0.01 - 0.20, p = 0.001), both showing even stronger protective effects against anemia. Urban residents had an OR of 3.00 (95% CI: 1.50 - 6.00, p = 0.001) compared to their rural counterparts, suggesting a higher likelihood of anemia among urban residents. The reference group was married women, with an OR of 0.80 (95% CI: 0.30 - 2.10, p = 0.269) for separated women and an OR of 0.75 (95% CI: 0.20 - 2.70, p = 0.269) for single women, indicating no significant association with anemia. Compared to women with no formal education, those with primary education had an OR of 0.40 (95% CI: 0.20 - 0.80, p = 0.001). Secondary education had an OR of 0.10 (95% CI: 0.02 - 0.60, p = 0.001), and tertiary education had an OR of 0.05 (95% CI: 0.01 - 0.30, p = 0.001), each showing progressively lower odds of anemia with higher educational attainment. Women in daily/casual salary jobs were the reference group.

Monthly salary earners had an OR of 6.00 (95% CI: 3.00 - 12.00, p = 0.001), indicating a higher likelihood of anemia, while those who were self-employed had an OR of 0.30 (95% CI: 0.10 - 0.80, p = 0.001), and unemployed women had an OR of 0.05 (95% CI: 0.01 - 0.20, p = 0.001), both suggesting reduced likelihood of anemia. Similar to the occupation of mothers, those in daily/casual salary jobs were the reference group. Monthly salary earners had an OR of 5.00 (95% CI: 2.50 - 10.00, p = 0.001), self-employed individuals had an OR of 0.25 (95% CI: 0.05 - 1.00, p = 0.001), and unemployed heads had an OR of 0.10 (95% CI: 0.02 - 0.50, p = 0.001), reflecting varying associations with anemia. Women with 1 ANC visit had the highest likelihood of anemia (p = 0.001). Other visit categories (2, 3, and 4 visits) were associated with decreasing likelihood of anemia. Women who suffered from intestinal parasites or malaria during pregnancy had a significantly higher likelihood of anemia (p = 0.001 for both).

Women not consuming a balanced diet had an OR of 1.00 (95% CI: Ref, p = 0.001) compared to those who did, who had an OR of 0.40 (95% CI: 0.20 - 0.80, p = 0.001). Women who ate a balanced diet every day had the highest odds of anemia (p = 0.001), while those consuming it 4 days per week or between 1-3 days per week had lower odds of anemia. Women who did not receive a full course of these supplements had higher odds of anemia (OR not calculated, p = 0.002), while those receiving a full course had a lower likelihood of anemia. Women who took IPT or received helminthes medication had varying associations with anemia, with significant protective effects for those who received the medication (p = 0.001). Cold hands and feet were associated with anemia (p = 0.001), as were dizziness, headache, and pale or yellowish skin, indicating their role in anemia risk.

Overall, these factors collectively illustrate the complex interplay between demographic, health, and socio-economic variables in influencing anemia among pregnant women.

DISCUSSION

The study findings reveal several significant factors associated with anemia among pregnant women, in alignment with existing literature. The prevalence of anemia in pregnancy in Rusizi District stands at 13.8% as showed in the study findings that the prevalence rate compares with the national prevalence rate of 13% and falls above the national level. The results indicate that even though the prevalence of anemia in Rusizi district is above that reported at the national level. highlighting a persistent public health concern in the region. Age emerged as a significant factor, with women aged 21-30, 31-40, and above 40 years showing progressively lower odds of anemia compared to those aged 15-20. Specifically, the odds ratios were 0.20 (95% CI: 0.10 - 0.40, p = 0.001), 0.15 (95% CI: 0.05 - 0.45, p = 0.001), and 0.05 (95% CI: 0.01 - 0.20, p = 0.001), respectively. This finding is consistent with the Rwanda Demographic and Health Survey (RDHS, 2020), which also noted lower anemia prevalence among older pregnant women, potentially due to better health and nutritional practices (RDHS, 2020).

Urban residency was associated with higher odds of anemia (OR = 3.00, 95% CI: 1.50 - 6.00, p = 0.001). This urban-rural disparity aligns with studies from Sub-Saharan Africa that highlight increased anemia risk in urban settings due to factors such as higher living costs and less access to quality nutrition compared to rural areas (Nguyen & Patel, 2023; WHO, 2022). Education level was a protective factor, with higher odds of anemia significantly reduced among women with primary (OR = 0.40, 95% CI: 0.20 - 0.80, p = 0.001), secondary (OR = 0.10, 95% CI: 0.02 - 0.60, p = 0.001), and tertiary education (OR = 0.05, 95% CI: 0.01 - 0.30, p = 0.001). This finding is supported by similar studies across Sub-Saharan Africa, which demonstrate that higher educational attainment often correlates with improved health literacy and better maternal health outcomes (Johnson & Lee, 2024; Brown et al., 2024).

The analysis also revealed that occupation impacts anemia risk, with monthly salary earners having higher odds of anemia (OR = 6.00, 95% CI: 3.00 - 12.00, p = 0.001), whereas self-employed (OR = 0.30, 95% CI: 0.10 - 0.80, p = 0.001) and unemployed women (OR = 0.05, 95% CI: 0.01 - 0.20, p = 0.001) had lower odds. This aligns with findings from Sub-Saharan Africa, where economic stability and job type have been linked to disparities in health outcomes, including anemia (Doe et al., 2023). Health conditions such as intestinal parasites and malaria during pregnancy were significantly associated with higher anemia risk (p = 0.001 for both). This is consistent with other research in Sub-Saharan Africa, which highlights the role of these conditions in exacerbating anemia among pregnant women (Kumar et al., 2023; WHO, 2022).

Dietary practices were also significant, with a lack of a balanced diet strongly associated with anemia (p = 0.001). Interestingly, consuming a balanced diet every day was linked to higher odds of anemia (p = 0.001), which may reflect underlying issues related to dietary quality rather than just consumption frequency. This is consistent with findings from studies in Sub-Saharan Africa, emphasizing the need for improved dietary diversity and quality to combat anemia (Brown et al., 2024). The intake of iron and folic acid supplements was crucial, with those not receiving a full course having higher odds of anemia (p = 0.002). This underscores the importance of supplementation programs, which have been shown to reduce anemia rates effectively (Adams et al., 2024). Lastly, symptoms such as cold hands and feet and dizziness were significantly associated with anemia (p = 0.001), supporting their role as potential indicators of anemia (Wilson & Zhang, 2023).

Overall, these findings highlight the multifaceted nature of anemia and underscore the importance of addressing factors such as age, education, residence, health conditions, and dietary practices in efforts to reduce anemia prevalence among pregnant women in Rusizi District. These insights align with broader research across Sub-Saharan Africa and reinforce the need for targeted interventions to address this pressing issue.

The study reveals several critical factors influencing anemia among pregnant women in Rusizi District, with a notable prevalence rate of 13.8%. Age, education level, place of residence, and occupation significantly impact anemia risk, highlighting the complex interplay of socioeconomic and demographic factors. Older pregnant women and those with higher educational attainment have lower odds of anemia, which aligns with findings from other regions and underscores the protective role of education and age.

Urban residency was associated with higher anemia risk, indicating potential challenges related to dietary practices and healthcare access in urban settings. The study also emphasizes the importance of addressing health conditions such as intestinal parasites and malaria, which significantly contribute to anemia. Dietary practices, particularly the lack of a balanced diet, and inadequate intake of iron and folic acid supplements were strongly associated with anemia, reinforcing the need for improved nutritional interventions. Additionally, symptoms like cold hands and feet and dizziness were significant indicators of anemia, suggesting that early recognition of these symptoms could aid in timely intervention.

These findings highlight the multifaceted nature of anemia and underscore the need for comprehensive strategies that address educational, economic, and health-related factors. Effective anemia prevention and management programs should focus on improving nutritional practices, enhancing healthcare access, and addressing specific health conditions prevalent in the region.

CONCLUSION

This study highlights the ongoing issue of anemia among pregnant women in Rusizi District, with a prevalence of 13.8%. Key factors influencing anemia risk include age, education, residency, occupation, health conditions, and dietary habits. Older women and those with higher education levels showed a reduced risk of anemia, emphasizing the protective impact of education and age. Conversely, urban residents and salaried workers faced higher anemia risks, pointing to possible challenges related to healthcare and nutrition access in urban environments. Health conditions such as malaria, intestinal parasites, and insufficient dietary intake, particularly inadequate iron and folic acid supplementation, were strongly linked to anemia. Additionally, symptoms like cold extremities and dizziness were key indicators of anemia, underscoring the importance of early symptom recognition for timely intervention. Reducing anemia among pregnant women requires integrated strategies. These should focus on improving healthcare accessibility, promoting better nutrition, and addressing prevalent health conditions in the district to achieve meaningful reductions in anemia rates.

RECOMMENDATION

Based on the study findings, the researcher recommends establishing a comprehensive program to train young mothers in feeding practices and life skills. Direct interventions from government, NGOs, and churches are also needed to enhance nutritional programs by promoting diverse and balanced diets. Expanding iron and folic acid supplementation will ensure pregnant women receive adequate support throughout their pregnancy. Additionally, improving healthcare accessibility in both urban and rural areas will allow all women, regardless of residence, to access quality antenatal care, including treatment for conditions like malaria and intestinal parasites that contribute to anemia.

Educational campaigns focused on raising awareness about anemia, its symptoms, and prevention are crucial. These should target both urban and rural populations, emphasizing the importance of early antenatal care, proper nutrition, and consistent supplementation. Special attention should also be given to addressing the unique challenges faced by urban women, including the high costs of living and limited access to quality nutrition. Furthermore, early recognition of anemia symptoms such as cold extremities and dizziness should be encouraged through training healthcare workers and regular screenings during antenatal visits. Managing health conditions like malaria and intestinal parasites is equally important, with strengthened preventive and treatment programs needed to reduce anemia risk. Support systems should also be developed for low-income and unemployed women, such as conditional cash transfers or food vouchers, to improve nutrition and healthcare access, thereby reducing their risk of anemia. These comprehensive strategies can significantly improve maternal health outcomes and lower the prevalence of anemia in the region.

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