

Original Research Article

Dietary Factors Associated with Anemia in Pregnant Women Attending Antenatal Care (ANC) at the Kalaban-Coro Reference Health Center in 2025

Chaka COULIBALY^{1*}, Massaba KOUYATÉ², Mariam GUINDO³, Djibril TRAORÉ², Bakary BERTHÉ⁴, Ahmadou BOLY¹, Mahamadou TRAORÉ¹

¹National Institute of Public Health

²National Institute for Training in Health Sciences

³Kati Reference Health Center

⁴Kalaban-coro Reference Health Center

Article History

Received: 23.02.2026

Accepted: 17.04.2026

Published: 21.04.2026

Journal homepage:

<https://www.easpublisher.com>

Quick Response Code

Abstract: Introduction: According to the results of the Demographic and Health Survey of Mali, the prevalence of anemia among pregnant women in the Koulikoro region and the Bamako district is 65.8% and 48.2%, respectively. Anemia remains a public health problem in Mali and one of the most common pathologies during pregnancy. The objective of this study was to investigate the dietary factors associated with anemia in pregnant women attending antenatal care (ANC) at the Kalaban-Coro Reference Health Center. **Methodology:** This was a case-control study conducted at the Kalaban-Coro Reference Health Center from August 5 to 31, 2025. The sample size was calculated using Epi Info 7 software version 7.1.2.0. It included 324 pregnant women, comprising 108 cases and 216 controls. Data were entered using the Kobocollecte tool and analyzed using SPSS version 25.0. We performed descriptive, bivariate, and multivariate analyses with a significance level of 5%. **Results:** The multivariate analysis showed that anemia in pregnant women attending antenatal care at the Kalaban-coro Reference Health Center was associated with consuming fewer than three meals per day ($p=0.00$), low dietary diversity ($p=0.00$), low fruit and vegetable consumption ($p=0.00$), low consumption of roots and tubers ($p=0.00$), and low dairy consumption ($p=0.03$). **Conclusion:** Based on these results, we recommend strengthening awareness and nutrition education activities to promote better dietary diversity among women of reproductive age.

Keywords: Anemia, Dietary Factors, Pregnant Women, Kalaban-Coro Reference Health Center /Mali.

Copyright © 2026 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

1. INTRODUCTION

Anemia during pregnancy is defined by the World Health Organization (WHO) as a hemoglobin level below 11 g/dL [1]. It is a major public health problem worldwide, particularly in developing countries, and primarily affects young children and women of reproductive age [2]. Anemia in pregnant women is of particular concern due to its serious consequences for both mother and child. Indeed, anemia in pregnant women can lead to complications such as infections, premature births, intrauterine growth restriction, and an increased risk of maternal and neonatal mortality [2].

Globally, in 2019, the WHO estimated that 37% of pregnant women were affected by anemia. In the same year, anemia caused the loss of 50 million healthy life years due to disability. The main causes of anemia were

iron deficiency, thalassemia, sickle cell trait, and malaria [2].

In 2024, the WHO estimated that approximately 50% of pregnant women worldwide would suffer from anemia, primarily due to iron deficiency [3].

In Sub-Saharan Africa in 2019, the prevalence of anemia among women of reproductive age was over 40%, compared to 46% among pregnant women [4].

In Mali, anemia is a major public health problem; more than one in two women suffers from anemia, according to the results of the sixth edition of the Demographic and Health Survey of Mali [5]. The national prevalence of anemia among pregnant women is 69.3%, according to the Demographic and Health Survey of Mali results. The main causes of anemia in pregnant

women in Mali include iron deficiency, blood loss, hemoglobinopathies, parasitic infections (malaria), inadequate diet, and limited access to prenatal care [6].

According to the results of the Demographic and Health Survey of Mali, the prevalence of anemia in pregnant women in the Koulikoro region and the Bamako district is 65.8% and 48.2%, respectively.

The objective of this study was to determine the dietary factors associated with anemia in pregnant women attending antenatal care at the Kalaban-Coro Reference Health Center in 2025.

2. METHODOLOGY

✓ Study Setting

The study was conducted at the Kalaban-Coro Referral Health Center in the gynecology and obstetrics department.

✓ Study Type and Period

This was a case-control study with a 1:2 ratio in favor of the control group. It took place from June to December 2025, and data collection was carried out from August 5 to 31, 2025.

✓ Study Population

The study population consisted of pregnant women who attended prenatal consultations at the Kalaban-Coro Reference Health Center during the study period.

✓ Target Population

This included pregnant women who attended prenatal consultations at the Kalaban-Coro Reference Health Center and had their hemoglobin levels measured during the study period.

✓ Inclusion Criteria

- Cases: Pregnant women with a hemoglobin level < 11 g/dL who attended prenatal care at the Kalaban-Coro Reference Health Center at the time of data collection and who agreed to participate in our study were included in our study.
- Control: Pregnant women with a hemoglobin level \geq 11 g/dL who attended prenatal care at the Kalaban-Coro Reference Health Center at the time of data collection and who agreed to participate in our study were included in our study.

✓ Exclusion Criteria

- ✓ Cases: Pregnant women who attended prenatal care at the Kalaban-Coro Reference Health Center at the time of data collection with a hemoglobin level < 11 g/dL and who did not agree to participate in our study were not included in our study.

- ✓ Control: Pregnant women with a hemoglobin level \geq 11 g/dl who came to CPN at the Kalaban-Coro Reference Health Center at the time of data collection were not included in our study, as they did not agree to participate in our study.

✓ Sampling

➤ Sampling Technique

- Selection of the Reference Health Center: It was chosen rationally because it receives a large number of patients, constituting a representative sample of the population of the health district. It is the reference center for the Kalaban-Coro health district, which covers an area of 2,425 km² with a projected population of 400,769 in 2025 according to the 2009 General Population and Housing Census in 2009, of which 199,703 are women (49.83%). The district comprises 5 communes and 118 villages.

✓ Prospective Recruitment of Cases and Controls in the Gynecology and Obstetrics Department

- ✓ Cases: Cases were selected in order of registration in the outpatient consultation register.
- ✓ Controls: Controls were randomly selected from the consultation register.

✓ Sample Size Calculation

The sample size was calculated based on the prevalence of anemia among pregnant women in Bamako, which is 48.2% according to Demographic and Health Survey of Mali [5].

For this estimation, we used Epi Info 7 software version 7.1.2.0, choosing an odds ratio (OR) of 2, a risk factor (α) of 5%, and a power (1- β) of 80%. This resulted in a minimum sample size of 103 cases and 206 controls, for a total of 309 pregnant women.

✓ Data Collection Techniques and Tools

• Data Collection Tools

The questionnaire was configured on Kobocollecte with the following sections: Sociodemographic Information, Medical and Obstetric History, Malaria and Other Parasitic Infections, Dietary Habits with Dietary Diversity Score, and Access to Healthcare.

• Data Collection Technique

A structured questionnaire was administered face-to-face to collect sociodemographic data, explore dietary habits, medical history, prenatal practices... The ANC record was used to obtain information on hemoglobin levels.

✓ Study Variables

The main variables collected during this study were: anemia, age, education level, marital status,

residence, occupation, number of meals, and Individual Dietary Diversity Score (IDDS).

▪ **Data Processing and Analysis**

Data were entered using Kobocollecte, Word 16, and Excel 16. SPSS version 25 was used for descriptive, bivariate, and multivariate analyses. The significance level for the tests was set at 5%.

▪ **Descriptive Analysis**

We calculated means and standard deviations for quantitative variables and proportions for qualitative variables.

▪ **Bivariate and Multivariate Analysis**

We used binary logistic regression to cross-tabulate the dependent variable with the different independent variables because our dependent variable has two categories (hemoglobin level < 11 g/dL and hemoglobin level ≥ 11 g/dL). Odds ratios were calculated to identify associations between risk factors for the development of anemia. We used logistic regression for variables with a p-value < 5% in multivariate analysis.

✓ **Ethical Considerations**

A letter of authorization for the study was sent to the head physician of the Kalaban Coro Referral Health Center to inform him of the objectives of our study. He gave his approval for data collection. We obtained the free and informed consent of the pregnant women before administering the questionnaire. The

survey form was anonymous, as it did not include the names of the pregnant women. No names or affiliations of the pregnant women will appear in any report or publication.

3. RESULTS

We conducted a case-control study from June to December 2025, with data collection taking place from August 5 to 31, 2025, to investigate dietary factors associated with anemia in pregnant women attending consultations at the Kalaban-coro Referral Health Center. During our study, we identified 324 pregnant women, including 108 cases (anemic) and 216 controls (non-anemic).

3.1. Sociodemographic Characteristics of Pregnant Women Attending Prenatal Care (CPN)

Our study found that the 15-29 age group was the most represented, accounting for 81.5% of cases and 76.9% of controls. The mean age of cases was 25 ± 6 years, and that of controls was 25.59 ± 6.5 years, with a range of 15 to 45 years (Table I).

Married women were the majority, representing 98.1% of cases and 99.1% of controls.

Regarding education level, the majority of pregnant women had attended school, representing 56.48% of both cases and controls (Table I). The majority of pregnant women were self-employed, at 94.44% of cases and 92.13% of controls (Table I).

Table I: Distribution of pregnant women attending antenatal care at the Kalaban-coro Reference Health Center according to their sociodemographic characteristics in 2025

Variables	Case (n=108)		Witnesses (n=216)	
	Number	%	Number	%
Age range				
[15-29]	88	81,5%	166	76,9%
[30-45]	20	18,5%	50	23,1%
Marital Status				
Single	2	1,85	2	0,93
Married	106	98,15	214	99,07
Education level				
Schooled	61	56,48	122	56,48
Not in school	47	43,52	94	43,52
Occupation				
Self-employed	102	94,44	199	92,13
Employee	6	5,56	17	7,87

Among pregnant women, 50% of cases had 3 or more meals per day, compared to 81% of controls (Table II). Women with a diversity score of ≥ 5 food groups represented 68.52% of cases and 94.91% of controls (Table II). Cereals were the most consumed food group,

at 97.22% of cases and 99.1% of controls. Pregnant women consumed less tubers and roots (79.63% of cases and 56.48%), milk (75% of cases and 61.57% of controls), and fruits and vegetables (42.59% of cases and 20.83% of controls) (Table II).

Table II: Distribution of pregnant women attending antenatal care at the Kalaban-coro Reference Health Center according to their dietary habits in 2025

Variables	Case (n=108)		Witnesses (n=216)	
	nber	%	Number	%
Number of meals per day				
< 3 meals	54	50	175	19
≥ 3 meals	54	50	41	81
Consumption of cereals				
Yes	105	97,22	214	99,1
No	03	2,78	02	0,9
Consumption of tubers				
Yes	22	20,37	94	43,52
No	86	79,63	122	56,48
Consumption of protein				
Yes	95	88	196	90,7
No	13	12	20	9,3
Consumption of milk				
Yes	27	25	83	38,43
No	81	75	133	61,57
Consumption of fruits and vegetables				
Yes	62	57,41	171	79,17
No	46	42,59	45	20,83
IDDS				
Yes	34	31,48	11	5,09
No	74	68,52	205	94,91

3.2. Dietary Factors in Pregnant Women: Bivariate and Multivariate Analysis

In bivariate analysis, we found that anemia was 4.27 times more frequent in women who had fewer than three meals per day than in those who had at least three meals per day ($p=0.00$; $OR=4.27$; $CI [2.57-7.09]$) (Table III). We found no significant association between anemia and cereal consumption ($p=0.22$; $OR=0.33$; $CI [0.05-1.99]$).

Anemia was three times more frequent in women who did not consume tubers and roots than in those who did ($p=0.00$; $OR=3.01$; $CI [1.76-5.17]$). However, we found no significant association between

protein consumption and anemia ($p=0.43$; $OR=1.34$; $CI [0.64-2.81]$).

Anemia was 1.87 times more frequent in women who did not consume milk than in those who did ($OR=1.87$; $CI [1.12-3.13]$) (Table III).

Anemia was 2.82 times more frequent in women who did not consume fruits and vegetables than in those who did ($p=0.00$; $OR=2.82$; $CI [1.70-4.66]$) (Table III).

Anemia was more common in women with a dietary index (DI) of fewer than 5 food groups than in those with a DI of 5 or more food groups ($p=0.00$; $OR=0.12$; $CI [0.06-0.24]$).

Table III: Distribution of pregnant women according to dietary factors in bivariate analysis

Variables	Case		Witnesses	
	Number	%	Number	%
Number of meals/days				
≥ 3 meals per day	54	50	175	81
< 3 meals per day	54	50	41	19
Cereal consumption				
Yes	105	97,22	214	99,1
No	03	2,78	02	0,9
Tubers and roots				
Yes	22	20,37	94	43,52
No	86	79,63	122	56,48

Variables	Case		Witnesses	
	Number	%	Number	%
Protein				8
Yes	95	88	196	90,7
No	13	12	20	9,3
Dairy consumption				
Yes	27	25	83	38,43
No	81	75	133	61,57
Fruit and vegetable consumption				
Yes	62	57,41	171	79,17
No	46	42,59	45	20,83
IDDS				
< 5 food groups	34	31,48	11	5,09
≥ 5 food groups	74	68,52	205	94,91

*IDDS (Individual Dietary Diversity Score)

In multivariate analysis, the consumption of fewer than three meals per day ($p=0.00$); low dietary diversity in pregnant women ($p=0.00$); low consumption of fruits and vegetables ($p=0.00$); low consumption of

roots and tubers ($p=0.00$); and low consumption of dairy products ($p=0.03$) were associated with anemia in pregnant women attending prenatal care at the Kalabancoro Referral Health Center.

Table IV: Distribution of pregnant women according to dietary factors in multivariate analysis

Variables	Odds ratio	Confidence interval		
			lower Superior	P>Z
Number of meals per day				
At least three meals per day				
Less than three meals per day	4,04	2,44	6,70	0,00
Consumption of roots and tubers				
No	0,34	0,20	0,58	0,00
Yes				
Consumption of dairy products				
No	0,57	0,34	0,94	0,03
Yes				
Consumption of fruits and vegetables				
No	0,37	0,23	0,61	0,00
Yes				
IDDS				
< 5 food groups	0,12	0,06	0,25	0,00
≥ 5 food groups				

4. COMMENTS AND DISCUSSION

The results of this study, as shown by multivariate analysis, demonstrated that consuming fewer than three meals per day, low consumption of fruits and vegetables, roots and tubers, and dairy products, as well as low dietary diversity, were associated with the occurrence of anemia in pregnant women.

❖ Socio-Demographic Characteristics of Pregnant Women

The mean age of the cases was 25 ± 6 years, with a range from 15 to 44 years. The 15-29 age group was the most represented, at 81.5%. These results are similar to those of DIARRA, T [7], who found that the mean age of patients was 25.99 years, with a range from

15 to 45 years. This could be explained by the fact that this is the most reproductively active population.

In our study, the majority of anemic pregnant women were married (98.15%), a result comparable to that of SAMAKE, K at the Kalabancoro Reference Health Center in 2019 [8], who found 82%. This could be explained by the fact that the population in question resided in the same locality, and that in our socio-cultural context, marriage is closely linked to motherhood, while frequent and closely spaced pregnancies can increase the risk of anemia in these women.

In our study, the majority of pregnant women were enrolled in school, at 56.48%. This result is similar to that of Cissé, M. in Burkina Faso [9], who found that more than half of the women were enrolled in school (53.12%). This could be explained by progress in public

policies and the evolution of social attitudes in favor of girls' education.

We found that 94.44% of the women were self-employed, which is similar to the findings of Diarra T. [30] in 2022 and Maiga, I. B. [10], who reported proportions of housewives of 77.8% and 62.2%, respectively. This could be explained by income instability and women's economic dependence, limiting access to adequate food and regular healthcare.

❖ Dietary Habits

Our study revealed that 50% of pregnant women consumed fewer than three meals per day, contrary to the study by GUINDO, A [11], on the determinants of low dietary diversity scores among women of reproductive age, which found that 98.67% of women of reproductive age consumed three or more meals per day. This difference could be explained by the fact that our data were collected during the lean season, which leads to higher food prices in urban markets.

In our study, 97.22% of women consumed cereals. This result is explained by the fact that starchy foods, especially cereals, constitute the staple food of the Malian population. Approximately 31.48% of women had an Individual Dietary Diversity Score (IDDS) of less than 5 food groups; this could be explained by limited access to a diverse diet and the influence of food preferences during pregnancy.

❖ Dietary Factors in Pregnant Women

Regarding dietary habits, our study found a significant association between anemia and the number of meals per day (OR = 4.27), the woman's SDAI (OR = 8.56), the consumption of milk and dairy products (OR = 1.87), and roots and tubers (OR = 3). These results highlight the crucial role of nutrition in preventing anemia during pregnancy. They confirm that the quality and quantity of pregnant women's diets are major determinants of maternal health.

We also found a significant association between anemia and fruit and vegetable consumption (OR = 2.82). This result is similar to that of Sitou, M [12], who found a significant association between not consuming fruits and vegetables and anemia (OR = 4.85). Fruits and vegetables are important sources of essential micronutrients for preventing nutritional deficiencies. Their low consumption may have implications for hemoglobin formation.

In our study, the results of the multivariate analysis showed that low dietary diversity in pregnant women ($p=0.00$), low consumption of fruits and vegetables ($p=0.00$), low consumption of roots and tubers ($p=0.00$), and low consumption of dairy products ($p=0.03$) were significantly associated with anemia in pregnant women attending prenatal care at the Kalaban-coro Reference Health Center. This result contradicts

that of Ouzennou, Nadia, *et al.*, [13], in the Essaouira province of Morocco, who showed in their multivariate analysis that gravidity ($p<0.001$), origin ($p<0.001$), and educational level ($p<0.05$) were significantly associated with anemia. This difference could be explained by socio-economic and nutritional disparities. In Morocco, the issues related to food may be less significant, revealing other determining factors.

❖ Difficulties and Limitations of the Study

One of the major difficulties was the availability of pregnant women for data collection, as they were eager to return home immediately after their prenatal appointments. Some refused to participate in the study due to the waiting time for appointments, but this does not detract from the quality of the work carried out.

5. CONCLUSION

At the end of this study, the results of the multivariate analysis showed that low dietary diversity among pregnant women, low consumption of fruits and vegetables, low consumption of roots and tubers, and low consumption of dairy products were significantly associated with anemia in pregnant women attending prenatal care at the Kalaban-coro Referral Health Center.

Conflict of Interest: None

Acknowledgments

We extend our thanks to all the staff of the Kalaban-coro Referral Health Center for facilitating this study. We also thank the pregnant women for their availability.

BIBLIOGRAPHIC REFERENCES

1. World Health Organization (WHO) at the following link:
<http://apps.who.int/irs/bitstream/handle/10665/75368/978924159610>
2. World Health Organization (WHO), 2019: Prevalence of nutritional anemia among pregnant women in developing countries.
3. World Health Organization (WHO), 2024: Anemia in pregnant women, global estimates and recommendations. <https://www.who.int>
4. [.PRG.ANEM?locations=ZG&citationMarker=](https://donnees.banquemondiale.org/indicateurs/SH.PRG.ANEM?locations=ZG&citationMarker=)
5. National Institute of Statistics (INSTAT), Planning and Statistics Unit, Health-Social Development and Family Promotion Sector (CPS/SS-DS-PF), and ICF. 2019. Sixth Demographic and Health Survey in Mali 2018. Key Indicators. Bamako, Mali, and Rockville, Maryland, USA: INSTAT, CPS/SS-DS-PF, and ICF
6. <https://www.maliweb.net/sante/anemie-grossesse-au-mali-286-femmes-enceintes--souffrent-danemie-671402.html>
7. DIARRA, T. (2022) Anemia and pregnancy: Epidemiological and clinical aspects at the Gabriel Touré University Hospital in Bamako.

8. SAMAKE, Kalilou. (2021) Epidemiological, clinical, and therapeutic study of severe anemia during pregnancy at the Kalaban-coro Reference Health Center
9. CISSE, M., et al. (2022) Prevalence and factors associated with anemia in pregnant women in the city of Bobo-Dioulasso, Burkina Faso
10. MAIGA, I. B. (2024) Epidemiological, clinical, therapeutic, and prognostic aspects of anemia associated with pregnancy at the Gao Reference Health Center www.bibliosante.ml
11. GUINDO, A. (2024): Determinants of the low dietary diversity score of women of reproductive age in Commune I of the Bamako district in September 2022
12. SITOU, M. (2023): Factors contributing to the persistence of anemia in pregnant women in the third trimester at the obstetrics and gynecology department of the health center in Commune VI of the Bamako district <https://bibliosante.ml/handle/123456789/12617>
13. OUZENNOU, Nadia, et al. (2018): Prevalence and social determinants of anemia in pregnant women in the Essaouira province of Morocco.

Cite This Article: Chaka COULIBALY, Massaba KOUYATÉ, Mariam GUINDO, Djibril TRAORÉ, Bakary BERTHÉ, Ahmadou BOLY, Mahamadou TRAORÉ (2026). Dietary Factors Associated with Anemia in Pregnant Women Attending Antenatal Care (ANC) at the Kalaban-Coro Reference Health Center in 2025. *East African Scholars J Med Sci*, 9(4), 189-195.
