

Prevalence and Factors Associated With Anemia Among Pregnant Women Attending AMDA Hospital of Eastern Nepal

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Abstract

Background

Anemia is a global public health problem, consisting 40% of pregnant women being anemic worldwide. Manifold factors directly or indirectly contribute to anemia during pregnancy and amplify the risk of maternal and fetal mortality and morbidity. However, factors associated with anemia among pregnant women are not broadly understood in sub-national level. Thus, this study has made an effort to ascertain the prevalence and associated factors of anemia among pregnant women in AMDA Hospital of Eastern Nepal.

Methods

Health-facility based cross-sectional study was conducted among pregnant women of age 18-49 years attending antenatal care (ANC) in AMDA Hospital. A total of 420 samples were recruited through systematic random sampling. Data was collected through a validated semi-structured questionnaire. Hemoglobin concentration was recorded from laboratory test report. Collected data were entered in EpiData and analyzed in SPSS Version 22 licensed by Chulalongkorn University. Chi-square test was used for bivariate analysis and later, significant variables at p -value <0.10 were processed on multivariate analysis. Finally, the adjusted odd ratio was reported considering significant at p -value <0.05 with 95% confidence interval.

Results

The overall prevalence of anemia was 42.1% (37.4%–47.0%). Almost 46%, 41% and 14% of women were with mild, moderate and severe types respectively. Factors such as age less than 20 years (7.23, 2.50–20.87) and between 20- 24 years (2.80, 1.31–5.96), religious minorities (3.09, 1.35–7.06), vegetarian diet pattern (4.33, 1.49–12.59), inadequate frequency (DGLV: once a week, fruits: twice in a week) of eating DGLV (8.71, 2.26 – 33.63) and fruits (2.73, 1.41–2.29), inadequate dietary diversity (7.16, 3.15–16.27), as well as no intake of multivitamins during pregnancy (4.23, 1.49– 11.98) were statistically associated with anemia among pregnant women.

Conclusion

Overall, the prevalence of anemia was found to be high in the study area. The associated factors of anemia ranged from socio-economic, dietary and obstetric care, and included age, religion, diet pattern, and frequency of eating DGLV and fruits, dietary diversity, as well as intake of multivitamins during pregnancy. The study recommends enhancing community-based interventions considering the identified factors.

Introduction

Anemia is characterized as a low level of hemoglobin in the blood and decreased oxygen-transporting capacity to tissues (1, 2). It is recognized as a global public health problem with adverse consequences on human health as well as creates an unfavorable atmosphere for social and economic growth (3). Anemia occurs in all age groups, but it is most common among pregnant women and young children (4, 5). Anemia in pregnancy is recognized if the concentration of hemoglobin in blood drops, below 11 g/dl (6). Pregnant women are highly susceptible to anemia because of high requirements of iron and vitamins for their growth and development of the fetus. At the same time, they also have less access to antenatal care in the low-income country like Nepal (1, 7).

Worldwide, approximately 1.6 billion people are affected by anemia; of which 56 million are pregnant women. The developing nations account for almost 90% of the burden (8, 9). In Southeast Asia, the anemia prevalence among pregnant women is highest with 48.7% (3). Likewise, 46% of pregnant women are anemic in Nepal (10) which is unacceptably high. As evidenced, anemia during the pregnancy is found associated with increased risk of maternal and perinatal morbidity and mortality including intrauterine growth retardation and low birth weight (11). It is estimated that, roughly 11, 5000 maternal and 59, 1000 perinatal deaths occur due to anemia per year globally. As a result, it has an economic effect on human capital which results in the loss of billions of dollars annually (8).

Recognizing anemia as a serious public health problem, the 65th World Health Assembly endorsed a comprehensive nutrition plan for maternal, infant and young child. Six specific global nutrition targets were set to be achieved by 2025, among which 50% reduction in the prevalence of anemia is targeted for Women of Reproductive Age (WRA) group (1, 12). Similarly, Nepal Health Sector Strategy (2015-2020) also aims to decrease the prevalence of anemia among WRA to 30% by 2020 (13, 14). For a long time, the Government of Nepal has had policy of universal, daily iron-folic acid (IFA) supplementation to pregnant women and postpartum women. The IFA tablets are recommended to start at the beginning of the second trimester of pregnancy and continuing through 45 days of postpartum (15). Health workers and Female Community Health Volunteers (FCHV) are also implementing other complementary measures such as deworming of pregnant women and dietary diversification, food fortification and promotion of maternal care practices (13). Despite of such targeted interventions, Nepal has not witnessed significant reduction in anemia prevalence among pregnant women over the 10 years from 2006 to 2016 (10).

In the context of Nepal, there is limited evidence on the factors associated with anemia as well as on micronutrient deficiencies among pregnant women at a particular sub-national level. Mostly, study covering the Eastern Terai region is almost non-existent. Although some small-scale studies from other parts of Nepal have attempted to examine the prevalence, these findings cannot be analogous with the Eastern settings. Thus, to fill this gap, this study attempts to unveil the prevalence of anemia and its associated factors among pregnant women attending AMDA Hospital of Eastern Terai.

Methodology

Study Design and Setting

The study was a facility based cross-sectional study, with quantitative methods. It was carried out at AMDA Hospital, Jhapa from July-December 2018. AMDA Hospital is serving as a primary referral hospital in Eastern Nepal and provides services to the local community, refugees and the people from remote districts of Eastern Nepal. It has been recognized as a 75-bedded hospital from Ministry of Health and Population (MoHP) and more than 100 beds are in operation.

Participants, sample size and sampling methods

The pregnant women (18-49 years) who attended Antenatal Care (ANC) check-up at AMDA Hospital during the period of September-November 2018 were included in the study. Pregnant women with known medical conditions/diseases such as hypertension, diabetes, HIV/AIDS and tuberculosis were however excluded from the study.

The sample size for this study was calculated from n4studies application considering an infinite population proportion. According to the Nepal Demographic and Health Survey-2016, the prevalence of anemia among pregnant women was 46% (10). With the national prevalence, P= 46%, 5%- allowable error, 5% non-response rate and confidence interval of 95%, a sample size of 425 pregnant women was calculated.

The pregnant women were selected using a systematic random sampling technique. With regard to procedure, the sampling frame was developed based on the ANC attendance record of last year. On average, 903 women attended the hospital for ANC in a month. Based on this, the sampling interval was determined by dividing this population to the required sample size, and the yielded sampling interval was 2. The pregnant women who entered first for ANC visit was taken as the first participant and others were subsequently recruited in the sampling interval of 2.

Instruments and Measurements

Socio-demographic, economic, reproductive, diet and health service utilization information were collected by semi-structured questionnaire. The questionnaire was developed after the widespread literature review and reading concepts and theories related to anemia and pregnancy. For the dietary diversity, standard questionnaires-modified by FANTA- III project; Minimum Dietary Diversity for WRA (MDD-W) 24 hours dietary recall tool was used with a dichotomous outcome (16). Participants who have consumed at least one food from each food group were scored 1 in each group if not scored, 0. The dietary diversity was known if the total score was more or equal to 5 (16). Individual ANC card and laboratory report of pregnant women was used to record the hemoglobin level along with age and trimester of pregnancy were also cross verified through it (Refer to Additional file 1).

Data Collection

Data was collected during the time of ANC services but immediately after their antenatal checkup. Coordination was done with antenatal clinic staffs of AMDA Hospital for identification and sampling of

the study population as well as their support was asked for the entire period of data collection. Four data enumerators with a nursing background were recruited for the data collection and two days orientation on tools was provided. To measure the content validity, three experts were asked to evaluate the content of the questionnaire by Item-Objective Congruence (IOC). The average score was 0.877. Similarly, the tool was pretested in 10% of sample size in similar settings. Data was collected with continuous monitoring by the researcher. Probing was done as per the need to bring a reliable response from the participants. Data editing was done in the field to ensure the completeness and accuracy in recording responses.

Data Management and Analysis

Data was entered in EpiData and analyzed in SPSS-22 licensed by Chulalongkorn University. Both descriptive and inferential statistics were used to give a clear picture of anemia and to show the association between dependent and independent variables. For descriptive statistics, categorical data were analyzed by frequency and percentage. Continuous data were reported in mean, range and standard deviation (S.D). Intended for inferential statistics, bivariate analysis was performed using the Chi-square test. However, those who did not meet the assumption for the Chi-square test; Fisher's exact test was used. Later, the significant variables at p-value <0.1 were selected to perform multivariate analysis. Before the multivariate binary logistic regression, correlation was checked between the statistically significant variables. Multicollinearity was found between family size and types of family, so family size was removed from the fitted model. To test the goodness of fit for the regression model Hosmer and Lemeshow Chi-square test was used. The acquired p-value was 0.372 (>0.05). Designed for multivariate analysis, the statistical association was considered significant if p-value was <0.05 and reported with the adjusted odds ratio (AOR) at 95% Confidence Interval (CI).

Results

Socio-demographic and economic characteristics

A total of 420 pregnant women participated in the study with 100% response rate. The mean age was 25.39 ± 5.13 years with the highest (39.5%) from 20-24 years. A large number was shared by Hindu (69.8%) and nearly half (46.4%) of the participants were Brahmin/Chhetri (46.4%). The largest share of pregnant women represented from the nuclear family (56.9%) and nearly two-third (61%) represented from the urban area. Less than half (42.9%) of the pregnant women and their husbands (49.3%) had completed secondary and above education. Almost 40% of the pregnant women were working as a housemaid while just over one-third (38%) of their husbands were engaged in foreign employment as a major occupation. Nearly three-fourth (74.8%) had sufficient family income for their daily foods and activities (Table 1).

Agricultural and dietary characteristics of the study population

Of 420 pregnant women, 7% were having alcoholic drinks and 9% were smoking in their pregnancy period. Most of the pregnant women (90.5%) were non-vegetarians and more than half (62.1%) were

eating Dark Green Leafy Vegetables (DGLV) every day. Almost 36% of the pregnant women were found having fruits every day, while almost 50% and 48% were eating meats and eggs once a week. More than two-third (77.4%) were drinking tea/coffee. The adequate dietary diversity was found with 75.5% pregnant women (Table 2).

Obstetric and health care characteristics of the study population

Table 3 shows the obstetric and health care characteristics of the study population. More than half of the women (56.7 %) had first gravida and almost 75% were from the third trimester. Majority of the women (84.4%) had moderate menstrual blood loss. Almost 63% had at least four ANC visits at health institutions, while the vast majority of women were receiving combined iron and folic acid supplementation till the date of data collection. The overwhelming majority of the women (93.3%) received deworming tablets, but only 18% of participants were taking a multivitamin during their current pregnancy.

Prevalence of Anemia

Among 420 pregnant women, 42.1% (37.4-47.0) were found anemic (Hgb: < 11 g/dl). Of the Anemic women, 45.8% had mild anemia followed by 40.7% moderate and 13.6% severe. The Mean (\pm) Standard Deviation of hemoglobin concentration among pregnant women was $10.9 \pm (2.1)$ (Table 4).

Factors associated with Anemia

The factors associated with anemia among pregnant women were identified after using the regression model to the fit variables. The age of the pregnant women less than 20 years (aOR 7.23, 95% CI: 2.50–20.87) and between 20- 24 years (aOR 2.80, 95% CI: 1.31–5.96) were found associated with anemia. The religious minorities; Buddhist, Muslim, Kirat and Christian (aOR 3.09, 95% CI: 1.35–7.06) had a higher chance of developing anemia compared to that followed Hindu religion. Significantly the risk of anemia raised to those who had a vegetarian diet pattern (aOR 4.33, 95% CI: 1.49–12.59). Inadequate consumption frequency of DGLV i.e. once a week had high (aOR 8.71, 95% CI: 2.26 – 33.63) likelihood of developing anemia. Similarly, fruits consuming twice a week found directly associated with developing anemia (aOR 2.73, 95% CI: 1.41–2.29). Inadequate dietary diversity (aOR 7.16, 95% CI: 3.15–16.27), as well as no intake of multivitamins during pregnancy (aOR 4.23, 95% CI: 1.49– 11.98) were statistically associated with anemia among pregnant women.

Discussion

The overall prevalence of anemia among pregnant women was 42.1%. This finding is comparable with Nepal Demographic and Health Survey 2016 (10), a study conducted by World Bank (40%) in 2016 (17), and a study conducted in Turkey (18). However, the prevalence in our study observed to be higher than other similar studies conducted in Ethiopia (19), 27.9%, Iran, 13.6% (20) and Sudan, 10% (21). The difference in anemia prevalence might be due to socio-economic differences, food habits linked with

culture, dietary variations and available health services and utilization. Among 177 anemic pregnant women, 45.8% were mild anemic, 40.5% found moderate and 13.6% were severely anemic which is comparable with a study done in India (22).

In the current study, pregnant women below 20 years and between 20-24 years were 7.2 and 2.8 times more likely to be anemic compared to those in other age groups. This coincides with similar studies from Ethiopia (23) and Nepal Demographic and Health Survey (10), where the women below 20 years were found associated with anemia. The likelihood of anemia among women belonging to Buddhist, Muslim, Kirat, and Christian religion was 3.1 times higher than those belonging to the Hindu religion. However, this finding contrasts from a similar study in India where women belonging to Hindu religion had higher odds of having anemia compared to Muslim (24). These differences might be due to cultural variation, food beliefs and health service access. In this study, type of family, residence, alcohol and smoking habits were however not significantly associated with anemia.

Regarding alcohol consumption and smoking, the consistent result was found in the study among blacks of the United States where the women with alcohol and smoking habit were not found associated with anemia (25). But, as evidenced, alcohol and smoking help to reduce the absorption of iron as identified in the study of micronutrients during pregnancy at the United States (26). This finding must be taken with caution that only a quantitative measure with minimum sample size might not be adequate to access the association of anemia with alcohol and smoking habits.

In this study, the dietary habit of women who consume vegetarian diet were more likely to be anemic than the women eating non-vegetarian diet. The study conducted in rural Wardha also revealed that vegetarian women were significantly associated with anemia (27). Iron and Zinc are supposedly less bioavailable in vegetarian diets as compared to non-vegetarian diets (28), which might be the reason for having higher chances of anemia who follow the vegetarian diet pattern in comparison to non-vegetarians.

Pregnant women consuming Dark Green Leafy Vegetables (DGLV) only once in a week were at greater risk of developing anemia compared to those consuming every day or every other day. Similar studies conducted in different parts of Ethiopia also explored that lower consumption of DGLV increases the risk of having anemia among pregnant women (29, 30). The possible reason to lead anemia might be the less intake of DGLV reduces getting non-heme iron and vitamin A & C in a body.

In the current study, pregnant women who were not taking any forms of multivitamins were 7.9 times more likely to be anemic than those who took multivitamins. The study from Hungary also reveals that multivitamin supplementation protects from developing anemia (31). Similarly, intake of fruits less than two times in a week had 2.7 odds of having anemia among the pregnant compared to those who intake more than two times in a week. The result from the study in Parakou pregnant women too support that lack of consumption of fruits increases the occurrence of anemia(32). On the other hand, the preceding study had explored vitamin A & C helps to promote the absorption of non-heme iron (33). Along with this, vitamin A is involved in the formation of erythrocytes and the mobilization of stored iron in the body (34).

Thus, regular intake of DGLV, fruits and multivitamin supplementation plays a crucial role in reducing anemia during pregnancy.

Dietary diversity was found independently associated with anemia. Those pregnant with a low diversity diet were found with higher odds of developing anemia compared with the high dietary diversity. The result is consistent with the study of Ethiopia (35), Mekelle town (36) and also with the study in nine regional states of Ethiopia (37). The previous study among women of the Terai belt of Nepal also explored diets of women have less diversity and inadequacy in nutrition (38). Diet with diverse foods or ingredients provides a number of essential nutrients. Especially, pregnant women require adequate nutrients for them as well as for the development of a fetus. Dietary diversity is considered as a key indicator for assessing the access, utilization and quality of diet at an individual or household level (39).

For the policy and program implication, this study suggests that the government and other stakeholders should develop anemia control interventions, focusing on pregnant women and ethnic minority or disadvantaged groups. Multifaceted nutrition interventions, including promotion on regular intake of DGLV, fruits, diet diversity; proper health education including counseling on nutrition should be made mandatory during the time of ANC visit.

This study also has some limitations. This was an institution-based study and conducted among pregnant women visiting a hospital, therefore it may not be generalized to the whole population. Besides, history questions like 24 hours dietary recall and questions targeted to explore the situation before the pregnancy might not be free from recall bias.

Conclusions

The overall prevalence of anemia among pregnant women was 42.1% with 45.8% mild anemic, 40.5% moderate and 13.6% severely anemic. The pregnant women age with 20 and between 20-24 years and belonging to religious minorities (Buddhist, Muslim, Kirat, and Christian religion) to Nepal found higher in developing anemia. Factors such as vegetarian diet pattern, no diet diversity, frequency of eating DGLV and fruits once a week, as well as no taking of any forms of multivitamins during pregnancy were found independently associated with anemia. Nutrition education to pregnant women needs mandatory with proper counseling regarding anemia and its consequences on maternal and fetal health during the antenatal checkup.

List Of Abbreviations

ANC: Antenatal Care

AOR: Adjusted Odds Ratio

CI: Confidence Interval

DDS: Dietary Diversity Score

DGLV: Dark Green Leafy Vegetable

DoHS: Department of Health Services

FANTA: Food and Nutrition Technical Assistance Project

FAO: Food and Agriculture Organization

FHI: Family Health International

GoN: Government of Nepal

Hb: Hemoglobin

IDA: Iron Deficiency Anemia

IFA: Iron Folic Acid

NDHS: Nepal Demographic Health Survey

NHRC: Nepal Health Research Council

MDG: Millennium Development Goals

MDD-W: Minimum Dietary Diversity for Women of Reproductive Age

MPH: Masters of Public Health

SDG: Sustainable Development Goal

WHO: World Health Organization

WRA: Women of Reproductive Age

Declarations

Ethics approval and consent to participate

The ethical approval was received on 2nd September 2018 with reference no. 480 from the Nepal Health Research Council (NHRC), Ministry of Health and Population (MoHP). Written consent was obtained from every respondent. Their anonymity and dignity were highly respected as well as their information was kept confidential.

Consent for publication

Not Applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

Funding

Not Applicable

Authors' contributions

GA was the Principal Investigator who designed the study, undertook data collection, analysis and wrote the manuscript. WS and KS involved in the design of the study and supported in data analysis and interpretation. GA, KS and WS reviewed and revised the draft manuscript. All authors read and approved the final manuscript.

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Tables

Table 1: Socio-demographic and economic characteristics of pregnant women attending ANC at AMDA Hospital, Jhapa

Variables	Number (n= 420)	%
Age Group		
<20	46	11.0
20 – 24	166	39.5
25 – 29	117	27.9
30 – 34	60	14.3
≥ 35	31	7.4
Religion		
Hindu	293	69.8
Buddhist	26	6.2
Muslim	22	5.2
Kirat	64	15.2
Christian	15	3.6
Ethnicity		
Dalit	30	7.1
Brahmin/Chhetri	195	46.4
Janajati	152	36.2
Terai Caste	43	10.2
Type of family		
Nuclear	239	56.9
Extended	181	43.1
Family size		
≤2	60	14.3
3-5	168	40
≥5	192	45.7
Residence		
Urban	255	60.7
Rural	165	39.3
Education		

Illiterate	16	3.8
Informal education	26	6.2
Primary education	57	13.6
Secondary education	180	42.9
Higher education	141	33.6
Occupation		
Unemployed	3	0.7
Student	11	2.6
Daily laborer	20	4.8
Housemaid	169	40.2
Housewife	120	28.6
Civil service	23	5.5
Employed at private sector	26	6.2
Business	47	11.2
Agriculture	1	0.2
Family Income		
Insufficient	9	2.1
Barely sufficient	52	12.4
Sufficient	314	74.8
Enough sufficient	45	10.7

Table 2: Dietary characteristics of pregnant women attending ANC at AMDA Hospital, Jhapa

Variables	Number (n= 420)	%
Alcohol consumption		
Yes	28	6.7
No	392	93.3
Smoking habit		
Yes	34	8.1
No	386	91.9
Dietary habits		
Vegetarian	40	9.5
Non-vegetarian	380	90.5
Frequency of eating DGLV		
Every day	261	62.1
Every other day	117	27.9
Once a week	42	10
Frequency of eating fruits		
I don't eat	6	1.4
Every day	153	36.4
Every other day	127	30.2
Once a week	130	31
Once a month	4	1
Frequency of eating meats		
I don't eat	40	9.5
Every day	13	3.1
Every other day	126	30
Once a week	211	50.2
Once a month	30	7.1
Frequency of eating eggs		
I don't eat	57	13.6
Every day	35	8.3

Every other day	106	25.2
Once a week	203	48.3
Once a month	19	4.5
Tea/coffee consumption		
Yes	325	77.4
No	95	22.6
Dietary diversity		
No dietary diversity	103	24.5
Dietary diversity	317	75.5

Table 3: Obstetric and health care characteristics of pregnant women attending ANC at AMDA Hospital

Variables	Number (n= 420)	%
Gravidity		
1 Gravida	238	56.7
2 Gravida	127	30.2
>2 Gravida	55	13.1
Flow of menstruation		
Very heavy	4	1
Heavy	37	8.8
Moderate	355	84.5
Low	24	5.7
Trimester of pregnancy		
First trimester	2	0.5
Second trimester	102	24.3
Third trimester	316	75.2
ANC visit		
<4 visit	156	37.1
≥4 Visit	264	62.9
Currently taking combined Iron folic tablets		
Yes	412	98.1
No	8	1.9
Intake of Deworming tablets		
Yes	392	93.3
No	28	6.7
Intake of Multivitamin		
Yes	77	18.3
No	343	81.7

Table 4: Prevalence and severity of anemia among the study population

Variables	Number (n= 420)	Percent	95% CI
Prevalence of Anemia			
Anemic (< 11 gm/dl)	177	42.1	37.4-47.0
Non anemic (> 11 gm/dl)	243	57.9	53.0-62.6
Hemoglobin Concentration: Mean (\pm) SD 10.9 \pm (2.1)			
Severity of Anemia (n=177)			
Severe anemia (< 7.0 g/dl)	24	13.6	8.8-19.5
Moderate anemia (7.0–9.9 g/dl)	72	40.7	33.4-48.3
Mild anemia (10.0–10.9 g/dl)	81	45.8	38.3-53.4

Table 5: Unadjusted and adjusted relationship of explanatory variables with anemia in pregnancy, AMDA Hospital, Jhapa

Variables	Anemia		COR (95% CI)	AOR (95% CI)
	Yes	No		
Age				
< 20	31(67.4)	15(32.6)	5.17 (2.4 – 11.12)	7.23 (2.51 – 20.87) ^a
20 – 24	75(45.2)	91(54.8)	2.06 (1.19 – 3.56)	2.80 (1.31 – 5.96) ^a
25 – 29	45(38.5)	72(61.5)	1.56 (0.87 – 2.81)	1.49 (0.67 – 3.33)
≥30	26(28.6)	65(71.4)		1
Religion				
Hindu	111(37.9)	182(62.1)		1
Religious minorities	66(52.0)	61(48.0)	1.77 (1.17 – 2.70)	3.092 (1.35 – 7.06) ^a
Ethnicity				
Advantaged	73(37.4)	122(62.6)		1
Disadvantaged	104(46.2)	121(53.8)	1.44 (0.97 – 2.12)	0.38 (0.18 – 0.81)
Family type				
Nuclear	80(33.5)	159(66.5)		1
Extended	97(53.6)	84(46.4)	2.30 (1.54 – 3.41)	1.175 (0.66 – 2.08)
Residence				
Urban	96(37.6)	159(62.4)		1
Rural	81(49.1)	84(50.9)	1.597 (1.07 – 2.38) *	0.622 (0.34 – 1.15)
Alcohol consumption				
Yes	20(71.4)	8(28.6)	3.74 (1.61 – 8.71) *	0.02 (0.00 – 0.41)
No	157(40.1)	235(59.9)		1
Smoking habit				
Yes	21(61.8)	13(38.2)	2.38 (1.16 – 4.90) *	1.616 (0.57 – 4.58)
No	156(40.4)	230(59.6)		1
Education				
Primary & below	70(70.7)	29(29.3)	4.83 (2.95 – 7.89) *	1.936 (0.82 – 4.58)
Secondary & higher	107(33.3)	214(66.7)		1
Occupation				

Not working	67(50.0)	67(50.0)	3.36 (1.88 – 6.03)	0.67 (0.27 – 1.67)
Laborer & present farmer	88(46.3)	102(53.7)	2.90 (1.67 – 5.05)	1.90 (0.79 – 4.56)
Salaried & business	22(22.9)	74(77.1)		1
Income				
Insufficient/Barely	48(78.7)	13(21.3)	6.58 (3.44 – 12.61)	0.940 (0.30 – 2.99)
Sufficient/enough	129(35.9)	230(64.1)		1
Menstrual Flow				
Excess	26(63.4)	15(36.6)	2.43 (0.87 – 6.80)	1.16 (0.37 – 3.66)
Moderate	141(39.7)	214(60.3)	0.92 (0.40 – 2.13)	0.295 (0.06 – 1.67)
Low	10(41.7)	14(58.3)		1
Diet Pattern				
Vegetarian	31(67.4)	15(32.6)	3.23 (1.68 – 6.19)	4.33 (1.49 – 12.59) ^a
Non-vegetarian	146(39.0)	228(61.0)		1
DGLV intake				
Every day	73(28.0)	188(72.0)		1
Every other day	68(58.1)	49(41.9)	3.574 (2.27 – 5.64) *	1.88 (0.94 – 3.77)
Once a week	36(85.7)	6(14.3)	15.45 (6.25 – 38.22)	8.71 (2.26 – 33.63) ^a
Fruits in a week				
≥ 2 times	71(25.4)	209(74.6)		1
< 2 times	106(75.7)	34(24.3)	9.12 (5.73- 14.70)	2.73 (1.41 – 2.29) ^a
Meat in a week				
≥ 2 times	21(15.1)	118(84.9)		1
< 2 times	156(55.5)	125(44.5)	7.01 (4.17 – 11.80)	1.96 (0.89 – 4.30)
Egg in a week				
≥ 2 times	27(19.1)	114(80.9)		1
< 2 times	150(53.8)	129(46.2)	4.91 (3.04 – 7.94) *	1.02 (0.46 – 2.23)
Diet Diversity				
No	89(86.4)	14(13.6)	16.54 (8.95 – 30.59)	7.16 (3.15 – 16.27) ^a

Yes	88(27.8)	229(72.2)		1
ANC visit				
< 4 visit	87(55.8)	69(44.2)	2.44 (1.63 – 3.66)	1.47 (0.82 – 2.61)
≥ 4 visit	90(34.1)	174(65.9)		1
Iron				
Yes	170(41.3)	242(58.7)		1
No	7(87.5)	1(12.5)	9.97 (1.22 – 81.74) *	1.79 (0.11 – 30.40)
Multivitamin				
Yes	8(4.5)	69(89.6)		1
No	169(49.3)	174(50.7)	8.38 (3.91 – 17.95)	4.23 (1.49 – 11.98) ^a

^a Statistically significant at 95% CI

Supplementary Files

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- [OperationalDefinationforAnemiastudy.xlsx](#)