Original article

Correlates of anemia among women of reproductive age in Ethiopia: Evidence from Ethiopian DHS 2005

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Abstract

Background: Globally, 41.8% of pregnant women and 30.2% of non-pregnant women are anemic. Previous studies which attempted to identify determinants of anemia among women of reproductive age reported conflicting findings.
Objective: To assess the correlates of anemia among women of reproductive age in Ethiopia.
Methods: A quantitative cross-sectional study carried out based on the secondary data of the Ethiopia Demographic Health Survey (EDHS) 2005. Data of a total of 5963 women of reproductive age were included in the analysis. Data were mainly analyzed using ANOVA and binary logistic regression.
Result: The prevalence of anemia was 27.4% (95% CI: 26.3-28.5%). Rural residence, poor educational and economic status, 30-39 years of age and high parity were key factors predisposing women to anemia. Lactating women and those who gave birth in the month of the interview had 1.3 ($p = 0.000$) and 2.2 ($p = 0.012$) times higher risk than their counterparts. Those not using contraceptive were 1.4 times ($p = 0.02$) more likely to develop anemia than current contraceptive users. The average Dietary Diversity Score (DDS) was only 4.01, and not more than 15% of the respondents consumed iron rich foods in the preceding day of the survey. Respondents with low DDS and those who did not consume iron rich foods in the reference period had significantly higher risk of anemia with odds ratio of 1.3 ($p = 0.01$) and 1.3 ($p = 0.002$), respectively. Utilizing maternity services, taking iron and vitamin A supplement during pregnancy and postpartum period, respectively, didn't have a significant effect in reducing the burden of anemia.
Recommendation: Family planning, economic and educational empowerment of women have affirmative inputs in combating anemia. A combination of nutrition, educational and livelihood promotion strategies should be instated to enhance dietary diversity. Maternal nutrition interventions should be integrated in a stronger manner into maternity services. [*Ethiop. J. Health Dev.* 2011;25(1):22-30]

Introduction

Anemia is a disorder which is principally characterized by a decline in the concentration of circulating erythrocytes or hemoglobin in the blood and a concomitant impairment of oxygen transportation (1). Common etiological classification identifies nutritional, marrow disease and hemolytic anemia types. Nutritional anemia is by far the most common type worldwide and mainly includes iron, folate and vitamin B_{12} deficiencies (2).

Anemia is a global public health problem affecting both developing and developed countries (3) and occur at all stages of the life cycle, but is more prominent in pregnant women, young children and other women of reproductive age (1-3). Consequences of anemia include increased risk of adverse pregnancy outcomes, maternal mortality, child mortality, impaired neuro-cognitive and physical development of children and reduced work capacity (4, 5).

According to WHO, based on the studies conducted from 1993 to 2005, the estimated global prevalence of anemia was 24.8%, and it affected 1.62 billion people worldwide. Estimated prevalence was 41.8% in pregnant women and 30.2% in non-pregnant women. In numbers, 56 million pregnant women and 468 million non-pregnant women were affected (3). Furthermore, many more are likely to have not apparent iron deficiency (2). In 2002, iron deficiency anemia was considered to be among the most important contributing factors to the global burden of diseases, attributed to 3.1% of the total Disability Adjusted Life Years (DALY) lost in the developing world (6).

Studies conducted over the years witnessed the public health significance of anemia in Ethiopia. A study in 1999 by Haidar et al (7) reported that 18.4% of pregnant and lactating women in rural Ethiopia were anemic. In 2006, Micronutrient Initiative (MI) Ethiopia estimated 27.0% and 30.6% prevalence of anemia among women of reproductive age and pregnant women, respectively (8). The Ethiopian DHS 2005 documented that 27% of Ethiopian women were anemic (9). Recent nationwide surveys reported 29.4% and 30.5% prevalence in women of reproductive age (10, 11).

A handful of previous studies tried to identify potential socio-cultural, economic, demographic, nutritional, reproductive and other potential risk factors of anemia in women of reproductive age (12-18). However, in addition to being small scale, these studies reported conflicting and divergent conclusions. Hence, this study was done to identify correlates of anemia among women of reproductive age in Ethiopia using large scale EDHS

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2005 data.

Methods

Study Setting: Ethiopia is situated in the horn of Africa. It is a country with great climatic, geographic and cultural diversity. According to the 2008 estimate, it has a population of 78,254,090 of which 84% live in rural areas. More than one fifth (23.3%) of the population are women in the reproductive age (19). The country is characterized by rapid population growth with an annual rate of 2.6% and a total fertility rate of 5.4, and low GDP per capita of 173 USD (9, 19, 20).

In Ethiopia, maternal health indicators are seriously low. The maternal mortality ratio of 673 per 100,000 live births is among the highest in the world with only 5% of Ethiopian mothers delivering in health institutions and, ANC and PNC coverage are 27.6% and 6.1%, respectively. Likewise, the contraceptive prevalence rate is 14%. More than a quarter of women of reproductive age have chronic energy deficiency (9).

Study Design: This is a quantitative, cross-sectional comparative study based on secondary data of Ethiopia DHS 2005.

Data Extraction: The Ethiopian DHS 2005 data were downloaded from Measure DHS website in SPSS format. Further data cleaning was done by the investigators. Data on a total of 5963 women of reproductive age were included in the analysis. Information on a wide-range of potential independent variables (socio-demographic, economic, dietary intake, nutritional status, micronutrient supplementation history, breastfeeding history, maternity services utilization, family planning use, fertility history etc) were extracted accordingly.

Sampling Method of the Ethiopian DHS 2005: The Ethiopian DHS 2005 was designed to provide representative estimates of health and demographic indicators at national level and across 11 geographic areas (9 regions and 2 city administrations) of the country. Stratified and cluster sampling was used to identify study subjects. The stratification was made based on de-facto place of residence (urban/rural). The samples were selected in two stages. In the first stage, 540 clusters (145 urban and 395 rural) were selected from the list of enumeration areas of the 1994 population and housing census. Then a representative sample of approximately 14,500 households was selected for the main study. For the anemia study, among women of reproductive age, one in two households selected for the main study were identified, and representative samples of approximately 6000 women of reproductive age were included (9).

Data Collection Method of the Ethiopian DHS 2005: The survey employed standard DHS questionnaire which is used across similar surveys in the world. However, the tool was adapted to the socio-cultural setting of Ethiopia through experts' review. The questionnaires were finalized in English and translated into the three main local languages: Amharic, Oromiffa and Tigrigna. Prior to data collection, the questionnaires were pretested. The data were collected using experienced and qualified data collectors in the presence of intensive supervision. Dietary intake was assessed using 24 hours dietary recall method. Blood hemoglobin level was determined using the HemoCue portable meter. Hemoglobin level was adjusted for altitude of respective clusters using the formula recommended by Centers for Disease Control and Prevention (CDC) (9).

Data Analysis: The data analysis was done by the principal investigators using SPSS for windows version 16.0. Frequencies, percentage, mean and standard deviation were used for the descriptive analysis. Weighted percentage was used to compute national anemia prevalence. Independent sample t-test and One-way Analysis of Variance (ANOVA) with Bonferroni post hoc test were applied to compare mean blood hemoglobin level across different categories of the independent variables. Binary logistic regression was employed to control potential confounders and to explore association between dependent variable (anemia status) and a wide range of the aforementioned independent variables. Variables were entered into the model using the "enter" method. During the analysis, the fitness and statistical assumptions of the logistic model were checked to be satisfied. Hosmer-Lemeshow statistic was used to assess the fitness of the model. P value of 0.05 was taken as the level of significance.

The Dietary Diversity Score (DDS) was computed from a single 24 hours dietary recall data according to the recommendation of Food and Nutrition Technical Assistance Project Scale Version 2 (21). Food items and liquids consumed in the preceding day and night of the survey were categorized into 12 groups (cereals, root/tubers, pulses/legumes/nuts, vegetables, fruits, meat/poultry, eggs, fish/seafood, sugar/honey, milk/milk products, oil/fats, and miscellaneous) (21). Consuming a food item from any of the aforementioned groups earned a score of 1 for that specific category. If not, a score of 0 was given. Accordingly a DDS of 12 points was developed (21). Then the DDS was categorized into three categories, namely low (DDS $\leq$ 3), medium (DDS = 4 or 5) and high (DDS $\geq$ 6) groups. The cutoff points were selected as they had been frequently applied in similar previous studies (22-24).

Wealth index, composite indicator of a cumulative living standard, is calculated based on ownership of selected assets, such as televisions and bicycles, materials used for housing construction, and types of water source and sanitation facilities. The five quintiles (lowest, second, middle, fourth, and highest) were generated using Principal Components Analysis (PCA) statistical technique. This study used pre-computed wealth index values.

Ethical Issues: The data were downloaded and used after the purpose of the analysis was communicated and permission was taken from Measure DHS Organization. The original data were collected in confirmation with international and national ethical guidelines.

Operational definitions

The following operational definitions were applied in this study;

- Severe anemia: Women with <7.0 g/dl of blood hemoglobin level.
- Moderate anemia: Women with 7.0-9.9 g/dl of blood hemoglobin level.
- Mild anemia: Pregnant women with 10.0-10.9 g/dl blood hemoglobin level and non-pregnant women with 10.0-11.9 g/dl blood hemoglobin level.
- Low Body Mass Index (BMI): Non-pregnant women with BMI less than 18.5 kg/m^2.
- Normal BMI: Non-pregnant women with BMI of 18.5-25.0 kg/m^2.
- Low Dietary Diversity: DDS less than or equal to three.
- Medium Dietary Diversity: DDS of four or five.
- High Dietary Diversity: DDS greater than or equal to six.

Results

Socio-demographic Information

The data on 5963 women in the reproductive age were included in the analysis. The mean (±sd) age of the respondents was 28 years (±9.4 years). More than two third (72.6%) of them were from rural areas. Most (62.6%) were married or living together with partners. Concerning educational status, more than half (61.0%) had no formal education. The socio-demographic information of the participants is summarized in Table 1.

Table 1: **Socio-demographic information of the respondents, Ethiopia, 2005**

Variables	Frequency (n=5963)	Percentage
Age in years		
15-19	1397	23.4
20-24	1089	18.3
25-29	1109	18.6
30-34	725	12.2
35-39	689	11.6
40-44	515	8.6
45-49	439	7.4
Type of place of residence		
Urban	1636	27.4
Rural	4327	72.6
Highest educational attainment		
No education	3636	61.0
Primary	1327	22.3
Secondary	861	14.4
Higher	139	2.3
Marital status		
Never married	1553	26.0
Married/Living together	3732	62.6
Widowed	253	4.2
Divorced/Separated	425	7.1
Region		
SNNP	1003	16.8
Oromiya	971	16.3
Amhara	827	13.9
Addis Abeba	676	11.3
Tigray	566	9.5
Benshagul Gumz	398	6.7
Harari	345	5.8
Gambela	339	5.7
Dire Dawa	298	5.0
Afar	283	4.7
Somali	257	4.3
Religion		
Orthodox	2858	47.9
Moslem	1895	31.8
Protestant	1023	17.2
Traditional	72	1.2
Catholic	68	1.1
Other	47	0.8
Wealth index		
Poorest	1212	20.3
Poorer	951	15.9
Middle	931	15.6
Richer	887	14.9
Richest	1982	33.2

Prevalence of Anemia

Among all respondents, the mean (±sd) blood hemoglobin level (adjusted for altitude) was 12.7 g/dl (±2.0 g/dl). Of the total, more than a quarter 1654 (27.7%) were anemic. In this study, the region-wise composition of the study population was found to vary from what is reported in the recent Ethiopia census. Few regions were over-represented while others were under-represented. Hence, the weighted prevalence (based on population size of each region) was computed as a correction. Accordingly, the weighted prevalence for any form of anemia was 27.4% (95% CI: 26.3-28.5%). The prevalence of mild, moderate and severe anemia were 17.8%, 8.2% and 1.4%, respectively.

Correlates of Anemia

The mean hemoglobin level significantly varied across age categories. The highest level of 12.9 g/dl was reported in the youngest (15-19 years) age group while the lowest level of 12.5 g/dl in 35-39 years age group. The overall pattern showed an approximately linear decline between the ages of 15-39 years (Figure 1). Compared to the youngest group, the risk of anemia is significantly higher in the age group 30-34 and 35-39 years with adjusted odds ratio (AOR) of 1.31 (95% CI: 1.07-1.60) and 1.56 (95% CI: 1.27-1.90), respectively (Table 2).

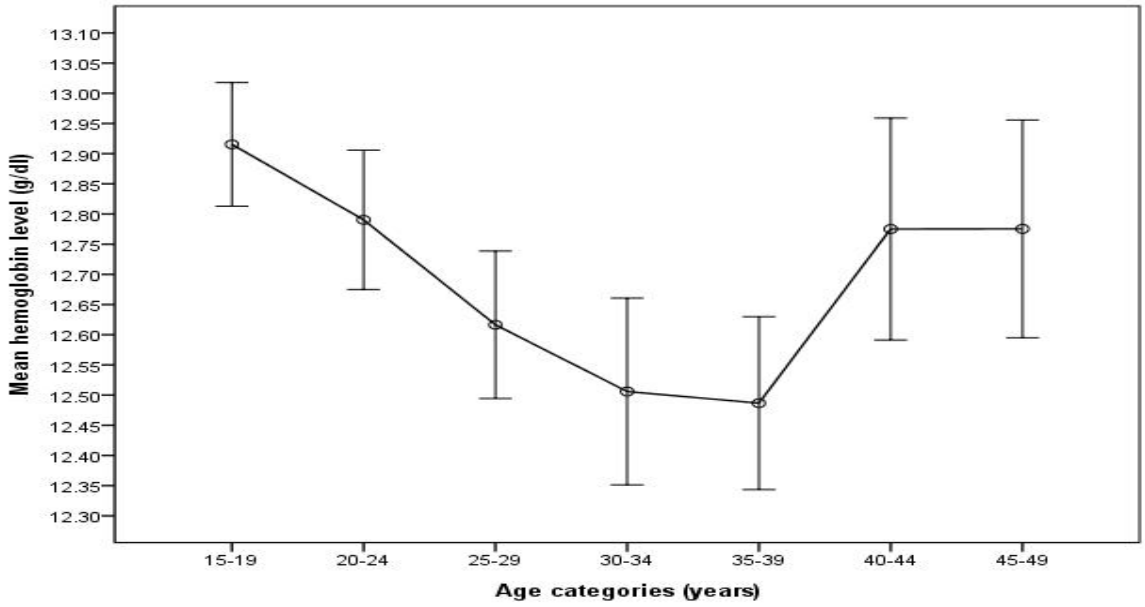

Figure 1: **Mean blood hemoglobin level with 95% CI across different age categories, Ethiopia, 2005.**

Religion, marital status and ethnicity of respondents did not have association with risk of anemia. Those women who were living in rural areas at the time of the survey were twice more likely to have anemia than urban dwellers with AOR of 1.99 (95% CI: 1.73-2.30). Compared to women beyond secondary level of education, illiterates and those who had primary level education experienced significantly higher risk of anemia with AOR of 2.59 (95% CI: 1.62-4.14) and 1.83 (95% CI: 1.13-2.96), respectively. Likewise, the better the economic status of the women the lesser risk of anemia (Table 2).

Of 2527 mothers who gave at least one birth in the preceding 3 years of the survey, only 399 (15.0%) consumed iron rich foods like meat, organ meat, fish and poultry in the reference period. The mean hemoglobin level among those who consumed iron rich foods (12.8 g/dl ± 1.9 g/dl) was significantly higher than those who didn't (12.5 g/dl ± 2.1 g/dl) (*p=0.019*). The risk of anemia was 1.3 (95%CI: 1.08-1.64) times higher among those who did not consume iron reach foods compared to their counterparts (Table 2).

The average (±sd) dietary diversity score among mothers who had at least one delivery in the preceding 3 years of the survey was 4.01 (±1.53). The majority of the respondents 1241 (49.5%) had low DDS. About 902 (36.0%) and 364 (14.5%) had medium and high DDS, respectively.

The mean DDS for pregnant and breastfeeding women were compared to other women in order to assess whether there is a better dietary diversity during these critical periods. Accordingly, the mean DDS for pregnant and non-pregnant women were found to be 3.84 and 4.03, respectively. The DDS for pregnant women was significantly lower than for non-pregnant women *(p=0.032)*. The average scores for breastfeeding and non-breastfeeding women were 3.99 and 4.08, respectively. The difference was not statistically significant.

Table 2: **Socio-demographic and nutritional variables as correlates of anemia among women of reproductive age, Ethiopia, 2005**

Variable	Non anemic	Anemic	COR (95% CI)	AOR (95% CI)**
Age	(n=4309)	(n=1654)		
15-19	1057	340	1	1
20-24	795	294	1.15 (0.96-1.38)	1.14 (0.95-1.36)
25-29	799	310	1.21 (1.01-1.44)*	1.18 (0.99-1.42)
30-34	507	218	1.34 (1.09-1.63)*	1.31 (1.07-1.60)*
35-39	457	232	1.58 (1.29-1.93)*	1.56 (1.27-1.90)*
40-44	374	141	1.17 (0.93-1.47)	1.17 (0.93-1.48)
45-49	320	119	1.16 (0.91-1.47)	1.17 (0.91-1.49)
Place of residence	(n=4309)	(n=1654)		
Urban	1335	301	1	1
Rural	2974	1353	2.02 (1.75-2.32)*	1.99 (1.73-2.30) *
Highest educational level	(n=4309)	(n=1654)		
No education	2481	1155	2.62 (1.64-4.18) *	2.59 (1.62-4.14)*
Primary	1000	327	1.84 (1.14-2.97) *	1.83 (1.13-2.96)*
Secondary	710	151	1.20 (0.73-1.96) *	1.20 (0.73-1.97)
Higher	118	21	1	1
Wealth index	(n=4309)	(n=1654)		
Poorest	773	439	2.47 (2.10-2.91)*	2.45 (2.08-2.88)*
Poorer	635	316	2.17 (1.82-2.59)*	2.15 (1.80-2.56)*
Middle	665	266	1.74 (1.45-2.09)*	1.73 (1.44-2.07)*
Richer	624	263	1.84 (1.53-2.21)*	1.82 (1.52-2.19)*
Richest	1612	370	1	1
Consumption of Iron rich foods	(n=1736)	(n=791)		
Yes	288	111	1	1
No	1448	680	1.22 (0.96-1.55)	1.34 (1.08-1.64)*
Diet diversity level	(n=1736)	(n=791)		
Low	1128	565	1.33 (1.12-1.59)*	1.33 (1.11-1.58)*
Medium or High	608	226	1	1
BMI	(n=3959)	(n=1482)		
<18.5	973	466	1.36 (1.19-1.56)*	1.36 (1.19-1.56)*
18.5-24.9	2715	956	1	1
≥ 25.0	271	60	0.63 (0.47-0.84)*	0.63 (0.47-0.84)*

** Adjusted for pregnancy status (except for BMI which was calculated among non-pregnant women).
* Significant association (p<0.05).
COR Crude Odds Ratio.
AOR Adjusted odds Ratio.

The mean hemoglobin levels for low, medium and high diet diversity (DD) categories were 12.3 g/dl (±2.1 g/dl), 12.6 g/dl (±1.8 g/dl) and 12.9 g/dl (±1.9 g/dl), respectively. One-way ANOVA indicated significant difference across the three categories *(P=0.000)*. Compared to those with medium or high DD level, the risk of anemia was 1.33 (95% CI: 1.11-1.58) times higher among those with low DD level.

Among 5444 non-pregnant women whose body height and weight measurements were available, BMI was calculated as a measure of nutritional status. Accordingly, 1518 (27.9%) had low BMI. The remaining 3595 (66.0%) and 331 (6.0%) had normal and above normal values. The mean hemoglobin levels for low, normal and overweight categories of BMI were 12.6 g/dl (±2.1 g/dl), 12.9 g/dl (±1.9 g/dl) and 13.3 g/dl (±1.9 g/dl), respectively. The difference was statistically significant *(P=0.000)*. Compared to those with normal BMI, women with low BMI were 1.36 (95% CI: 1.19-1.56) times more likely to have anemia (Table 2).

About 474 (7.9%) of all women were pregnant at the time of the survey. The hemoglobin level among pregnant women was 11.7 g/dl (±2.1 g/dl) and about 33.1% (95%CI: 28.9-37.3%) were anemic. Compared to non-pregnant, pregnant women had higher risk of anemia with OR of 1.32 (95%CI: 1.08-1.61). The mean hemoglobin levels in the second and third trimesters were significantly lower than that of the corresponding value in the first trimester. Neither receiving ANC nor Iron-folate supplement during the pregnancy was associated with reduction in the risk of anemia (Table 3).

About one-third, 1962 (32.9%) of respondents were breastfeeding at the time of the survey. The mean hemoglobin level among breastfeeding mothers was 12.6 g/dl (±2.0 g/dl) and 31.3% (95% CI: 29.2-33.4%) of them were anemic. Compared to non-lactating mothers, lactating mothers had significantly higher risk of anemia with OR of 1.30 (95% CI: 1.16-1.47).

Table 3: **Hemoglobin level among pregnant women across potential determinants, Ethiopia, 2005**

Variable	Frequency	Hemoglobin level (g/dl) (Mean ± SD)	P value of ANOVA or Independent t-test
Gestational age	**(n=474)**		
1st trimester	97	12.2 (±2.3)	
2nd trimester	187	11.5 (±2.1)	0.035*
3rd trimester	190	11.5 (±1.8)	
Received ANC	**(n=341)**		
Yes	91	11.6 (±2.2)	0.946
No	250	11.6 (±1.8)	
Fe-Fol supplementation	**(n=340)**		
Yes	28	11.4 (±1.9)	0.683
No	312	11.6 (±1.8)	

The association between duration of breastfeeding and risk of anemia was assessed among 2247 mothers who had given one or more births in the preceding 3 years of the survey and had already ceased nursing. The mean hemoglobin levels for those who breastfed for less than 6 months, 6-11 months and 12 or more months were 12.3 g/dl (±2.4 g/dl), 12.6 g/dl (±1.9 g/dl) and 12.5 g/dl (±2.0 g/dl), respectively. The difference was not statistically significant.

With reference to respondents who had given no birth before, those with 1-2, 3-5 and more than 5 children had 1.47, 1.51 and 1.86 times higher risk of developing anemia. As the number of children born in the preceding 5 years of the survey increased, the risk of anemia also increased. Likewise, those women who gave birth in the month of the interview were 2.24 times more likely to develop anemia than their counterparts (Table 4).

Among 1362 women of reproductive age who gave two or more births in the preceding 5 years of the study, the effect of birth interval between the recent two births on risk anemia was assessed. However, no significant association was witnessed (Table 4).

Current use of contraceptives was associated with reduced risk of anemia. Those who were not using contraceptive were 1.36 times more likely to develop anemia than users. Among users, mean hemoglobin level did not vary significantly across contraceptive types (Table 4).

Among 988 mothers who delivered in the preceding 6 months of the survey, the effects of postnatal care, place of delivery and postpartum vitamin A supplementation history were assessed. However none of the variables were correlated with the risk of anemia (Table 4).

Table 4: **Potential reproductive health related correlates of anemia among women of reproductive age, Ethiopia, 2005**

Variable	Non anemic	Anemic	OR (95% CI)	AOR (95% CI)**
Children ever born (CEB)	(n=4309)	(n=1654)		
0	1502	433	1	1
1-2	884	376	1.48 (1.26-1.73)*	1.47 (1.20-1.80)*
3-5	1034	427	1.43 (1.23-1.73)*	1.51 (1.19-1.91)*
>5	889	418	1.63 (1.39-1.91)*	1.86 (1.40-2.49)*
CEB in the preceding 5 years	(n=4309)	(n=1654)		
0	2275	717	1	1
1	1100	507	1.46 (1.28-1.67)*	1.37 (1.16-1.63)*
2	802	355	1.40 (1.21-1.63)*	1.31 (1.06-1.63)*
3 or more	132	75	1.80 (1.34-2.42)*	1.70 (1.22-2.37)*
Gave birth in the month of the interview	(n=4309)	(n=1654)		
Yes	4285	1634	2.19 (1.20-4.00)*	2.24 (1.23-4.07)*
No	24	20	1	1
Time interval between the recent two births in the last 5 yrs	(n=932)	(n=430)		
9-17 months	96	48	1.14 (0.78-1.65)	1.14 (0.78-1.66)
18-23 months	158	84	1.21 (0.90-1.63)	1.21 (0.90-1.61)
24 or more months	678	298	1	1
Current contraceptive use	(n=4309)	(n=1654)		
No	3743	1514	1.60 (1.32-1.95)*	1.36 (1.11-1.66)*
Yes	566	140	1	1
Place of delivery	(n=658)	(n=330)		
Health institutions	58	16	1	1
Home	600	314	1.90 (1.07-3.36)*	1.02 (0.52-2.01)
Received vitamin A supplementation in the postpartum period after recent birth	(n=658)	(n=330)		
Yes	140	61	1	1
No	518	269	1.19 (0.85-1.67)	1.05 (0.75-1.48)
Had postnatal checkup	(n=600)	(n=314)		
Yes	17	8	1	1
No	583	306	1.15 (0.48-2.61)	0.91 (0.38-2.20)

* Significant association (p<0.05).
** Adjusted for place of residence, educational status, wealth index.
COR Crude Odds Ratio.
AOR Adjusted Odds Ratio.

Discussion

More than a quarter of Ethiopian women of reproductive age were anemic. With reference to the WHO cutoff points (3), the magnitude indicates moderate public heath significance of anemia in Ethiopia. A recent study by Umeta et al (11) also documented a comparable prevalence of 30.4%. Likewise, in 2006 MI Ethiopia estimated the prevalence as 27.0% (8). Among pregnant women about one third were anemic. This figure is higher than the 2002 estimate of UNICEF (17.4%) (25) and what has been documented by Hayder et al (18.4%) in 1999 (7). The findings over the decade did not witness tangible progress in the reduction of anemia in Ethiopia.

Women aged 25-39 years had the highest risk of anemia. This might be due to the fact that the age category is fertility intensive in women's life. According DHS Ethiopia 2005, approximately 60% of all births occurred in this age category (9). Studies conducted so far reported various patterns of association between age and of anemia. Studies in Ethiopia (10) and Tanzania (13) reported higher prevalence in older age groups. A study in Mexico documented higher prevalence in the 20-29 years of age than the younger or older age categories (15); while, studies in Tanzania (18), Nigeria (14) and India (17) failed to witness any association.

Regarding other socio-demographic factors, being from lower economic and education category, and living in rural areas were identified as predisposing factors to anemia. Hence, empowering women in terms of education and economic status would have positive contributions to avert the problem.

The negative effect of women's reproductive role in causing anemia is clearly witnessed in this study. The risk of anemia was directly associated with cumulative fertility, fertility in the preceding five years of the survey and history of birth in the month of the interview. Similar studies in Ethiopia (7), Indonesia (26) and Mexico (15) also documented such association between parity and risk of anemia. The positive contribution of contraceptive use also provides supportive evidence in this regard.

Pregnancy is the most nutritionally demanding period in a woman's life. Consequently, pregnant women are advised to eat more diversified diet than usual. However, this wasn't the case in Ethiopia. The level of diet diversity among pregnant women was significantly lower

than non-pregnant women. One possible explanation might be the presence of food taboos during pregnancy. According to a study in southern Ethiopia, 65% of women avoided at least one food type during their recent pregnancy (27).

The role of breastfeeding as a predisposing factor for anemia is also overt in this study. Breastfeeding mothers were 1.3 times more likely to have anemia than non-breastfeeding mothers. A study in Mexico reported a similar but stronger association (2.5 times higher risk) (15). Despite the scientific understanding that more diversified diet is needed during lactation, in this study the level of diet diversification among breastfeeding mothers was not better than non-breastfeeding mothers.

As pregnancy and delivery increase the risk of anemia, various components of maternity care are expected to mitigate this vulnerability. Providing of antenatal, postnatal care and skilled delivery attendance are believed to have beneficial contributions. However, this was not the case in the present study. Having one or more ANC, delivering at health institutions or having PNC did not contribute to the reduction of risk of anima.

Similarly, among pregnant women taking iron-folate supplement did not contribute to lessening the risk of anemia. However, this is not consistent with the scientific understanding that the supplement is effective in improving the hematologic indices of pregnant women (28-30). This unexpected finding might be due noncompliance of study subjects to regimen of the supplementation. According to DHS 2005, only 11% of Ethiopian pregnant women took iron-folate supplement during their recent pregnancy and nearly all of them took the supplement for not more than 60 days (9).

Vitamin A deficiency can contribute to anemia as retinol and its metabolites are involved in the formation of erythrocytes and mobilization of stored iron (21). However, such a finding was not witnessed in this study. Among women who gave birth in the preceding 6 months of the survey, postpartum vitamin A supplementation was not associated with the risk of anemia.

Conclusion and Recommendation

Anemia has moderate public health significance in Ethiopia. The overall level of diet diversity and consumption of iron rich foods were enormously low. DDS was even lower among pregnant women. Living in rural areas, being from the lower economic and educational status categories were important predisposing factors to anemia. Breastfeeding and high parity increases risk of anemia significantly; whereas, contraceptive use reduces the risk. Utilization of maternity services, taking iron-folate supplement during pregnancy and vitamin A supplement in the postpartum period did not significantly associate with the reduction of the risk of anemia.

Family planning contributes crucially in reducing the burden of anemia in women of reproductive age. Economic and educational empowerments of women have affirmative inputs in this regard. A combination of nutrition education and livelihood promotion strategies should be instated to enhance diet diversity especially during pregnancy and breastfeeding. Maternal nutrition interventions should be integrated into maternity services. The compliance of Ethiopian mothers to prenatal iron supplement should be assessed.

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