CORRELATES OF ANEMIA STATUS AMONG WOMEN OF REPRODUCTIVE AGE IN ETHIOPIA

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Abstract

Background: Anemia is a condition characterized by a low level of hemoglobin in the blood which seriously affects young children and women (1). It is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development.

Objective: To identify socio-economic, demographic and health correlates of anemia status among women of reproductive age in Ethiopia.

Methods: Data from the Ethiopian Demographic and Health Survey conducted in 2011 was used for this study. Data of a total of 15,567 women of reproductive age were included in the analysis. The prevalence of anaemia was calculated and chi-square tests, odds ratios and binary logistic regression were used to identify the relationship between anemia and each independent variable.

Results: The overall prevalence of anemia in the women aged 15-49 years was 19.9 %. Total number of children born, BMI, region, educational level, wealth index, pregnancy, months of breast feeding and contraceptive use were significantly correlated with anemia. Utilizing

maternity services, receiving iron tablet and drug use for intestinal parasite have a significant effect in reducing the risk of anemia. The exposure of anemia increases with gestational age among pregnant women.

Recommendation: Women health intervention programs including access to maternal health care service, iron supplementation, drug use for intestinal parasite, improving mothers' access to education and family planning practice have been strongly recommended in order to reduce the risk of anemia among women.

Keywords: Anemia, Ethiopia, Women, Ethiopian Demographic and Health Surveys

Introduction

Globally, anemia affects 1.62 billion people, which corresponds to 24.8% of the total population. The highest prevalence is in children (47.4%), and the lowest prevalence is in men (12.7). However, 35% of women in the world are affected by anemia (1).

In Africa, 67.6% of per-school age children, 47.5% non pregnant women and 57.1% pregnant women were affected by anemia (2). During pregnancy, approximately 75% all anemias diagnosed are due to iron deficiency (4). It is estimated that, each year, 271, 000 deaths and 10,140,000 disability-adjusted life years are attributable to iron deficiency anemia in Africa (3).

Iron deficiency is the most prevalent cause of anemia with an estimated 50% of anemia cases attributable to iron deficiency. The main risk factors for anemia include a low intake of iron, poor absorption of iron from diets high in phytate or phenolic compounds, and period of life when iron requirements are especially high (2). Nutritional deficiencies, acute and chronic inflammation, parasitic infections, and inherited or acquired disorders that affect hemoglobin synthesis, red blood cell production or red blood cell survival, can all cause anemia (1,16).

Hemoglobin measurement provides a prospect to estimate the prevalence of anemia (5) by adjusting hemoglobin level for altitude and smoking status using the formula recommended by Centers for Disease Control and Prevention (6, 17). Anemia was defined as Hemoglobin lower than 12.0 g/dl in non-pregnant women and lower than 11.0 g/dl in pregnant women (1).

Methods

Study area: Ethiopia is situated in the Horn of Africa between 3 and 15 degrees north latitude and 33 and 48 degrees east longitude. Ethiopia is administratively subdivided into nine regional states and two city administrations (7,CSA, 8).The total area of the country is about 1.1 million square kilometres with 83 million populations in 2007 and life expectancy at birth is about 54 years for women and 51 years for men (22).

The total fertility rate for the three-year period preceding the survey is 4.8 children per woman. The maternal mortality rate was 676 deaths per 100,000 live births, which is one among the highest in the world with only 10% of Ethiopian mothers delivering in health institutions and, ANC and PNC coverage are 34% and 8%, respectively (6).

A large part of the country is high plateau and mountain ranges. It's topographic features range from 4,550 metres above sea level to 110 metres below sea level (20). The climatic condition of the country varies with the topography, with temperatures as high as 47 degrees Celsius in the Afar Depression and as low as 10 degrees Celsius in the highlands (6).

Agriculture accounts for 43 percent of the gross domestic product (20). With average population growth rate of 2.6 percent, the GDP growth rate of Ethiopian economy was 8.4 percent (6).

Data Source: The research utilized 2011 EDHS data as a secondary source that was conducted under the agency of the Ministry of Health and was implemented by the Central Statistical Agency from September 2010 through June 2011.

The 2011 EDHS sample was selected using a stratified; two-stage cluster design and enumeration areas from the 2007 Population and Housing Census sample frame were the sampling units for the first stage. The sample included 624 enumeration areas: 187 in urban centers and 437 in rural areas. But 18 selected EAs of Somali region were not interviewed due to drought and security problems.

Data Analysis: The data analysis was done by using SPSS for windows version 20. Frequencies and percentage were used for the descriptive analysis. The variables were then assessed for their association with anemia using the chi-square test. Those variables found to have a significant association with anemia ($P < 0.05$) were then entered into logistic regression analysis. Binary logistic regression was employed to control potential confounders so that it is possible to employ plausible statistical tools for estimating the magnitude of the association between the anemia status of the women as a function of independent predictor variables. Variables were entered into the model using the "enter" method. The model coefficients were estimated using the maximum likelihood estimation method. During the analysis, the fitness and statistical assumptions of the model were checked to be satisfied. The adequacy of the fitted model was checked for possible presence and treatment of outliers, and influential cases.

Ethical consideration

Permission to undertake the studies was obtained from the Ethical Committees of Hawassa University. 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 EHNRI Review Board, the National Research Ethics Review Committee (NRERC) at the Ministry of Science and Technology, the Institutional Review Board of ICF International, and the CDC.

Results

Overall, 15,567 Ethiopian women were included in analysis of whom 1226 (7.9 %) were pregnant. The overall prevalence of anemia in the women was 3103 (19.9%) The prevalence of mild (Hb level 11.0 -11.9 g/dl) and moderate anemia (Hb level 8.0-10.9) was 2249(14.4%) and 718 (4.6%) respectively. However, the rates of severe anemia (hemoglobin level below <7.0 g/dl) among women was only 136 (0.9%). In this study, the prevalence of anemia was found to vary from what is reported in the recent Ethiopia Demographic and Health Survey report.

There was a substantial difference in the prevalence of anemia between non-pregnant women and pregnant women. 353(28.2%) of pregnant women were anemic where the prevalence of mild (Hb level 10-10.9 g/dl), moderate (Hb level 7.0- 9.9 g/dl) and severe anemia (Hb level 4.0-6.9 g/dl) was 162(13.2%), 166(13.5%) and 25(2%), respectively. In the random sub-sample of pregnant women, the prevalence of anemia was found to be 428(34.9%) during first trimester, 553(45.1%) during second trimester and 245(20%) during third trimester of gestational age.

The prevalence of anemia also varied from one region to the other (P<0.05). The highest proportion of women with anemia was recorded in Somali 354(43.5%), and the lowest prevalence was recorded in Addis Ababa 154(10.1%). Higher numbers of anemic women 2417(22.4%) reside in rural areas and relatively smaller numbers of anemic women 686(14.4%) reside in urban centers.

7886(50.7%) of women were uneducated mothers with 1990(25.2%) prevalence of anemia, 55620(35.7%) of women had Primary education with 875(15.7%) anemia cases and the remaining 2119(13.6%) had secondary and higher education with 238(11.2%) prevalence of anemia.

Wealth index is a composite measure of the cumulative living standard of a household used as a proxy for socio-economic status. It was calculated using household's ownership of selected assets by CSA. The result on Table 4.1 indicates that Wealth index was found to have a significant association with anemia and 992(27.5%), 509(21.7%), 451(20.6%),

445(18.6%) and 706(14%) of Women from poorest, poor, middle, rich and richest households were anemic, respectively.

Table 1: **Socio - demographic information of the respondents, Ethiopia, 2011**

	Category	Count	Percent
Woman's age	15-19	3620	23.3
	20-29	5837	37.5
	30-39	3817	24.5
	40-49	2293	14.7
Educational level	No education	7886	50.7
	Primary	5562	35.7
	Secondary and above	2119	13.6
Body mass index	Less than 18.5 kg/m^2	4198	27.1
	18.5-24.9 kg/m^2	10095	65
	More than 25 kg/m^2	1221	7.9
Religion	Orthodox	6993	44.9
	Protestant	2811	18.1
	Muslim	5763	37
Place of residence	Urban	4780	30.7
	Rural	10787	69.3
Wealth index	Poorest	3608	23.2
	Poor	2344	15.1
	Middle	2187	14
	Rich	2388	15.3
	Richest	5040	32.4
Number of Children born	Less than 4 children	10131	65.1
	4-6 children	3234	20.8
	More than 6 children	2202	14.1
Contraceptive use	Not used	12783	82.1
	Used	2784	17.9
Antenatal visit	No	4059	26.1
	Yes	3378	21.7
Duration of breast feeding	Less than 6 months	1311	8.4
	More than 6 months	3262	21.0
	Not breast feeding	2864	18.4
Place of delivery	Health institution	1223	7.9
	Home	6214	39.9
Drug use	No	7030	45.2
	Yes	407	2.6
Given iron tablet	No	5834	37.5
	Yes	1603	10.3

The prevalence of anemia was 1785(17.6%) for women with less than three children, 774(23.9%) for women with 3-5 children and 544(24.7%) for women with more than five children. Women who were using contraceptive method had lower risk of anemia 324 (11.6%) compared to non- users 2779 (21.7%).

The prevalence of anemia was 878(13.3%) for orthodox women, 448(15.9%) for protestant women, 1696(29.4%) for Muslim 81(19.9%) for other religious followers. The prevalence of anemia among married, unmarried and widowed/divorced or separated women were 959(13.7%), 448(15.9%) and 1696(29.4%), respectively.

The proportion of anemic status of women for underweight, normal and overweight categories of body mass index were 1001(23.8%), 1917(19%) and 185(15%) respectively.

Among 7,437 mothers who gave at least one birth in the preceding 5 years of the survey, women who had delivered at home had higher risk of anemia 1588 (25.6%) compared to those women who had delivered at health institutions 182(14.7%). The proportion of anemic women who had antenatal visit during pregnancy was less 581(17.6%) compared to anemic women who did not have antenatal visit during their pregnancy 1189(28.8%).

Women, who received iron tablet/syrup, had lower risk of anemia 290(17.7%) than women who did not receive iron supplementation 480(25.5%). The prevalence of anemia was also higher among women who did not use drug for intestinal parasite 1703(24.4%) than anti intestinal parasite user 67(14.9%).

Logistic regression model was fitted using the SPSS package after adequacy of the model was checked by Goodness of fit of the Models such as Likelihood ratio Test, Hosmer-Lemeshow Test Statistic, Omnibus Test of model Coefficients and Classification table at 5% level of significance.

The bivariate association between anemia status of women and independent variables indicates that anemia status was strongly correlated with total number of children born, body mass index, region, educational level, wealth index, pregnancy, months of breast feeding, place of delivery, antenatal visit, taking iron tablet, postnatal check up, contraceptive use and drug use for intestinal parasite. Religion, age, marital status and place of residence of respondents did not have significant association with risk of anemia.

Table 2: **Socio - demographic and health care variables as correlates of anemia among women in Ethiopia, 2011**

Variable	Non anemic		Anemic		OR (95% CI)
	N	%	N	%	
Number of Children					
Less than 4 children	8346	82	1785	18	0.55 (0.36,0.83) *
4-6 children	2460	76	774	24	0.56 (0.37, 0.85) *
More than 6 children	1658	75	544	25	1
Body Mass Index					
Less than18.5 kg/m²	3217	76	1002	24	1.9 (1.38,2.6) *
18.5-24.9 kg/m²	8208	81	1920	19	1.48 (1.09,2) *
More than 25 kg/m²	1039	85	181	15	1
Educational level					
No education	5896	75	1990	25	2.17(1.46,3.21) *
Primary	4687	84	875	16	1.73 (1.16,2.56)*
Secondary and above	1881	89	238	11	1
Wealth Index					
Poorest	2616	73	992	28	1.59 (1.2,2.1)*
Poor	1835	78	509	22	1.66 (1.25,2.21*
Middle	1736	79	451	21	1.47 (1.1,1.96)*
Richer	1943	81	445	19	1.34 (1.02,1.77)*
Richest	4334	86	706	14	1
Pregnancy Condition					
Pregnant	873	71	353	29	1
Not pregnant	11591	81	2750	19	0.71 (0.59,0.86)*
Duration of Breast feeding					
Less than 6 months	1028	69	454	31	1.47 (1.24,1.73)*
More than 6 months	2612	80	660	20	0.49(0.82,1.09)
Not breast feeding	2027	76	656	25	1
Place Delivery					
Health Institution	1054	85	182	15	0.77 (0.61,0.98)*
Home	4613	74	1588	26	1
Antenatal visit					
No	2939	71	1189	29	1.17 (1.02,1.34)*
Yes	2728	82	581	18	1
Iron tablet					
No	4321	75	1480	26	1.3 (1.11,1.53)*
Yes	1346	82	290	18	1
Postnatal					
No	5284	76	1703	24	0.76 (0.61,0.96)*

Yes	383	85	67	15	1
Contraceptive use					
Not used	10004	78	2779	22	1.38 (1.16,1.65)*
Used	2460	88	324	12	1
Drug use					
No	5284	76	1703	24	1.45 (1.1,1.9)*
Yes	383	85	67	15	1

The vulnerability of women by anemia was considerably associated with their body mass index. Compared to those with overweighed body mass index, women with low BMI were 1.9 (95% CI: 1.38- 2.6) times more likely to had anemia. The odds of having anemia for normal Body Mass Indexed women were 1.48 times high as compared to over weighted women.

The relationship between wealth index and anemia status was also significant. It can be observed from Table 4.2 that the risk of anemia was increased with wealth index from poorest to poor and decreased from middle to rich at 5% level of significance. The odds ratio indicates that women with poorest, poor, middle, and rich economic status were 1.59, 1.66, 1.47 and 1.34 times more likely vulnerable to anemia than women with richest wealth index.

The risk of anemia was high for illiterates with OR 2.17, (95% CI: 1.46-3.21) and women who had primary education were 1.73 times (95% CI 1.16-2.56) more likely at danger compared to secondary and above educated women. Women who gave more children were higher risk of experiencing anemia. Respondents who born less than three children were 0.55 times lower risk of developing anemia than who born more than five children. Women who born three – five children were 0.56 times less exposed to anemia than women who born more than five children.

Current use of contraceptives was associated with reduced risk of anemia. Those who were not using contraceptive were 1.38 times more likely to develop anemia than contraceptive users. Compared to pregnant, the risk of anemia was less in non pregnant women with OR 0.71, (95% CI: 0.59-0.86). Breastfed mothers were also at increased risk of anemia compared to mothers who were non breastfed. Woman who breast feed their child for six months was 1.47 times more likely to have anemia than non breast feeders.

There was statistical correlation between maternity health care services and anemia. Antenatal visit during pregnancy, place of delivery, taking iron tablet during pregnancy and receiving drug for intestinal parasite were statistically correlated with anemia among 7,437 mothers who gave at least one birth in the preceding 5 years of the survey. Woman who had no antenatal visit during her pregnancy was 1.17 (95% CI 1.02-1.34) times more likely to have anemia than who had antenatal visit during her pregnancy. The odds of having anemia in women who had delivered at health institution were 0.77 (95% CI 0.61-0.98) times less than those women who had delivered at home. Women are supplemented with iron during their pregnancy in order to decrease the risk of anemia. Women who did not receive iron tablets/syrup during pregnancy and drug for intestinal parasite were, 1.3 (95% CI 1.11-1.53) and 1.45 (95% CI 1.1-1.9) times more likely to have anemia than their counter part, respectively.

Correlates of anemia were considered for pregnant women to examine the effect of independent variable at the time of survey. It can be seen from Table 4.3 that anemia status of a pregnant woman was significantly correlated with Body Mass Index, gestational age, wealth index, educational level, antenatal visit, receiving iron tablet and drug use for intestinal parasite. Total number of children born, religion, place of residence and marital status were not significantly correlated with anemia among pregnant women at the time of data collection at 5% level of significance.

The odds of having anemia were increased by a factor of 4.43 (95% CI 1.89-10.37) and 2.2 (95% CI 1.05-4.61) for being underweight and normal body weight respectively relative to overweighed woman.

Compared to pregnant women with secondary and above level of education, illiterates and those who had primary education experienced significantly higher risk of anemia with OR of 0.65 (95% CI: 0.33- 1.27) and 0.52 (95% CI: 0.25- 1.06), respectively.

Table 3: **Socio - demographic and health care variables as correlates of anemia among pregnant women Ethiopia, 2011**

Variable	Non anemic		Anemic		OR (95% CI)
	N	%	N	%	
Body Mass Index					
Less than18.5 kg/m²	79	66.9	39	33.1	4.43 (1.89 10.37)
18.5-24.9 kg/m²	690	70.6	288	29.4	2.2 (1.05 4.61)
More than 25 kg/m²	104	80	26	20	1
Gestation					
1st trimester	333	77.8	95	22.2	0.33 (0.2 0.55)
2nd trimester	373	67.5	180	32.5	0.79 (0.55 1.14)
3rd trimester	167	30.4	78	31.8	1
Education					
No education	531	67.5	256	32.5	0.65 (0.33 1.27)
Primary	281	77.2	83	22.8	0.52 (0.25 1.06)
Secondary and above	61	81.3	14	18.7	1
Wealth Index					
Poorest	268	68	126	32	3.17 (1.41 7.16)
Poor	143	68.8	65	31.2	4.72 (2.01 11.06)
Middle	126	71.2	51	28.8	3.31 (1.40 7.82)
Richer	146	74.1	51	25.9	1.93 0.82 4.56
Richest	190	76	60	24	1
Antenatal visit					
No	370	65.8	192	34.2	1.55 (1.06 2.27)
Yes	254	74.5	88	25.7	1
Iron tablet					
No	502	68.2	234	31.8	2.29 (1.35 3.89)
Yes	122	72.6	46	27.4	1
Drug use					
No	590	68.2	273	31.8	6.65 (1.51 9.25)
Yes	34	87.2	5	12.8	1

The relationship between antenatal visit during pregnancy and anemia status was important. Hence, women who did not have antenatal visit during their pregnancy were, 1.55 (95% CI 1.06-2.27) times more likely to develop anemia than their reference group. The result of odds ratio for age of conception revealed that first trimester was 0.33 (95% CI 0.2-0.55) times less likely exposed to anemia compared to third trimester.

The risk of anemia was high for pregnant women at lower economic status. Pregnant women with poorest, poor and middle economic status were 3.17(95% CI 1.41-7.16), 4.72 (95% CI 2.01-11.06) and 3.31 (1.4-7.82) times at a higher risk of developing anemia than richest economic status, respectively. But there was no significance difference between richer and richest economic status regarding the vulnerability of anemia.

Compared to pregnant women who were taken iron, those who were not received iron supplementation experienced significantly higher risk of anemia with OR of 2.29 (95% CI: 1.35- 3.89). The likelihood of positive anemia status was 6.65 (95% CI 1.51-9.25) times high for pregnant women who did not receive drug for intestinal parasite compared to drug users.

Discussion

This study was intended to identify socio-demographic and health correlates of anemia in Ethiopia based on EDHS 2011 data. The criteria for determining the presence of anemia is based on hemoglobin cut-off values for age and sex with additional adjustments for assessing the severity and magnitude of the problem in Ethiopia. Women with higher probability of occurrence of these determinant factors would be inferred to be most likely to experience anemia.

The likelihood of having anemia for women in Addis Ababa, Oromiya, SNNP, Dire Dawa, Benishangul Gumuz were not significantly different from women in Harari regional state. Women in Tigray regional state were less likely to have anemia than the women living in Harari region. Women who live in Somali, Benishangul Gumuz, Amhara and Afar regions were more likely experienced anemia than women in Harari regional state. This regional discrepancy in anemia was due to the difference in iron intake among mothers and the proportion of mothers that received drug for intestinal parasite varies across regions (6). Additionally cultural food and eating habits of the peoples varies among different ethnic groups as most of the regions are occupied by the identical ethnic groups with similar eating tradition (9).

There was a significant difference in the risk of anemia status of mothers by educational level. The risk of anemia was higher for mothers who were uneducated and who had primary educational level than secondary and higher educated women. This finding is

supported with other studies which indicated that education improves the ability of mothers to implement simple health knowledge and facilitates their capacity to manipulate their health and nutritional status (3,10, 11).

The risk of anemia was increased as the number of children born increases. The study revealed that anemia among women was significantly correlated with duration of breast feeding. Mothers who breast fed their child was more likely vulnerable to anemia than non breast feeders. This finding is in agreement with other studies (11, 18).

Woman economic status was also an important socio-economic variable that affects anemia status of mothers in Ethiopia. Women in low wealth index were found to be at a higher risk of anemia problem than women from richest economic status. This finding is supported by previous studies that revealed the direct effects of poverty that result in insufficient diet have all been associated with poor health outcomes for the poorest women had the greatest risk of anemia (10).

The experience with anemia was significantly correlated with body mass index of the woman. Compared to over weighted, normal BMI and underweighted women had significantly higher risk of anemia. This finding is also in agreement with studies done in Mali that showed Women with BMI greater than 25 kg/m^2 appeared at lower risk of anemia, which could suggest that having a diet providing sufficient energy to maintain body weight within normal limits does not suffice in supplying iron (3). Furthermore, as energy intake became insufficient and BMI fell below 18 .5kg/m^2 the risk of being anemia increased. This overall association between BMI and risk of anemia appears to point towards the need to develop interventions to increase available iron in the diet (3). However, other studies in different context have reported a higher risk of anemia among obese women (12).

The risk of anemia was significantly high for women who did not receive iron supplementation during their pregnancy. This finding is consistent with the report of the previous study taking iron tablets significantly and positively associated with hemoglobin concentration in pregnant women (13, 19).

The risk of anemia was also high for women who didn't receive drug for intestinal parasite during their pregnancy. Providing women with anti intestinal parasite reduces the risk of

anemia since intestinal parasites such as hookworm infection is described to be one of the principal causes of anemia. This finding is in agreement with a study done in Ethiopia which indicate intestinal drug lowers the chance of exposure of women by anemia (14). But other study suggested that intestinal parasite was less likely to be the causative agent of anemia implying that anemia is mainly caused by dietary factors in Ethiopia (9).

Women who didn't have antenatal visit during their pregnancy and who had delivered at home were more likely in danger than those who had antenatal visits and delivered at health institution. The result also indicates that first trimester was less likely exposed to anemia compared to third trimester. This finding is consistent with previous investigations that show the occurrence of anemia increases with gestational age (14, 11, 15,23).

Conclusion

The prevalence of anemia in women has decreased from 27 percent to 19.9 percent in last five years. The prevalence of anemia was high for uneducated and less educated women in Ethiopia. However, the current prevalence falls within the high risk category according to the epidemiological criteria set by the WHO and thus still remains a moderate public health problem in Ethiopia.

The main predictors of anemia were being from the lower economic status, gestational age, lower educational status, months of breastfeeding, Body Mass Index and having three or more living children five years prior to the survey.

Utilization of maternity service was significantly associated with the reduction of the risk of anemia. The prevalence of anemia was high in third trimester. The risk of anemia was high for pregnant women who did not attend antenatal visit, delivered at home and who did not have postnatal check up after delivery. Anemia among pregnant women has association with absence of receiving iron during pregnancy and drug for intestinal parasite.

Recommendations

Improvement of mothers' access to education and economic empowerment contributes crucially in reducing the risk of anemia in Ethiopia.

It is necessary for women to receive effective health care service and examination to guarantee timely intervention. Pregnant women should be encouraged to have regular antenatal follow up and they should give their birth at health institution.

Routine iron supplementation during pregnancy is the opportunity to improve the maternal iron stores. Thus, efforts should be made to communicate through different programs, such as health and nutritional education and thereafter introducing other supplementary nutrient rich with iron and also women are advised to take drugs for intestinal parasite.

Health education on family planning information should be given to women and they are advised to have sufficient energy providing diet to maintain body weight as well as they should use contraceptive method and adopt consistent time of breastfeeding their infants so that they should not be expose to anemia.

Acknowledgements

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