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Prevalence and Associated Factors of Anemia among Women of Reproductive Age Group in Ethiopia, Evidence from 2016 Ethiopian and Health Survey

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Abstract

Background: Anemia is a global public health problem affecting both developed and developing countries. "The consequences of anemia increase the risk of adverse pregnancy outcomes, including maternal and neonatal mortality. The aim of this study was to determine risk factors of Anemia among reproductive age women in Ethiopia.

Method: A cross-sectional study was carried out based EDHS 2016. A total of 9416 reproductive age women were included in the analysis. Since, the outcome variable is binary; the appropriate model used was binary logistic regression.

Results: The overall prevalence of anemia among studied women was 27.8%, of which 19.3%, 6.7% and 1.8% had mild, moderate and severe respectively. Region, Place of residence, educational and economic status, 35-45 years of age, diet diversity, fruit/vegetable consumption, iron riche foods, BMI, ANC, contraceptive and numbers of children were statistically significance factors of women to suffer anemia. Rural women and those who were pregnant during the interview had 1.5 (95% CI: 1.3-1.7) and 2.5(95% CI: 2.1-2.9) times higher risk of anemia than counterparts respectively. Women who didn't use contraceptive (AOR =1.9, 95% CI: 1.6-2.2), didn't use ANC (AOR = 2.2, 95% CI: 1.9- 2.6), didn't take iron riche foods (AOR= 1.9, 95% CI: 1.5-2.3), didn't eat fruit/vegetable (AOR =1.5,95% CI 1.2-1.8), ate low diet diversity (AOR=1.6, 95% CI: 1.3-1.9) were more likely to develop anemia than counter parts.

Conclusion: The prevalence of anemia among women in reproductive age is still high in Ethiopia. Family planning, ANC during pregnancy, iron riche foods and educational empowerment of women has positive contribution in struggle anemia.

Key words/Phrases: Anemia, Risk Factors, Women of Reproductive Age, Ethiopia

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1. Introduction

Anemia is defined as a condition in which there is under a normal hemoglobin level in the body, which decreases oxygen-carrying capacity of red blood cells to issues [1]. It is a global public health problem for both developing and developed countries with major consequences on human health as well as social and economic development [1, 2]. It occurs at all stages of the life cycle but is more prevalent in reproductive age women and young children. Although the prevalence of anemia is estimated at 9% in countries with high development, in countries with low development, the prevalence is estimated as 43% [3]. According to World Health Organization (WHO), in 2014, an estimated 1.62 billion people worldwide exposed to anemia. Children and women of childbearing age are unfortunately the most exposed with a global anemic prevalence of 43% in children under five, 38% in pregnant women and 30% in non-pregnant women aged 15 to 49 years [3-4].

Nutritional anemia is a major public health problem worldwide particularly in developing countries among women of reproductive age. Nutritional anemia is defined by WHO as "a condition in which the hemoglobin content of blood is lower than normal as a result of deficiency of one or more essential nutrients regardless of the cause of such deficiency. Nutritional anemia attributes to high maternal mortality, high incidence of low-birth weight babies and fetal wastage [5].

Iron is one of the minerals required by our body to carry out some of the essential functions. The basic function of iron is to transport oxygen from lungs to cells in our body and is an essential requirement of the body. Anemia is detected by a hemoglobin concentration less than a certain recommended level. According to WHO the recommended Hemoglobin level, for non-pregnant women (age 15 and over) is 120 gm/L and for males (15 years and over) it is 130 gm/L. Anemia prevalence in the poorest as compared to richest is twice high in many countries. It is mainly caused by iron deficiency in all developing countries, including Africa, where consumption of iron is limited [6]. It is also a similar situation of iron consumption in Ethiopia.

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as economic development. Anemia among reproductive age women is one of the most common preventable causes of maternal morbidity and poor prenatal outcome. It is considered as largely preventable and easily treatable if it is detected in time and strategies for its prevention and control are well documented. Previous studies have reported variations in anemia prevalence and associated risk factors on women of childbearing age which makes it difficult to electively address the problem [26]. Determination of the magnitude of anemia among reproductive age women helps to monitor health of the women, contributing in reduction of maternal morbidity and mortality [7, 8]. Despite these facts, still it has been continued to be a common cause of mortality and morbidity. Studies conducted over the years observed the public health significance of anemia in Ethiopia. In 2006, Micronutrient Initiative estimated 27.0% and 30.6% prevalence of anemia among women of reproductive age and pregnant women, respectively. A study in 2011 by Samson G, et al [2] reported that 27.4% of women of reproductive age in Ethiopia were anemic. The study conducted in 2014 by Filagot K. explained that anemia prevalence of pregnant women in Southeast Ethiopia was 27.9% [1]. The other study employed in 2014 by Yaregal, also observed that prevalence of anemia among nonpregnant women in eastern Ethiopia was 16.1% [9]. However, due

to taking small size of data, in deferent regions and fewer predictors, these studies reported conflicting and divergent conclusions. Therefore, the purpose of this study was to estimate the severity of anemia and assess several risk factors among women of reproductive age in Ethiopia using large size of EDHS 2016 Data. The main objective of this study was to determine the prevalence of anemia and assess its risk factors among reproductive age women in Ethiopia.

2. Materials and Methods

Study Area: The study was employed in Ethiopia which is located in the horn of Africa. It is a country with great climatic, geographic, cultural and economic diversity. According to the 2008 estimate, it has a population of 78,254,090 of which 84% live in rural areas. Nearly one quarter (23.3%) of the populations are women in the reproductive age. The country is characterized by rapid population growth with an annual rate of 2.6% and a total fertility rate of 5.4 [11, 12).

Study Design: a quantitative cross-sectional study was employed based on secondary data of Ethiopia DHS 2016.

Data Source: The EDHS 2016 data were obtained from Central Statistical Agency Ethiopian. Further data cleaning was done by the researcher. Data on a total of 9416 reproductive age women were included in the analysis. Information on a wide-range of potential independent variables (socio-demographic, economic, dietary intake, nutritional status, maternity services utilization, etc) was extracted consequently.

Sampling Techniques: The Ethiopian DHS 2016 was designed to provide representative estimates of health and demographic indicators at national level and across 11 geographic regions 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). A nationally representative sample of 15,683 women age 15-49 in 16,650 selected households were interviewed. This represents a response rate of 95% of women. The 2016 EDHS provides reliable estimates at the national level, for urban and rural areas, and for each of the 9 regions and 2 administrative cities [10].

Data Collection Method: 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 with the presence of intensive supervision. 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) [10].

Data Analysis: Data analysis was done using SPSS version 20 for windows. The data was cleaned and preliminary analysis was done by the investigator. Bivariate analysis was done to see the association of each independent variable with the outcome variable. Variables found to have statistically significant association with anemia, p value less 0.15 during bivariate analysis were entered to multiple logistic regression analysis to identify risk factors of anemia. 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. Odds ratios with their 95% confidence level were calculated and P value of 0.05 was taken as the level of significance.

Operational definitions: The outcome variable in the study is the presence of anemia (yes = 1/no = 0). Anemia is defined as hemoglobin value below the established reference interval for the sex and age of the population. The World Health Organization (WHO) has suggested that anemia is present in women when hemoglobin level is <11 g/dl. The severity of anemia was also classified as mild (10.0-10.9 g/dl), moderate (7.0- 9.9 g/dl), and severe (lower than 7.0 g/dl) based on the level of hemoglobin concentration [11].

3. Results

Prevalence of Anemia among Reproductive age women in Ethiopia

A total of 9416 reproductive age women were included in the study. The overall prevalence of anemia among studied women was 27.8%, of which 19.3%, 6.7% and 1.8% had mild, moderate and severe anemia respectively **(**Table 1**)**.

Table 1: Anemia Status Among Reproductive Age Women in Ethiopia, 2016 EDHS

Status of Anemia	Women	Percent
Severe anemia	169	1.8
Moderate Anemia	630	6.7
Mild Anemia	1817	19.3
Not Anemia	6800	72.2

Residential Factors Associated with Anemia among Reproductive Age Women in Ethiopia, 2016 EDHS

The majority of the study participants, *6912 (73.4%)* were rural dwellers. Compared to women who were living in urban region at the time of survey, rural dwellers were significantly higher risks of anemia (AOR = 1.5, 95% CI: *1.3-1.7*). The result of this study revealed that the prevalence of anemia among women was significantly varying in different parts of the country. Women who were living in Affar, Somali, Harari and Dire Dawa were more likely to suffer anemia with AOR of 2.1 (95% CI: 1.6-2.6), 2.7 (95% CI: 2.3-3.1), 1.5 (95% CI: 1.1-1.9) and 1.9 (95% CI: 1.5-2.3) respectively compared with the reference category (Tigray) (Table 2)**.**

Table 2: Residential and Regional Factors of Anemia among Reproductive Age Women in Ethiopia, 2016 EDHS

Predictors	***Have not Anemia***	***Have Anemia***	***Total***	***OR (95% CI)***
Region				
Tigray	*812(75.7%)*	*260(24.3%)*	*1072(11.5%)*	*1*
Afar	521(65.7%)	272 (34.3%)	793(8.4%)	2.1(1.6-2.6)*
Amhara	941(81.3%)	216(18.7%)	1157(12.3%)	0.7(0.5-0.9)*
Oromia	848(71.4%)	340 (28.6%)	1188 (12.6%)	1.1(0.9-1.3)
Somali	549 (63.5%)	316 (36.5%)	865 (9.2%)	2.7(2.3-3.1)*
Benishangul	545 (77.2%)	161 (22.8%)	706 (7.5%)	0.6 (0.5.0.8)*
SNNPR	849 (75.5%)	275 (24.5%)	1124 (11.9%)	0.7(0.4-0.9)*
Gambela	460 (67.3%)	223 (32.7%)	683 (7.3%)	1.1 (0.9-1.5)
Harari	323 (66.3%)	164 (33.7%)	487 (5.2%)	1.5(1.1-1.9)*
Addis Ababa	626 (80.3%)	154 (19.7%)	780 (8.3%)	0.8(0.5-1.1)
Dire Dawa	344 (61.3%)	217 (38.7%)	561 (6.0%)	1.9 (1.5-2.3)*
Place of residence				
Urban	*1878 (75%)*	*626 (25%)*	*2504 (26.6%)*	*1*
Rural	*4454 (64.4%)*	*2458 (35.6%)*	*6912 (73.4%)*	*1.5 (1.3-1.7)**

* = Significant at □ = 0.05 (P-value <0.05)

Socio-Demographic factors* Associated with Anemia among Reproductive Age Women *in

Ethiopia, 2016 EDHS

According to this study, the average age of the participants was 28.3 ± 3.7 years. The majority of the study groups, 3918 (41.6%) were in the age range of 25-35 years and more than half, 5128 (54.5%) were uneducated. Most of the respondents, 5268 (55.9%) were poor and only, 743 (7.9%) were rich in their economic level. The prevalence of anemia was high in women who were in 35-45-yearage, uneducated and poor. Compared to women with higher level of education, uneducated women and those who had primary level of education had significantly higher risk of anemia with AOR of 2.3 (95% CI: 1.9-2.7) and 1.5 (95% CI: 1.2-1.8), respectively. This study also showed that the odds of getting anemia in mothers who were in the age range of 25-35 years was 1.3 times greater than the odds of mothers who were in the age range of 15-24 years (AOR=2.49,95% CI:1.22- 5.08). Likewise, the worse the economic status of the women the greater risk of anemia (Table 3)**.**

Table *3: Socio-Demographic Factors of Anemia among Reproductive Age Women in Ethiopia, 2016 EDHS*

Predictors	Have not Anemia	Have Anemia	Total	OR (95% CI)
Age in year				
15-24	2098 (74.4%)	723 (25.6%)	2821 (30.0%)	1
25-34	2864 (73.1%)	1054 (26.9%)	3918 (41.6%)	1.0 (0.7-1.3)
35-45	1800 (67.2%)	877 (32.8%)	2677 (28.4%)	1.3 (1.1-1.5) *
Educational level				
No education	3160 (61.6%)	1960 (38.4%)	5128 (54.5%)	2.3 (1.9-2.7)*
Primary	2049 (73.0%)	750 (27.0%)	2807 (29.8%)	1.5 (1.2-1.8)*
Secondary	716 (77.2%)	212 (22.8%)	928 (9.9%)	1.2 (0.8-1.6)
Higher	764 (82.3%)	164 (17.7%)	928 (5.9%)	1
Economic Status				
Poor	3593 (68.2%)	1675 (31.8%)	5268 (55.9%)	2.1 (1.7-2.4)*
Medium	2567 (75.4%)	838 (24.6%)	3405 (36.2%)	1.6(1.3-1.9)*
Rich	623 (66.1%)	120 (16.2%)	743 (7.9%)	1
Religion				
Orthodox	2571 (72.3%)	986 (27.7%)	3557 (37.8%)	1
Protestant	1240(70.7%)	513 (29.3%)	1753(18.6%)	1.1(0.7-1.5)
Muslim	2715 (69.2%)	1212 (30.8%)	3927 (41.7%)	1.2(0.8-1.6)

Potential *Factors* Associated with Anemia among Reproductive Age Women *in Ethiopia, 2016 EDHS*

The rate of anemia was higher in women who were not using contraceptives (36.9%) than users (21.2%). The use of contraceptives was associated with reducing risk of anemia. Women who were not using contraceptive were 1.9 (95% CI: 1.6-2.2) times more likely to develop anemia compared to women who were using contraceptive. The finding of this study also indicated that using ANC during pregnancy was significantly associated with the risk of anemia. The likelihood of having anemia among women who were not using ANC during pregnancy was (AOR= 2.2, 95% CI: 1.9- 2.6) as compared/ to women who were users. The findings of the study also showed that respondents who had given birth more than four children during the survey been 1.4 times higher risk of developing anemia compared to women who had no given birth. Women who were pregnant during the survey were 2.5 times more likely to develop anemia compared to women who were not pregnant (AOR= 2.5, 95% CI: 2.1- 2.9) **(**Table 4).

Table 4: Potential *Factors of Anemia among Reproductive Age Women in Ethiopia*

Predictors	***Have not Anemia***	***Have Anemia***	***Total***	***OR (95% CI)***
ANC				
No	1001 (72.0%)	389(28.0%)	1390 (14.8%)	2.2 (1.9- 2.6)*
Yes	7047(87.8%)	979 (12.2%)	8026 (85.2%)	1
Current contraceptive use				
No	4376 (63.1%)	2557 (36.9%)	6933 (73.6%)	1.9(1.6-2.2) *
Yes	1956(78.8%)	527 (21.2%)	2483 (26.4%)	1
Currently pregnant				
No	6559 (76.6%)	2000 (23.4%)	8559 (90.1%)	1
Yes	437 (51.0%)	420 (49.0%)	857 (9.1%)	2.5(2.1-2.9) *
Children ever born				
0	971 (69.9%)	419 (30.1%)	1390 (14.8%)	1
1-2	2242 (70.9%)	920 (29.1%)	3162 (33.6%)	0.9(0.6-1.2)
	1585 (68.7%)	720 (30.6%)	2305 (24.5%)	1.2(0.9-1.5)
> 4	1602 (62.6%)	957 (37.4%)	2559 (27.2%)	1.4(1.1-1.7)*

Nutritional *Factors* Associated with Anemia among Reproductive Age Women *in*

Ethiopia, 2016 EDHS

Majority of women, 5574 (59.2%) were not eating balanced diet (low diet diversity). The result of multivariable logistic regression showed that the prevalence of anemia was significantly higher in women with low diet diversity than women who ate high diet diversity. Mothers who were not eating balanced diet (low diet diversity) had more likelihood to develop anemia (AOR=1.6, 95% CI: 1.3-1.9) than who were eating balanced diet. Regarding to fruit/vegetable consumption, most of women, 6296 (66.9%) were not taking fruit/vegetable per week is statistically a significant contributor of women to be anemic. In this study Fruit and /vegetable intake was also found to be a significant determinant of anemia. Those mothers who were not eating fruit and /vegetable were more likely to develop anemia than those who were not eating fruit and /vegetable (AOR=1.5, 95% CI: 1.2-1.8). Similarly, *iron* deficiency was also found to be a significant predictor of anemia. Mothers who were not eating *iron riche foods* were around two times more likely to develop anemia than who were eating this type of food (AOR=1.9, 95% CI: 1.5 – 2.3) Concerning body mass index, of the total women, 2105 (22.8%) were underweight, 6072 (65.8%) were Normal and 1055 (11.4%) were overweight. body mass index was one of statistically a significant predictor of anemia. Compared to those with normal BMI, women with *Underweight and Overweight* were 1.7 (95% CI: (1.5 1.9) and 1.4 (95% CI: (1.2-1.6) times more likely to develop anemia (Table 5)**.**

Table 5: Nutritional *Factors of Anemia of Reproductive Age Women in Ethiopia, 2016 EDHS*

Predictors	***Have not Anemia***	***Have Anemia***	***Total***	***OR (95% CI)***
Diet diversity level				
Low	3559 (63..9%)	2015 (36.1%)	5574 (59.2%)	1.6 (1.3-1.9)*
Medium	2316 (75.2%)	764 (24.8%)	3080 (32.7%)	1.1 (0.8-1.4)
High	591 (77.6%)	171 (22.4%)	762 (8.1%)	1
Fruit/Vegetable Consumption				
No	4236 (67.3%)	2060 (32.7%)	6296 (66.9%)	1.5 (1.2-1.8)*
Yes	2096 (67.2%)	1024 (21.5 %)	3080 (33.1%)	1
Consumption of fat riche foods				
No	3923 (67.4%)	1901 (32.6%)	5824 (61.9%)	1
Yes	2409 (67.1%)	1183 (32.9%)	3592 (38.1%)	1.1(0.8-1.4)
Consumption of iron riche foods				
No	3902 (61.2%)	2474 (38.8%)	6376 (67.7%)	1.9 (1.5-2.3)*
Yes	2417 (79.5%)	623(20.5%)	3040 (32.3%)	1
BMI				
Underweight	1400 (66.5%)	705 (33.5%)	2105 (22.8%)	1.7 (1.5-1.9)*
Overweight	763 (72.3%)	292(27.7%)	1055 (11.4%)	1.4 (1.2-1.6)*
Normal	4866 (80.1%)	1206 (19.9%)	6072 (65.8%)	1

* = Significant at □ = 0.05 (P-value <0.05)

4. Discussions

Anemia is one of worldwide public health problem for both developing and developed countries, affecting women of reproductive age groups. The prevalence of anemia increased with old age and the difference was significant. Women aged 35-45 years had the highest risk of anemia. It is in agreement with other studies [13, 14, 21] reported higher prevalence in older age groups. But a study in Ethiopia indicated women aged 25-39 years had the highest risk of anemia [2]. A study in Mexico reported higher prevalence in the 20-29 years of age than the younger or older age categories [15]. This might be due to the fact that the age category is fertility intensive in women's life. Regarding to lower economic and lower education category and living in rural areas were identified as influential factors to anemia. Hence, make powerful women in terms of education and economic status would have positive help to prevent the problem. A significantly higher prevalence of anemia was found in women who were uneducated or had only primary education compared to the reference category. Ratio of anemia was also found to be significantly associated with economic level as anemia was higher in poor class than rich class. This finding is in consistent with the findings from other studies [16, 17]. This might be due to availability of high-quality food with better economic level. The relationship of low diet i.e., lacks of vegetables and fruit with anemia was found to be statistically significant and this is in agreement with other studies [2, 18]. But the association of anemia with intake of fat riche foods like egg, meat, milk and milk products etc. was found to be insignificant. This might be due to the fact that adequacy of intake of these food items was determined based on the frequency of intake but not the amount of intake. The possibility of developing anemia increased in mothers who did not receive iron rich foods during pregnancy as compared to those who received iron rich foods. This may be due to the developing of iron deficiencies during pregnancy because of the increased iron requirements to supply the growing blood amount of the mother and

the rapidly growing fetus and placenta. This study is in conformity with other studies conducted in Karnataka India, Uganda, and Eastern Ethiopia [19, 20]. But it was in contrast with a study [21, 22] who mentioned that, there wasn't significant variance between Iron supplementation and anemia. A higher likelihood of anemia was observed among women who had greater than four children than those who had less than four. This result is congruent with what was reported by a study done earlier [24, 25]. Another important factor associated with anemia was ANC usage. A higher likelihood of anemia was observed among women who were using ANC those who were not using ANC. This finding is in line with that of a study conducted in Northwest Ethiopia [25].

The study implies the critical need for comprehensive, evidence-driven public health interventions to mitigate anemia among Ethiopian women of reproductive age. Tackling anemia will enhance women's overall health and productivity while significantly improving maternal and child health outcomes, thereby advancing Ethiopia's broader development objectives.

5. Conclusion and Recommendations

A total of 9416 women aged between 15 and 49 years were employed in the study. The current study showed that, the overall prevalence of anemia among reproductive age women was 27.8%, of which 19.3%, 6.7% and 1.8% had mild, moderate and severe anemia respectively. In order to effectively prevent anemia, it is important to identify the factors which contribute to the development of anemia. Using contraceptive method contributes importantly in reducing the weight of anemia in women of reproductive age. Living in rural areas, being from the lower economic and educational status categories were significantly influential factors to anemia. Utilization of maternal services, taking iron supplementation during pregnancy is also significantly associated with reduction of the risk of anemia. Taking inadequacy of balanced food, like low diversity of food, fruit/ vegetable consumption and being underweight or overweight leads women to suffer anemia. Thus, health education to create awareness about the importance of antenatal care and iron supplementation are recommended to reduce anemia. Both nutritional education and economic promotion policy should be established to improve diet diversity/and balanced food especially during pregnancy and breastfeeding.

5. Ethics approval

Ethiopian DHS was obtained ethical clearance from the Ethiopian Health Nutrition and Research Institute (EHNRI) Review Board, the national research Ethics Review committee (NRERC) at the Ministry of Science and Technology of Ethiopia, the Institute Review Board of ICF international, and the Centre for Disease Control (CDC) and where the participant is women (reproductive women), written informed consent for participation in the study was obtained from their guardian. A permission letter to download the 2016 EDHS data set was also obtained from EDHS program after requesting (www.measuredhs.com) website. The requested data were treated strictly confidential and were used only for this study.

6. Availability of data

All datasets used during this study are available at (www.measuredhs.com) website.

7. Abbreviations

ANC: Antenatal care, AOR: Adjusted odds ratio, EDHS: Ethiopia demographic and health survey, CI: Confidence interval, WHO: world health organization BMI: body mass index

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10. Author's contributions

MA involved in the design and conception of the study, the analysis, interpretation of the findings, and write up the manuscript. AA and GF approved the research proposal with some revision and comments by critically reviewing the manuscript as the role of the supervisor. All the authors approved the final version of the manuscripts.

11. Competing of interests

The authors declared that they have no competing interests.

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