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Determinants of Anaemia among Women of Reproductive Age in Ethiopia: Evidence from 2016 Ethiopian Demographic Health Survey

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Abstract

Even though anaemia is a preventable condition, it continues to be a global public health problem responsible for significant morbidity in women of reproductive age. There are various risk factors of anaemia among women of reproductive age. The objective of this study was to assess determinants of anaemia among women of reproductive age. An unmatched case-control study was conducted to study determinants of anaemia among women of reproductive age. The sample size was calculated by using the two-population proportion formula for unmatched case-control study. Epi-Info version 7 software was used to calculate the sample. The study included all cases (3929) and 7424 controls. The sample was stratified and selected in two stages. Bivariate and multivariate logistic regression was conducted to identify determinants of anaemia. This study included 11153 women of reproductive age with 3929 cases and 7224 controls. Living in Tigray region (AOR=5.04, 95% CI (1.02-24.80)), Amhara region (AOR=7.56, 95% CI (1.58-37.37)), Benshangul region (AOR=4.31, 95% CI (1.05-17.73)), and SNNPR (AOR=4.67, 95% CI (1.19-18.34)) were significantly associated with anaemia. Giving birth at home (AOR=2.13, 95% CI (1.13-3.98)), did not use anything to avoid getting pregnant (AOR=0.54, 95% CI (0.30-0.96)) were significantly associated with anaemia. The current study showed that region, place of delivery, and using anything to avoid getting pregnant were determinants of anaemia among women of reproductive age. The health sectors and other concerned bodies should give due emphasis for all regions of the country in prevention of anaemia. Place of delivery is one of the important determinants of anaemia in women, so promoting health institution delivery should be implemented by all stakeholders. In the current study, non-use of contraceptive is protective for anaemia. One cause of anaemia is vaginal bleeding/spotting, which is a common side effect of hormonal contraceptive. Thus, managing common side effects of hormonal contraceptive should get due concern by health professionals.

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Anaemia, EDHS, Determinants, Women of reproductive age.

Introduction

Anaemia is a medical condition in which the red blood cell count or haemoglobin (hg) is less than normal. It is defined in women when hg is less than 12.0 gram/100ml. The cause for anaemia is either a decrease in production

of red blood cells or an increase in loss of red blood cells due to bleeding. The symptoms of anaemia include tiredness, fatigue, paleness, feeling of heart racing, and shortness of breathing. The treatment of anaemia depends on particular causes (Jerry *et al.*, 2017).

Even though anaemia is preventable condition, it continues to be a global public health problem responsible for significant morbidity in WRA (women of reproductive age). The anaemia prevalence was estimated to be 27% globally in 2013, an equivalent of 1.93 billion people. In 2010 the prevalence was 32.9 %, contributing to 68.36 million years lived with disability, and 8.8 % of all total conditions recorded in 2010. Developing countries account for 89 % of anaemia burden among people affected (Kassebaum *et al.*, 2013 and 2016). Global stratified data among WRA revealed that the prevalence of anaemia was 29.4 % for WRA and at 38.2 % for pregnant women in 2011. Correspondingly, 528.7 million WRA had anaemia worldwide, 496.3 million were non-pregnant women, and 32.4 million were pregnant women (WHO, 2015).

About 24 % of women in Ethiopia are anaemic. Eighteen per cent of women have mild anaemia, 5% have moderate anaemia, and 1% has severe anaemia. In Ethiopia, anaemia prevalence among WRA declined to 17 % in 2005 from 27% of 2011 but then increased to 24% in 2016. Increase were observed from 2011 to 2016 in all categories of anaemia (ICF and CSA, 2016).The FMOH (federal minister of health)put plan to decrease anaemia on WRA from 16.6% to 12.5% in five years interval (FMOH, 2015/2016).

Anaemia can be classified as severe if prevalence is 40 % or higher, moderate if it is 20-39.9%, mild if it is 5-19.9%, and normal it is 4.9% or lower. According to this classification, Ethiopia is classified under moderate levels (WHO, 2011).

There are various risk factors of anaemia among WRA. Some of the factors were described in the following manner. Province of residence, economic status, marital status, having history of malaria disease, and sleeping under mosquito net were determinants of anaemia. Women with normal BMI (body mass index) had reduced risk of anaemia. Use of contraceptive reduces anaemia risk while the use of uterus device increased the risk of anaemia. Anaemia was significantly associated with place of residence, income, occupation, and intestinal parasitic infections (HAKIZIMANA, 2011; Gebremedhin and Enqueslassie, 2011; Asrie, 2017; Xianglong *et al.*, 2016). Age group and housing condition, first trimester, 3rd trimester, HIV infection and medication use were also associated with anaemia (Khem *et al.*, 2015; Tadesse *et al.*, 2016). Most studies done in Ethiopia focused on anaemia during pregnancy and they are limited to specific geographical areas. The

current study included all regions of the country and included all WRA. It also tried to include many potential determinants of anaemia among WRA. Determining risk factors of anaemia in WRA is important to design appropriate strategies that focused on anaemia prevention. The objective of this study was assessing determinants of anaemia among WRA.

Materials and Methods

Study area

Ethiopia is located in the North Eastern part of Africa, also known as the Horn of Africa. It occupies an area of 1.1 million square kilometres ranging from 4,620m above sea level at Ras Dashen Mountain to 148m below sea level at the Danakil (Dallol) Depression. More than half of the country lies above 1,500 meters. The predominant climate type is tropical monsoon, with temperate climate on the plateau and hot in the lowlands. There are topographic-induced climatic variations broadly categorized into three: the “Kolla”, or hot lowlands up to approximately 1,500 meters above sea level, the “Wayna Degas” which range 1,500-2,400 meters above sea level and the “Dega” or cool temperate highlands 2,400 meters above sea level (14).Projections from the 2007 population and housing census estimate the total population for the year 2015 to be 90 million (CSA, 2015).The average size of a HH (household) is 4.7. Women of reproductive age constitute 23.4% of the population (CSA, 2014).

Study design

Unmatched case-control

Population

All women aged either 15-49 who were permanent residents of the selected HH or visitors who stayed in the HH the night before the survey, were eligible to be interviewed (CSA &ICF, 2016).

Sample size determination

The sample size was calculated by using two-population proportion formula for unmatched case control study. Epi-info version 7 software was used to calculate the sample with the assumption of; 15 % of individuals' wealth index of middle among controls as an exposure variable, odd ratio of 1.73 from study conducted in Ethiopia (Gebremedhin and Enqueslassie, 2011), 1:3

cases to control, and 90% power. The final sample became 7664 women, with 240 cases and 7424 controls. However, the researcher used all cases (3929 women) and 7424 controls. The controls were selected randomly from SPPSS data. The final sample became 11153 WRA.

Sample design

The sampling frame used for the 2016 EDHS (Ethiopian demographic health survey) is the Ethiopia Population and Housing Census, which was conducted in 2007 by the Ethiopia Central Statistical Agency. The census frame is a complete list of 84,915 EAs (enumeration areas) created for the 2007 population and housing census. An EA is a geographic area covering on average of 181 households. The sampling frame contains information about the EA location, type of residence (urban or rural), and estimated number of residential households. The 2016 EDHS sample was stratified and selected in two stages. Each region was stratified into urban and rural areas, yielding 21 sampling strata. In all the selected households, height and weight measurements were collected from women 15-49. Anaemia testing was performed on consenting women 15-49 (CSA & ICF, 2016).

Data collection and measurements

Being a secondary data analysis, there was no primary data collection. This study used EDHS of 2016. The data set was downloaded from DHS (demographic health survey) program after approval from relevant authorities (attached in additional materials). Subsequently, the data were extracted from DHS dataset and all WRA (15-49 years) having available data about anaemia status and levels with their variables that were under study.

Socio-demographic variables selected included

Age of women, region, place of residence, marital status, education status of women, occupation status of women, number of HH, wealth index of family, who decide on women health, who decide on HH purchase, alcohol drinking by women, chewing chat.

Reproductive health related variables

Received ANC(antenatal care), ever had a terminated pregnancy, preceding birth interval, total number of ever born children, received postnatal, age at first birth, current breast feeding status, place of delivery, duration of current pregnancy, and currently pregnant.

Environmental health related factors

Source of drinking water, type of toilet and distance to health facility.

Health behaviour variables included

During pregnancy iron or syrup given, drugs for intestinal parasites during pregnancy, reading newspaper or magazine, listening to radio, watching television.

Anthropometric variable

Body Mass Index (BMI).

Data processing and analysis

Descriptive statistics (frequencies, means) was used to describe determinants of anaemia. Median was calculated for continuous variables. Bivariate and multivariate logistic regression was conducted to identify determinant of anaemia on WRA. Variables with p-value less than 0.05 on bivariate analysis were transferred to multivariate logistic regression.

Odds ratio at 95% CI was done to measure strength of association between dependent and independent variables. P-value less than 0.05 was used to declare significance of association on multivariate logistic regression.

Multicollinearity was checked and the variables that had an association had less than two standard error, showing that there was no multicollinearity.

Operational definitions

Severe anaemia

Women with < 7.0 g/dl of blood hg level; Moderate anaemia: women with 7.0-9.9 g/dl of blood hg level; Mild anaemia: pregnant women with 10.0-10.9 g/dl blood hg level and non-pregnant women with 10.0-11.9 g/dl blood hg level (5).

Anaemia: In current study, anaemia is defined as combination of severe, moderate, and mild anaemia. BMI: is calculated by dividing weight in kilogram by height in meters squared (kg/m)² (CSA & ICF, 2016).

Results and Discussions

Socio demographic and economic factors

This study included 11153 WRA with 3929 cases and 7224 controls. The prevalence of anaemia in current study is 35.2 %. Majority of cases, 761(19.4%) were found in age range of 25-29 but majority of controls, 163 (22.6%) were found in age of 15-19. Rural areas comprised the common place of residence for both cases, 2998 (76.3%) and controls, 4643 (64.3%). Oromia region had the highest cases, 482 (12.3%) and controls, 887 (12.3%). The wealth index showed, poorest comprised, 1519 (38.7%) for cases and 1472 (20.4%) for controls. Educational level of women showed, 2244 (57.1%) of cases, and 2558(35.4%) of controls had no education. About, 1943(49.5%) cases and 4045 (56.0%) controls had HH members less than five. Married women constituted the highest number in both cases, 2764 (70.3%) and controls, 4303 (59.6%). Nine hundred twelve (23.2%) cases and 2701 (37.4%) controls drank alcohol. Only, 379 (9.6%) cases and 713 (9.9%) controls chewed chat. For, 1661 (36.0%) cases and 2957 (67.2%) controls both husband and respondents were decided on HH purchases. For, 1645 (58.6%) cases and 2872 (65.2%) controls, both respondents and husband were decided on women's health. The occupational status of the women showed, 2337(59.5%) cases and 3457(47.9%) controls were not working (Table 1).

Reproductive health (RH) related variables

The median child women have was 2. The median of preceding birth was 35 months with minimum of 8 and maximum of 208 months. Median of pregnancy was 6 months. About 395 (10.1%) cases and 463 (6.4%) controls were currently pregnant. Third trimester of current pregnancy constituted the highest numbers with cases of 176 (44.6%) but second trimester constituted higher number in controls, 186 (40.2%). Home delivery was higher both in cases, 1507 (79.8%) and controls, 1749 (71.2%). One thousand three hundred six (39.0%) cases and 1875(26.0%) controls were currently feeding breast milk. For, 1534 (39.0%) cases and 2401(33.2%) controls age at first birth was less than 18 years. Only, 123 (5.5%) cases and 225 (7.2%) controls received postnatal care. One thousand ninety six (27.9%) cases and 1705 (23.6%) controls had three to five children. About 319 (8.1%) cases and 581 (8.0%) controls ever had terminated pregnancy. Two thousand seven hundred eight (71.0%) cases and 4149 (57.4%) controls ever tried

to delay pregnancy. About 1306 (58.1%) cases and 2195 (70.0%) controls received ANC. Injection was the highest current contraceptive for both cases, 299(50.9%) and controls, 1047(59.0%) (Table 2).

Health behavioural variables

One thousand forty three (59.8%) cases and 1598(50.9%) controls did not take iron tablets during pregnancy. Pit latrine was the commonest latrine both in cases, 1847 (47.7%) and controls, 4336 (61.5%). Only 113 (5.0%) cases and 200 (6.4%) controls were taken intestinal parasite during pregnancy. The minimum and maximum BMI was 12.0 and 55.70, respectively. The median BMI was 20.26. For 2442 (62.3%) cases and for 4675(64.9%) controls BMI was 18.50 to 24.90. Only, 123 (3.1%) cases and 331(4.6%) controls reads newspaper at least one in a week. Only, 510(13.0%) cases and 1329 (18.4%) controls listen radio at least one in a week. About 611 (15.6%) cases and 1904(26.4%) controls watch television at least one in a week. Pipe was the common source of drinking water for both cases, 1315(34.0%), and controls, 3149 (44.7%). Distance to health facility to get medical help was a big problem for 2032(51.7%) cases and 3053(42.3%) controls (Table 3).

Determinants of anaemia

Bivariate association and multivariate association were conducted to identify determinants of anaemia on WRA. On multivariate analysis, only three variables were associated with anaemia. They are region, place of delivery and using anything to avoid getting pregnant. Women who lived in Tigray region were 5 times more anaemic than women' of Diredawa region (AOR=5.04, 95% CI (1.02-24.80)). Women who lived in Amhara region were 7.5 times more anaemic than women' of Diredawa region (AOR=7.56; 95 % (1.58-36.37)). Women who lived in Benshagul region were 4.3 times more anaemic than women's were' of Diredawa region (AOR=4.31; 95% CI (1.05-17.73)). Women who lived in South region were 4.6 times more likely to be anaemic than women' of Diredawa region (AOR=4.67, 95 % CI (1.19-18.34)). women who gave birth at home were 2 times more anaemic than women who gave birth in health institution (AOR=2.13; 95 % CI (1.13-3.98)). Women who did not used anything to avoid getting pregnant were 46 % less likely to be anaemic than women used anything to avoid getting pregnant(AOR=0.54; 95% CI (0.302-0.96) (Table 4).

Table.1 Socio-demographic and economic factors of respondents, Ethiopia, 2017

Variables	Cases: n=3929	Control: n=7224	Total(percent)
Age in 5-year groups(n=11153)			
15-19	755(19.2%)	1636(22.6%)	2391(21.4%)
20-24	715(18.2%)	1341(18.6%)	2056(18.4%)
25-29	761(19.4%)	1274(17.6%)	2035(18.2%)
30-34	625(15.9%)	996(13.8%)	1621(14.5%)
35-39	511(13.0%)	897(12.4%)	1408(12.6%)
40-44	336(8.6%)	586(8.1%)	922(8.3%)
45-49	226(5.8%)	494(6.8%)	720(6.5%)
Type of place of residence(n=11153)			
Urban	931(23.7%)	2581(35.7%)	3512(31.5%)
Rural	2998(76.3%)	4643(64.3%)	7641(68.5%)
Region(n=11153)			
Tigray	331(8.4%)	888(12.3%)	1219(10.9%)
Afar	477(12.1%)	369(5.1%)	846(7.6%)
Amhara	297(7.6%)	964(13.3%)	1261(11.3%)
Oromia	482(12.3%)	887(12.3%)	1369(12.3%)
Somali	737(18.8%)	350(4.8%)	1087(9.7%)
Benishangul	202(5.1%)	573(7.9%)	775(6.9%)
SNNPR(south nations nationalities people region)	379(9.6%)	938(13.0%)	1317(11.8%)
Gambela	276(7.0%)	479(6.6%)	755(6.8%)
Harari	204(5.2%)	384(5.3%)	588(5.3%)
Addis Ababa	256(6.5)	929(12.9%)	1185(10.6%)
Dire Dawa	288(7.3%)	463(6.4%)	(7516.7%)
Wealth index(n=11153)			
Poorest	1519(38.7%)	1472(20.4%)	2991(26.8%)
Poorer	547(13.9%)	978(13.5%)	1525(13.7%)
Middle	484(12.3%)	966(13.4%)	1450(13.0%)

Richer	421(10.7%)	1010(14.0%)	1431(12.8%)
Richest	958(24.4%)	2798(38.7%)	3756(33.7%)
Education level of women(n=11153)			
No education	2244(57.1%)	2975(41.2%)	5219(46.8%)
Primary	1141(29.0%)	2558(35.4%)	3699(33.2%)
Secondary	388(9.9%)	1069(14.8%)	1457(13.1%)
Higher	156(4.0%)	622(8.6%)	778(7.0%)
House hold members(n=11153)			
< 5	1943(49.5%)	4045(56.0%)	5988(53.7%)
Above 5	1986(50.5%)	3179(44.0%)	5165(46.3%)
Marital status(n=11153)			
Never in union	765(19.5%)	2050(28.4%)	2815(25.2%)
Married	2764(70.3%)	4303(59.6%)	7067(63.4%)
Living with partner	44(1.1%)	99(1.4%)	143(1.3%)
Widowed	111(2.8%)	212(2.9%)	323(2.9%)
Divorced	185(4.7%)	445(6.2%)	630(5.6%)
No longer living together/separated	60(1.5%)	115(1.6%)	175(1.6%)
Have you ever taken a drink that contains alcohol?(n=11153)			
No	3017(76.8%)	4523(62.6%)	7540(67.6%)
Yes	912(23.2%)	2701(37.4%)	3613(32.4%)
Have you ever chewed Chat? (n=11153)			
No	3550(90.4%)	6511(90.1%)	10061(90.2%)
Yes	379(9.6%)	713(9.9%)	1092(9.8%)
Who decide on HH purchase(n=7210)			
Respondent alone	385(13.7%)	573(13.0%)	958(13.3%)
Respondent and husband/partner	1661 (36.0%)	2957(67.2%)	4618(64.0%)
Husband/partner alone	762(27.1%)	872(19.8%)	1634(22.7%)
Who decide on women health(n=7210)			
Respondent alone	550(19.6%)	812(18.4%)	1362(18.9%)

Respondent and husband/partner	1645(58.6%)	2872(65.2%)	4517(62.6%)
Husband/partner alone	613(21.8%)	718(16.3%)	1331(18.5%)
Occupational status of women(n=			
Not working	2337(59.5%)	3457(47.9%)	5794(52.0%)
Professional/technical/managerial	83(2.1%)	248(3.4%)	331(3.0%)
Clerical	27(0.7%)	102(1.4%)	129(1.2%)
Sales	502(12.8%)	1192(16.5%)	1694(15.2%)
Agricultural – employee	646(16.4%)	1319(18.3%)	1965(17.6%)
Services	102(2.6%)	240(3.3%)	342(3.1%)
Skilled manual	101(2.6%)	316(4.4%)	417(3.7%)
Unskilled manual	65(1.7%)	135(1.9%)	200(1.8%)
Others	66(1.7%)	215(3.0%)	281(2.5%)

Table.2 Reproductive health related variables of women, Ethiopia, 2017

Variables	Cases	Controls	Total
Currently pregnant(n=11153)			
No or unsure	3534(89.9%)	6761(93.6%)	10295(92.3%)
Yes	395(10.1%)	463(6.4%)	858(7.7%)
Duration of current pregnancy(n=858)			
first trimester	62(15.7%)	101(21.8%)	163(19.0%)
second trimester	157(39.7%)	186(40.2%)	343(40.0%)
third trimester	176(44.6%)	176(38.0%)	352(41.0%)
Place of delivery(n=4343)			
Home	1507(79.8%)	1749(71.2%)	3256(75.0%)
health institution	381(20.2%)	706(28.8%)	1087(25.0%)
Current breast feeding status(n=11153)			
No	2623(66.8%)	5349(74.0%)	7972(71.5%)
Yes	1306(33.2%)	1875(26.0%)	3181(28.5%)
Age at first birth(n=7548)			
less than 18	1534(39.0%)	2401(33.2%)	3935(35.3%)

18 -49	2395(61.0%)	4823(66.8%)	7218(64.7%)
Received postnatal care(n=5384)			
No	2124(94.5%)	2912(92.8%)	5036(93.5%)
Yes	123(5.5%)	225(7.2%)	348(6.5%)
Total number of ever born children(n=11154)			
0 child	1000(25.5%)	2605(36.1%)	3605(32.3%)
1-2 child	910(23.2%)	1701(23.5%)	2611(23.4%)
3-5 child	1096(27.9%)	1705(23.6%)	2801(25.1%)
above 5 child	923(23.5%)	1213(16.8%)	2136(19.2%)
Every had a terminated pregnancy(n=11153)			
No	3610(91.9%)	6643(92.0%)	10253(91.9%)
Yes	319(8.1%)	581(8.0%)	900(8.1%)
Used anything to avoid getting pregnant(n=11153)			
No	2788(71.0%)	4149(57.4%)	6937(62.2%)
Yes, used outside calendar	138(3.5%)	298(4.1%)	436(3.9%)
Yes, used in calendar	1003(25.5%)	2777(38.4%)	3780(33.9%)
Received ANC(n=5384)			
No	941(41.9%)	942(30.0%)	1883(35.0%)
Yes	1306(58.1%)	2195(70.0%)	3501(65.0%)
Current contraceptives(n=2364)			
Pill	43(7.3%)	132(7.4%)	175(7.4%)
IUCD	50(8.5%)	90(5.1%)	140(5.9%)
Injection	299(50.9%)	1047(59.0%)	1346(56.9%)
Barrier	8(1.4%)	24(1.4%)	32(1.4%)
Natural	18(3.1%)	68(3.8%)	86(3.6%)
Implant	155(26.4%)	409(23.0%)	564(23.9%)
female sterilization	15(2.6%)	6(0.3%)	21(0.9%)

Table.3 health behavioural and environmental variables of women, Ethiopia, 2017

Variables	Cases	Controls: N	Total (%)
During pregnancy, iron tablets or syrup was given or bought(n=5384)			
No	1343(59.8%)	1598(50.9%)	2941(54.6%)
Yes	904(40.2%)	1539(49.1%)	2443(45.4%)
Type of toilet facility(n=10920)			
flush latrine	234(6.0%)	565(8.0%)	799(7.3%)
pit latrine	1847(47.7%)	4336(61.5%)	6183(56.6%)
no latrine	1742(45.0%)	2050(29.1%)	3792(34.7%)
other type latrine	47(1.2%)	99(1.4%)	146(1.3%)
Drugs for intestinal parasites during pregnancy(n=5384)			
No	2134(95.0%)	2937(93.6%)	5071(94.2%)
Yes	113(5.0%)	200(6.4%)	313(5.8%)
BMI(n=11116)			
less than 18.50	1111(28.4%)	1600 (22.2%)	2711(24.4%)
18.50 to 24.90	2442(62.3%)	4675(64.9%)	7117(64.0%)
25 and above	365(9.3%)	923(12.8%)	1288(11.6%)
Frequency of reading newspaper or magazine(n=11153)			
Not at all	3534(89.9%)	5893(81.6%)	9427(84.5%)
Less than once a week	272(6.9%)	1000(13.8%)	1272(11.4%)
At least once a week	123(3.1%)	331(4.6%)	454(4.1%)
Frequency of listening to radio			
Not at all	2890(73.6%)	4581(63.4%)	7471(67.0%)
Less than once a week	529(13.5%)	1314(18.2%)	1843(16.5%)
At least once a week	510(13.0%)	1329(18.4%)	1839(16.5%)
Frequency of watching television			
Not at all	2947(75.0%)	4475(61.9%)	7422(66.5%)

Less than once a week	371(9.4%)	845(11.7%)	1216(10.9%)
At least once a week	611(15.6%)	1904(26.4%)	2515(22.5%)
Source of drinking water(n=10920)			
Pipe	1315(34.0%)	3149(44.7%)	4464(40.9%)
Well	1166(30.1%)	1643(23.3%)	2809(25.7%)
protected spring	270(7.0%)	592(8.4%)	862(7.9%)
unprotected spring	482(12.5%)	896(12.7%)	1378(12.6%)
river/dam/lake/surface/pond	518(13.4%)	631(9.0%)	1149(10.5%)
other source	119(3.1%)	139(2.0%)	258(2.4%)
distance to health facility to get medical help for self(n=111153)			
Big problem	2032(51.7%)	3053(42.3%)	5085(45.6%)
Not a big problem	1897(48.3%)	4171(57.7%)	6068(54.4%)

Table.4 Factors associated with anaemia, Ethiopia, 2017

Variables	Cases	Control	Total	COR(95% CI)	AOR(95%CI)	P-Value
Region						
Tigray	331(8.4%)	888(12.3%)	1219(10.9%)	1.669(1.375-2.026)	5.04(1.02-24.80)	0.047
Afar	477(12.1%)	369(5.1%)	846(7.6%)	0.481(0.394-0.588)	1.24(0.31-4.90)	0.761
Amhara	297(7.6%)	964(13.3%)	1261(11.3%)	2.019(1.659-2.457)	7.56(1.58-36.37)	0.011
Oromia	482(12.3%)	887(12.3%)	1369(12.3%)	1.145(0.945-1.376)	3.13(0.81-12.15)	0.099
Somalia	737(18.8%)	350(4.8%)	1087(9.7%)	0.295(0.243-0.359)	0.73(0.19-12.15)	0.650
Benshangu	202(5.1%)	573(7.9%)	775(6.9%)	1.764(1.419-2.19)	4.31(1.05-17.73)	0.043
SNNPR	379(9.6%)	938(13.0%)	1317(11.8%)	1.539(1.274-1.860)	4.67(1.19-18.34)	0.027
Gambela	276(7.0%)	479(6.6%)	755(6.8%)	1.080(0.876-1.330)	2.29(0.51-10.27)	0.278
Harari	204(5.2%)	384(5.3%)	588(5.3%)	1.171(0.935-1.466)	1.03(0.30-5.58)	0.790
Adis Ababa	256(6.5)	929(12.9%)	1185(10.6%)	2.257(1.845-2.762)	10.75(0.76-15.1)	0.079
Diredawa	288(7.3%)	463(6.4%)	(7516.7%)	1	1	

Place of delivery(n=4353)						
Home	1567(79.8%)	1749(71.2%)	3256(75.0%)	0.626(0.543-0.722)	2.13(1.13-3.98)	0.018
Health institution	381(20.2%)	706(28.2%)	1087(25.0%)	1	1	
Used anything to avoid getting pregnant (n=11153)						
No	2788(71.0%)	4149(57.4%)	6937(62.2%)	0.537(0.493-0.586)	0.54(0.302-0.96)	0.035
Yes, used outside calendar	138(3.5%)	298(4.1%)	436(3.9%)	0.780(0.629-0.966)	0.34(0.11-1.02)	0.054
Yes, used in calendar	1003(25.5%)	2777(38.4%)	3780(33.9%)	1		1

The current study tried to assess determinants of anaemia among WRA of Ethiopia. The prevalence of anaemia in this study is 35.2%. This is three folds higher than the transformational plan of FMOH, which planned to reduce to 12.5% in 2020(FMOH, 2015/2016). This shows that the FMOH should apply different strategies of anaemia reduction. It also suggests FMOH and other stakeholders should apply different intervention strategies on determinant factors of anaemia among WRA. Regional disparities were observed in this study. Four regions women were more likely to be anaemic than other regions. This is consistent with study done in Rwanda (HAKIZIMANA, 2011). It is also consistent with study done in Uganda (Gerald *et al.*,2016). This may due to difference in feeding habits of the regions. This finding calls concerned bodies especially minster of health to do more on anaemia prevention and promotion of community based nutrition program.

Women' who gave birth at home were more anaemic than women who gave birth at health institution. This may be due to women who gave birth in health institution being able to have quick access to emergency support if women have a severe bleeding. They can also get information /counselling about nutrition. For mothers who delivered at health facility, the first post-partum visit is held within 24 hours after stay at facility and the woman is checked for bleeding. The current study is inconsistent with study done in Ethiopia, which showed no significance (9). The difference may be due to difference in sample size of the studies. The current study has higher sample size than the previous. This finding calls health sector and other concerned bodies in promoting health institution delivery.

Women who did not used anything to avoid getting pregnant were 46% less likely to be anaemic than women used anything to avoid getting pregnancy. This could be due to using contraceptive may have side effects like nausea and vomiting, breakthrough bleeding or spotting , diarrhoea, nutrient depletion(18). In contrast to current study, study done in Ethiopia showed not using contraceptive was more likely to develop anaemia (9). Similarly, studies conducted in Rwanda showed use of contraceptive reduce anaemia risk (8). The difference may be due to difference in types of contraceptives the women used. Another reason for the difference could be difference in having side effects of the contraceptive among users as side effects of contraceptive could cause vaginal bleeding.

In conclusion, the current study showed that region, place of delivery and used anything to avoid getting pregnant were determinants factors of anaemia in women. The health sectors and other concerned body should give due emphasis for all regions of the country in prevention of anaemia. Place of delivery is one of important determinants of anaemia in women, so promoting health institution delivery should be implemented by all stakeholders. The government of Ethiopia is currently running programs on home delivery free districts and kebele; this initiation should be strengthened. In current study, non-use of contraceptive is protective for anaemia. One cause of anaemia is vaginal bleeding/spotting, which is the common side effects of hormonal contraceptive. Thus, managing common side effects of hormonal contraceptive should get due concern by health professional.

Limitation of the study

Since this study used data from DHS, variables that were not collected in EDHS were not included in the analysis. Variables that can be potential influencers but not collected in EDHS 2016 were diet divert score, HH food security status, malaria infection history, HIV infection status, vitamin A supplement during pregnancy and postpartum.

Abbreviations

EDHS; Ethiopian demographic health survey, DHS; demographic health survey, FMOH; federal minster of health, hg; hemoglobin WRA; women of reproductive age, HH; households, EAS; enumeration areas, BMI; body mass index, ANC; antenatal care, SNNPR; south nations nationalities people region.

Ethical approval and consent to participate

The consent to participate was taken from each study participant. The purpose of current analysis was sent to DHS organization. Permission to download and to use data was obtained from the DHS organization.

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