ORIGINAL ARTICLE

Dietary Diversity and Its Association with Anemia among Pregnant Women Attending Public Health Facilities in South Ethiopia

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ABSTRACT

BACKGROUND: Anemia is a major public health problem among pregnant women in developing countries like Ethiopia. Nutritional deficiency related to anemia is an important contributor to maternal mortality and poor fetal outcomes.

METHODS: Institution based cross-sectional study was conducted among pregnant women to assess the prevalence of anemia and its association with dietary diversity in Hossana Town from March 15 to April 30, 2017. Systematic random sampling procedure was employed to select 314 study subjects. Data were collected using an interviewer administered semi-structured questionnaire supplemented with laboratory tests. Multivariable logistic regression was used to determine the independent predictors of anemia.

RESULTS: The prevalence of mild to moderate anemia among pregnant women was 56.6% and 40.8% respectively. The mean dietary diversity and food variety score of study participants were 7 and 22 respectively. Maternal education (AOR=10.5; 95% CI:2.2, 27), occupation of spouse (AOR=9.3; 95% CI:1.6, 53), nutrition education (AOR=2.5; 95% CI:1.5, 6.4) and dietary diversity (AOR=18.6; 95% CI: 4.4, 28) were significantly associated with anemia.

CONCLUSION: Anemia was found to be a moderate public health problem in Hossana Town. Therefore, there is a need of nutrition education and promotion awareness on healthy diets to prevent anemia among pregnant women.

KEYWORDS: Dietary Diversity, Food Variety, Anemia, Pregnant Women

INTRODUCTION

Anemia occurs at all stages of the life cycle but its risk is higher in state of pregnancy due to an increased iron necessity, physiological need, infections and blood loss. In spite of having diverse causes of anemia, nutritional deficiency is the prominent cause of anemia. High consumption of plant source diet as compared to animal source diet is common in Sub-Saharan countries, which is associated with a low intake of dietary iron. The intestinal absorption of any dietary iron is likely to be reduced as a result of the high intake of phytates from grains (1–3).

Lack of diversified diets is a severe problem in the developing world, where diets are predominantly starchy staples with few animal products, seasonal fruits and vegetables. The nutritional status of a woman during pregnancy is important as a suboptimal diet impacts negatively on the health of the mother, the fetus and the newborn. Although Ethiopia has a wide range of agro-climatic conditions and grows a variety of cereals, root crops and vegetables, some of these are not fully utilized; there appears to be dependency on single food crops (4,5). The value of a different diet has long been known, the high nutrient burdens of pregnancy put women of reproductive age in Ethiopia at high risk of anemia because consumption of low-quality, monotonous diets, poor traditional dietary practice of the society which depends on single staple food rather than diversified diet (6,7).

Anemia is a global public health problem; it affects approximately 2 billion people worldwide and is estimated to contribute to more than 115,000 maternal deaths and 591, 000 prenatal deaths per year (8). Worldwide, the prevalence of anemia among pregnant women is 38.2%, and 0.8 million pregnant women had severe anemia and it is associated with substantially worse mortality and cognitive and functional outcomes. The prevalence of anemia is varied across different regions of the world; the highest prevalence of anemia is recorded in Asia and African; the problem is very high and serious among women in developing countries. This reflects the high magnitude of factors affecting anemia such as iron deficiency, malaria and sickle cell anemia (1,9). The increment of anemia incidence among pregnant women indicates the need of revisions on national policies and public health strategies including improvements in dietary diversity, food fortification with iron, folic acid and control of infectious disease. Recognizing the complexity of anemia can lead to the establishment of effective strategies to control and prevent anemia (3,10–12).

Anemia is a major public health problem in developing countries including Ethiopia. It causes different complications on the fetus and mother at the time of pregnancy. According to Ethiopia's demography health survey report, about one-fourth of women aged 15-49 (23%) are anemic with mild, moderate and severe anemia accounting for 17, 5 and 1% respectively (7,13). Poor nutritional status during pregnancy has adverse consequences which can persist from one generation to the next, since women who are undernourished are at risk of delivering premature or low birth weight infants, who are at risk of poor growth and development. Anaemia increases the risk of maternal and child mortality. There is an increased iron requirement during pregnancy due to greater expansion in plasma volume (7,12,13).

In Hadiya Zone, the dietary pattern and its association with anemia among pregnant women was not known especially in public facilities. Furthermore, there are no studies on this topic at town and zonal levels. Hence, this study attempted to fill this gap by considering socio-economic and demographic factors.

METHODS

Study area and period: Institution based cross sectional study was conducted from March 15 to April 30, 2017 in Hossana Town public health facilities, Southern Ethiopia. Hossana Town is the capital of Hadiya Zone, and is located at 232 km to Southwest of Addis Ababa, Ethiopia. According to the 2014 census, the total population in Hossana was 101,849. The estimated total households in the town were 20,785, and women of childbearing age (15-49) were 23,731. The main common foods of the population in the town were wheat and teff (12).

Source and study population: The source population was all pregnant women attending ANC in public health facilities in Hossana Town, Hadiya Zone, South Ethiopia. The study participants were selected pregnant women who were attending ANC at public health facilities of Hossana Town during the study period. Recently dewormed, severely ill and mentally disabled women were excluded from the study.

Sampling procedure and sample size: A total of 319 sample size was calculated by

using single population proportion formula with an expected prevalence of anemia, 62% among pregnant women in Boditi town (14) with 5% margin of error at 95% confidence level. The desired sample size was calculated using the correction factor formula because the source population was less 10,000.

Four public health facilities composed of one hospital and three health centers were included into the study and the desired numbers of study participants were allocated proportionally to each health facilities. Based on the number of attendants at each facility, the study participants were proportionally selected from all facilities. To select each study participant from each facility, we used registration book as sampling frame to select participants using systematic random sampling procedure. The attendance which contained the list of pregnant women was sought with the reference of three months period as the sampling frame.

Data collection methods: Socio-economic factors, maternal and clinical characteristics and dietary intake information were collected from all selected participants using pre-tested semi-structured questionnaires.The blood sample was collected by Hem Cue® 301 system. The blood sample was collected into a special single-use micro cuvette whose walls were lined with the dry sodium deoxycholate reagents. The sample was tested by a medical laboratory technician to identify the hemoglobin level of study participants; stool examination was also done to identify intestinal parasites among studied women. Data were collected using pretested questionnaires. The questionnaire was prepared in English and translated into Amharic and Hadissa. Then, it was translated back to English to keep language consistency.

Data analysis: Data were cleaned and checked for consistencies and completeness. Data were entered into EpiData version 3.5.1 and exported to SPSS version 20 for analysis. Descriptive and binary logistic regression analyses were done to see the association between the dependent and explanatory variables. In bivariate analysis, variables which had statistically significant results (p-value<0.25) were entered into multivariable logistic regression model to identify the independent effect of each explanatory variable on the outcome variable. The strength of statistical association was measured by adjusted odd ratio with 95% of confidence interval and p-values less than 0.05 were considered as having statistically significant association with anemia.

The dietary diversity was defined as the number of food groups consumed over one week out of ten food groups before the survey. Pregnant women were coded as a consumer of a food item if they had consumed the food item at least once per week from the listed food which is locally available. Consumption of a food item over the reference period was given a score of "1" while non-consumption was given a score "0". Since there was no conventional cut-off point to indicate adequate or inadequate dietary diversity within a week for the pregnant women, to calculate the highest dietary diversity score, the score was converted into tertiles. The higher tertile of the score was taken as high dietary diversity score and low tertiles was considered as minimum dietary diversity score. Nutrition education was defined as ever attending about women nutrition during pregnancy or lactation.

Ethical consideration: Ethical clearance and permission were obtained from the Research Review Board of Jimma University and offered to Hossana Town Health Bureau and respective administrative officials. Information about the objective of the study, confidentiality, autonomy and justice were explained for the participants during data collection. Informed verbal consent was obtained from each study participant.

RESULTS

A total of 314 participants were included into this study with 98.4% response rate. The mean age of

the study participants was 26.7 ± 3.98. The majority (97.1%) of the respondents were married. Around two-third (68.5%) of women were housewives. The majority (77%) of them delivered at health facility. Nearly half of the respondents (48.1%) had one or two antenatal care visits (Table 1).

Table 1: Socio-demographic and Economic Characteristics of the Study Participants in Hossana Town, South Ethiopia, 2017.

Characteristics	Categories	Frequency	Percent
Age group	15-19	2	0.6
	20-24	92	29.3
	25-29	158	50.3
	≥ 30	62	19.8
Marital status	Married	305	97.1
	Non-married	9	2.9
Ethnicity	Hadiya	217	69.1
	Kambata	53	16.9
	Silti	12	3.8
	Amhara	18	5.7
	Gurage	14	4.5
Religion	Orthodox	21	6.7
	Protestant	263	83.7
	Catholic	2	0.6
	Muslim	25	8
	Adventist	3	1
Maternal education	Can't read and write	85	27.1
	Primary level	124	39.5
	Secondary and above	105	33.4
Mothers' occupation	House wife	215	68.5
	Merchant	32	10.2
	Government employee	49	15.6
	Students	18	5.7
	Government employee	89	28.3
Spouse occupation	Farmer	29	9.2
	Merchant	150	47.8
	Daily laborer	46	14.7
Family size	< 5	270	86
	≥ 5	44	14
Household monthly income	< 1000	50	15.9
	1000-3000	78	24.8
	>3000	151	48.1
Birth space	< 2years	155	49.4
	≥2years	159	50.6
Number of pregnancy	Primi-gravida	72	22.9
	Multi-gravida	242	77.1
Place of previous delivery	Home	53	16.9
	Health institution	189	77
Number of ANC visit	1-2 times	151	48.1
	3 times	144	45.9
	4 times	19	6
Ever utilized contraceptive	Yes	223	71
	No	91	29

Table 2: Food Groups Consumption Patterns of Pregnant Women in Public Health Facilities in Hossana Town, South Ethiopia, 2017.

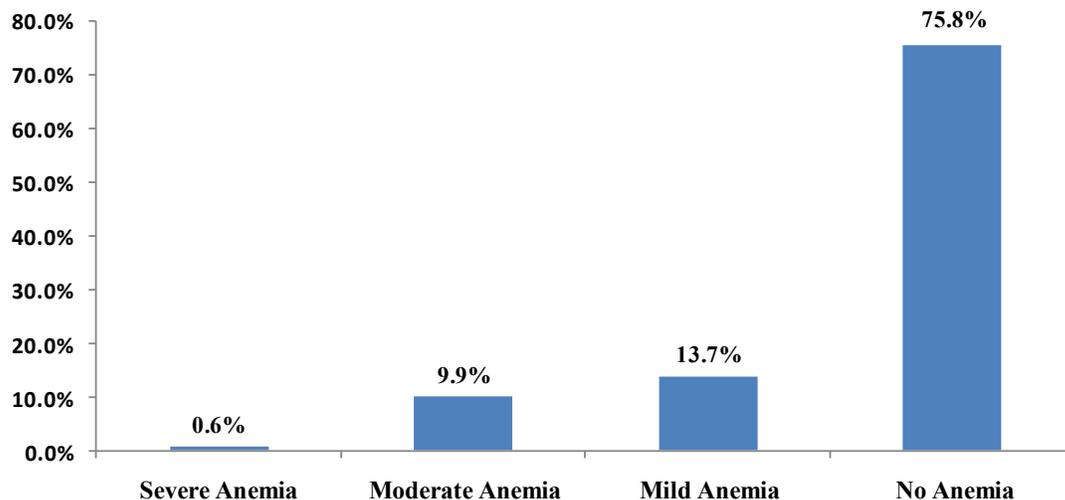| Food groups		Frequency	Percent
Milk and milk product		181	57.5
Egg		129	41.1
Cereals		312	99.4
Dark green leafy vegetables		305	97.1
Other vitamin A rich fruit, tubers and vegetables		260	82.5
Other fruits		262	83.4
Other vegetables		309	98.1
Meat, poultry and fish		153	48.7
Nut and seeds		19	6.1
Pulse or Legumes		311	99
Dietary Diversity Score	High	70	22.3
	Medium	168	53.5
	Low	76	24.2
Food Variety Score	< 20	103	32.8
	20-24	109	34.7
	25-29	92	29.3
	≥ 30	10	3.2

The mean dietary intake of respondents was 3.6 ± 2.27. More than one-fifth (22.3%) of the participants consumed equal to or greater than eight food groups while 76(24.2%) consumed minimum dietary diversity score or less than six food groups. A large proportion of study participants (99.4%) consumed cereal products. More than half (57.6%) of the pregnant women consumed milk and milk products while 48.7% of women consumed meat, poultry and fish (Table 2).

The mean food variety score of the respondents was 22.23 ± 4.54. The majority of study participants consumed cereal products like teff (99.7%) and wheat (96.5%). Proportionally, a small number of women consumed animal products like butter (27.1%), meat (17.5%), poultry (1.3%) and fish (0.6%) (Table 3).
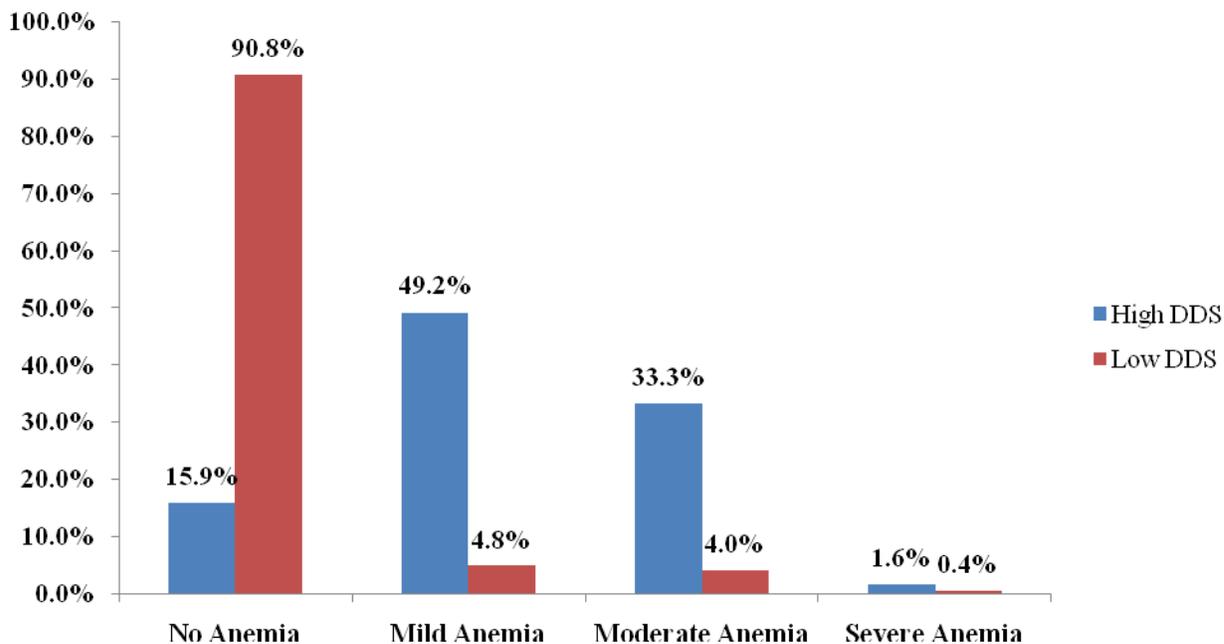
The overall prevalence of mild, moderate and severe anemia among pregnant women attending antenatal care at public health facilities in Hossana was 13.7%, 9.9%, 0.6%, respectively. The total prevalence of anemia was 24.2% (95% CI: 19.4, 28.7) which is found to be a moderate public health significance (Figure 1). The Findings of this study showed a large number of study participants (90.2%) were low dietary diversity consumers (Figure 2).

Table 3: Food Varieties Consumption Patterns of Pregnant Women in Public Health Facilities in Hossana Town, South Ethiopia, 2017.

Food Varieties	Frequency	Percent
Whole milk	156	49.8
Cheese	141	44.9
Yoghurt	94	29.9
Butter	85	27.1
Wheat	303	96.5
Barley	252	80.5
Oats	44	14
rice	203	64.6
teff	313	99.7
Millet	14	4.5
Potato	292	93
kale	249	79.3
Swiss chard	36	11.5
Endive	267	85
Lettuce	185	58.9
Mango	213	67.8
Papaya	154	49
Orange	144	45.9
Lemon	219	69.7
Tomato	284	90.4
Chillies	215	68.5
Beef	102	32.5
Mutton	55	17.5
Goat	41	13.1
poultry	4	1.3
Fish	2	0.6
Peas	287	91.4
Chickpeas	143	45.5
Horse bean	85	27.1
Lentils	298	94.9
Kidney bean	8	2.5
Product of Enset	269	86.2

Figure 1: *The severity of anemia among pregnant women in public health facilities of Hossana town, South Ethiopia, 2017*

Figure 2: *Food groups with Anemia Prevalence among Pregnant Women in Public Health Facilities in Hossana town, South Ethiopia, 2017*

Table 4: Factors Associated with Anemia among Pregnant Women Attending Public Health Facilities in Hossana Town, South Ethiopia, 2017.

Characteristics	Category	Anemic		COR (95% CI)	AOR (95% CI)
		Yes (%)	No (%)		
Mothers' education	Can't read and write	31(36.5)	54(63.5)	16(3.3, 77)**	10.5(2.2,27)**
	Primary level	27(21.8)	97(78.2)	5.1(1.6, 16.2)**	8.9(1.6,51)**
	Secondary and above	18(17.1)	87(82.9)	1	1
Spouse education	Can't read and write	26(72.2)	10(27.8)	4.4(0.18, 16.1)	9.7(0.03, 5.1)
	Primary level	32(35.2)	59(64.8)	3.23(1.3, 22.5)	0.3(0.02, 6.)
	Secondary and above	18(9.6)	72(90.4)	1	1
Mothers' occupation	House wife	28(12.4)	196(77.6)	1	1
	Merchant	20(62.5)	12(37.5)	1.7(0.6, 5.2)	0.6(0.12, 3)
	Government employee	16(32.6)	33(67.4)	4.2(1.2, 14)	6.2(0.2, 16)
	Students	12(66.7)	6(33.3)	2.6(0.3, 21.9)	0.9(0.6, 7.1)
Spouse occupation	Government employee	14(15.7)	75(84.3)	1	1
	Farmer	15(51.7)	14(48.3)	3.9(1.3, 11.9)*	10.2(2.1, 52)
	Merchant	20(13.3)	130(86.7)	1.5(1.4, 5.9)*	4.8(1.03, 22)
	Daily laborer	27(58.7)	19(41.3)	11.9(3.4,40.9)**	9.3(1.6,53)**
Birth space	< 24 month	45(29)	110(71)	1.7(1.4, 3.2)	1.6(0.7, 3.7)
	≥ 24month	31(19)	128(81)	1	1
Household monthly income	< 1000	30(60)	20(40)	2.2(1.3, 4.9)	1.3(0.5, 3.6)
	1000-3000	17(21.8)	61(78.2)	0.7(0.3, 1.7)	0.6(0.2, 1.9)
	>3000	14(9.3)	137(90.7)	1	1
History of malaria	Yes	12(48)	13(52)	3.2(1.03, 11.9)	0.2(0.02, 3.3)
	No	64(22.1)	225(77.9)	1	1
Heard about anemia	Yes	66(23.2)	219(76.8)	1.9(0.9, 4.5)	1.2(0.3, 3.8)
	No	10(34.5)	19(65.5)	1	1
Attend nutrition education	Yes	35(35)	65(65)	1	1
	No	41(19.2)	173(80.8)	3.4(1.6, 7.2)*	2.5(1.5, 6.4)*
Knowledge about Iron	Yes	13(40.6)	19(59.4)	1	1
	No	63(22.3)	219(77.7)	2.7(0.8, 9.3)	1.2(0.2, 6.7)
Dietary Diversity Score	Low	50(65.8)	26(34.2)	30.8(11.8, 13)**	18.6(4.4,28)**
	High	14(20)	56(80)	1	1

*Significant at <0.05, **Significant at <0.0 COR: Crude Odds Ratio, AOR: Adjusted Odds Ratio, CI: Confidence Interval

The findings of bivariate analysis showed that both maternal and paternal education and occupation, birth space, information about anemia and nutrition, low family income and minimum dietary diversity score were identified as the candidate for multivariable logistic regression analysis. The Findings of multivariable logistic regression analysis showed that attending only primary school (AOR=8.9; CI: 1.6, 51), lack of education (AOR = 10.5; 95% CI: 2.2, 27), having daily laborer spouse (AOR=9.3; 95% CI: 1.6, 53), lack of information about iron source foods (AOR = 2.5; 95% CI: 1.5, 6.4) and low dietary diversity score intake (AOR =18.6; 95% CI: 4.4, 28) were positively associated with an exposure among pregnant women in Hossana Town public health facilities (Table 4).

DISCUSSION

Anemia was found to be a moderate public health problem which was consistent with the study from Gondar and Nekemt towns in which 23.2% and 29% of pregnant women were anemic respectively(15,16). Studies also indicated that anemia is a major public health problem in developing countries including Ethiopia (17-21). According to Ethiopia's demography health survey report, about one-fourth of women aged from 15-49 (23%) were anemic (21-23). However, this figure was low as compared to the findings from Northern Nigeria (61.2%), Gilgel Gibe (53.9%) and Wolayita Soddo Town (39.94%) (17–20). This inconsistency might be due to differences with respect to socio-economic status, geographic and eating habit of study participants.

Lack of education among pregnant women was identified as one of the contributors to anemia. Pregnant women who were not able to read and write were more exposed to anemia as compared to women who attended secondary school and above which was consistent with other findings (2,18,24). This might be due to the fact that women who achieved secondary and above schooling had better awareness about balanced diet during pregnancy.

The occupation status of spouses was significantly associated with occurrence of anemia among pregnant women. Pregnant women whose spouses were daily laborers were more exposed to anemia as compared to women whose husbands were governmental employees which was consistent with studies from Turkey and Arba Minch town (24,25). This might be due to the fact that the economic level of merchants and other employees were higher than daily laborers'. It also suggests that women in low socio-economic levels are likely to be poorly educated and regularly have financial constraints which is challenging to access and afford nutritious food. Hence, they are more likely to suffer from the adverse effects of poor/inadequate nutrition, chronic infections and worm infestations.

Attending health education about nutrition during pregnancy was significantly associated with anemia. Women who did not get health education about nutrition during antenatal care were more likely to be exposed to anemia as compared to those who attended nutrition education. This finding is consistent with a study conducted at Arba Minch Town (25). This similarity might be due to the current wide-open health education for pregnant women at health institutions.

Pregnant women who consumed low dietary diversity were more likely to be anemic as compared to women who ate high dietary diversity score. This finding was consistent with the studies done in Mekelle Town and in Ghana (22,26). This might be due to the fact that pregnancy is the most nutritionally demanding period in a woman's life cycle. As a result, their iron level declined. Pregnant women are recommended to eat more diversified diet than monotonous diet to compensate the normal physiological demand of fetus and mother.

Although this study has a significant contribution to address the nutritional problem of pregnant women, there might be social desirability bias where participants demanded to provide dietary information on food frequency questionnaire and monthly income of the family. Additionally, most women consumed food from a

common bowl or mixed dish which is challenging to quantify specific intake food items. Quantitative measurement of nutrients was not done due to absence of dataset or measurement used to provide information on the amount of food consumed by pregnant women. The study was cross-sectional and may not show variations of dietary practices due to seasonal changes.

Generally, the findings of this study can have a significant implication for national nutrition strategy and the national nutrition program in the promotion women nutrition during the pregnancy. The prevalence of anemia among pregnant women was a moderate public health problem. The educational status of both pregnant women and their spouses, occupation status, health education during pregnancy and low minimum dietary diversity were significantly associated with anemia among the pregnant women in Hossana town. Therefore, adult learning should be strengthened to enhance women's educational level. There is also a need for enhancing dietary diversity or food groups and promotion of awareness on nutritional benefits especially consumption of iron-rich foods for pregnant women. Health extension workers should underline ongoing strengthening intervention strategies to decline the risk of anemia among pregnant women.

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