

Prevalence of Iron Deficiency Anemia and Determinants among Pregnant Women Attending Antenatal Care at Woldia Hospital, Ethiopia

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Abstract

Background: Anemia is one of the most widespread public health problems, especially in developing countries. It impaired cognitive development, reduced physical work capacity and in severe cases increased risk of mortality particularly during prenatal period. Anemia in pregnant women is defined by low hemoglobin levels, below 11g/dL in 1st and 3rd trimester and less than 10.5 g/dl 2nd trimester. The objective of this study is to assess prevalence of iron deficiency anemia in pregnant women at Woldia general hospital.

Method: This was a cross-sectional study conducted within a five month period at Woldia General Hospital.

Results: Out of 243 women enrolled in the study, ninety five (39.1%) were found to be anemic. Anemia was more prevalent in the first (52.2%) and second (52.6%) trimesters. nine women (9.5%) had severe anemia, and 86 women (90.5%) had mild anemia. Association with previous antenatal care follow up, the pregnant women who has history of ANC follow up in previous pregnancy has low prevalence (48.2%) whereas those who did not have antenatal care follow up previously have high prevalence (94.4%).

Conclusion: Prevalence of anemia is high in the study area and determined by different factors like feeding habit, level of education and history of antenatal care follow up. Based on this finding we recommend that; iron supplementation should be encouraged as a prophylactic measure. Health education for women on antenatal care follow up and diversified feeding practice should be given for the reduction of anemia.

Keywords: Sever anemia; Mild anemia; Iron; Efficiency

Introduction

Anemia is one of the most widespread public health problems, especially in developing countries. It impaired cognitive development, reduced physical work capacity and in severe cases increased risk of mortality particularly during prenatal period [1].

Anemia in pregnant women is defined by hemoglobin levels less than 11 g/dl for 1st and 3rd trimester and 10.5 g/dl for 2nd trimester. It is usually caused by iron deficiency, which is the most common nutrient deficiency in the world. It has been estimated that, at any one time in developing countries, half of the population (mainly children and women of reproductive age) is affected by anemia [2]. During pregnancy, approximately 75% of all anemia diagnosed are due to iron deficiency [3].

Iron deficiency is highest in population sub groups that are peak rates of growth namely infants, young children and pregnant women. Pregnancy is the time which risk developing iron deficiency anemia is greatest as iron requirements are substantially higher than 4-5 times than the non-pregnant [4]. Furthermore, WHO considers that women in developing countries may be pregnant for as much as one half of their reproductive lives and therefore are at increased risk of anemia during this time.

In the developing world, young pregnant women, and their infants and children frequently experience a cyclic under nutrition (macro nutrient and micronutrient) and repeated infection including parasitic infections. This lead to adverse consequences that can continue from one generation to the next. Among parasitic infections, malaria and intestinal helminthes co-exist widely with micro nutrient deficiencies and contribute importantly to anemia and this resulted for growth retardation and under development [5-9].

Statement of purpose

Anemia is remaining a major public-health problem in many developing country affecting about a quarter of the world's population and its adverse health consequences are affecting people of different groups with varied degree of affluence. Among these population groups, women of childbearing age (15-49 years) and children are highly vulnerable by the problem.

Identifying the magnitude of anemia and its determinants in high-risk groups, such as women of child bearing age, would be essential for evidence-based intervention modalities. Particularly in developing countries, like Ethiopia, where the social conditions pose serious challenges to women [10]. The nutritional status of women in Ethiopia, as in other developing countries, is low, and their daily workload is often enormous because of reproducing and ensuring the survival of their children [11]. To improve the nutrition situation of Ethiopian women, there have been several interventions by the Ministry of Health through its Essential Nutrition Action (ENA) plan, comprising the supplementation of three major nutrients (vitamin A, iron, and iodine) and other promoting activities, such as exclusive breastfeeding,

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Received August 24, 2016; **Accepted** December 06, 2016; **Published** December 13, 2016

Citation: Brhanie TW, Sisay H (2016) Prevalence of Iron Deficiency Anemia and Determinants among Pregnant Women Attending Antenatal Care at Woldia Hospital, Ethiopia. J Nutr Disorders Ther 6: 201. doi: [10.4172/2161-0509.1000201](https://doi.org/10.4172/2161-0509.1000201)

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appropriate complementary feeding, and improved maternal and child nutrition [12-15].

Studying this research is important to know the prevalence and identify factors contribute to iron deficiency anemia in pregnant women such as poor nutritional diet, poor antenatal care service and inadequate iron supplementation contribute to anemia in pregnant women. In addition to that other factors like nutrition and socio-demographic situation contribute to anemia during pregnancy [16]. There is no updated data about the prevalence of iron deficiency anemia in pregnant women at the study area. This research is used to guide the ANC service to work towards alleviating the problem with an appropriate care and treatment, this study will use as base line data to the intervention provided in the health facility [17,18].

Methods

Study setting and study period

The study carried out at Woldia General Hospital. It is one of the Government hospitals in Ethiopia which established in 1953 E.C by American missionary [19-21]. It is located in the northern part of Amhara regional state in the capital town of north wollo zone, Woldia. Woldia found in Amhara regional state located at about 360 km to the north east of the regional capital town Bahir Dar and 521 km from Addis Abeba. The town has altitude of 11°50' 39°36/E 11.833°N and elevation of 2112 meter above sea level [22-25]. Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia (CSA), woldia has a total population of 46,139, of whom 23,000 are men and 23,139 women [26,27] and it has five Kebeles. Woldya has 1 hospital, 2 health center and more than nine private clinics. The study was conducted from January to May 2016 at Woldia General Hospital.

Study design

A cross sectional study was used to assess prevalence of anemia in pregnant mothers attending ANC at Woldia General Hospital.

Sample size determination

The required sample size for this study was calculate based on the prevalence rate of (19.7%) anemia in pregnant women at mekelle town of Tigray region, Ethiopia from literature review, the 95% confidence interval and 5% marginal error, sample size (n) the formula shown below was used to determine the sample size.

$$n = Z^2 P (1-P) / D^2$$

Where,

D=margin of error between the sample and the population

n=sample size

Z=95% confident interval

P=prevalence rate of 19.7% based on the previous study at Mekelle, Tigray

$$n = (1.96)^2 \times 0.197 (1-0.197) / 0.05^2$$

Sampling procedure

Fisher's formula for estimating means and proportions was used to determine the sample size.

Data collection instruments/tools and procedures

A structured questionnaire was used to obtain socio-demographic

information, present and past history in pregnant women, and dietary habit.

The questionnaire was developed in English and it translated to Amharic language. The entire principal investigator was responsible for conducting all interviews and the questioners were examined for clarity ambiguity time taken to fill it out and analyze ability. Appropriate adjustments were then made.

The study participants were identified as follows: After clients received the routine ANC services, the interviewer informed the clients about the study, its objectives, risks and benefits and then the interviewer convince the client to complete the interview. Medical records were examined and the patients interviewed in a private study room. The interviews were conducted in a safe, secure and confidential environment and then the hemoglobin test result obtained from the current client history card.

Data processing and analysis

Quantitative data was coded and entered in to Epi info version 3.5.1 software and the data was transferred to SPSS version 16. Descriptive analysis like mean, frequency and percentage were calculated.

The research was approved by the Ethical Clearance Committee of Bahir dar University. Permission letter was submitted to woldia general hospital. Confidentiality was ensured by making the questionnaires anonymous. Personal identification of the respondents was not asked and the interview also conducted in safe and private place. They were also be assured that the information provided whether orally or in writing would be used only for research purpose and would therefore be strictly anonymous and data will be entered as confidential, anonymous, aggregate analysis and reporting system will put secured and in place.

Result

Overall baseline characteristics of study population

A total of two hundred forty three (243) pregnant mothers who were attending antenatal care were enrolled in the study. 45.7% (111) of them were primigravida and the majority of them were womens of age between 21 to 30 years at 67.5% (164). 8.2% mothers were illiterate, 8.6% also attended collage and unversty. Three fourth of pregnant mothers were married (79.1%) (192), 5.3% and 15.6% are categorized under single and other. The highest number of the study population were housewife (67.0%) and followed by other category and murchant 13.6% and 11.1% respectively. where as these and other related datas are shown in Table 1 below.

Among mothers who were included in this study, 150 (64.1%) eat meat and animal products less frequently as every week or less. Besides this 3.7% of mothers did not eat meat and animal product in their pregnancy time. Majority of the mothers teke iron supplementation for one month (44.0%) when compered from 30-60 days and 60-90 days as 38.7%, and 16.25 respectively. For these and other food intake habits and supplementation taken shown in Table 2 below.

One hundred and thirty two pregnant mothers were their second and more pregnancies. 16 pregnant mother (21.1%) exhibited excessive blood loss from their last pregnancy. 56.1% of women do not have ANC follow up during their last pregnancy and therest 43.9% have ANC follow up before. 70.5% of women who enroled in this study have barth spacing more than two years and the rest are two years and less (Table 3).

Characteristics	Number	Percentage (%)
Sociodemographic		
Age (in year): 15-20	30	13.3
21-30	164	67.5
>30	49	20.2
Religion		
Christian	141	38
Muslim	102	41.9
Other	0	0
Educational status		
Illiterate	20	8.2
Read and write	45	18.5
Grade 1-8	92	37.8
Grade 9-12	65	26.7
College and University	21	8.6
Marital status		
Married	192	79
Single	13	5.3
Other	38	15.6
Occupation		
Farmer	20	8.2
Housewife	163	67
Merchant	27	11.1
Other	33	13.6
Parity		
Primigravida	111	45.7
Multigravida	92	37.8
Grandmultigravida	40	16.5
Gestational age		
First trimester	23	9.5
Second trimester	147	60.5
Third trimester	73	30

Table 1: Socio-demographic and reproductive characteristics of study population.

Parameter	Number	Percentage (%)
Consumption of meat and animal product during the recent pregnancy		
Consumed	9	3.7
Not consumed	234	96.2
Level of consumption of meat and animal product		
Every day	21	8.9
Every two days	63	26.9
Every week or less	150	64.1
Consumption of green leafy vegetables and fruits		
Consumed	0	0
No consumed	243	100
Level of consumption of green vegetables and fruits		
Every day	9	3.7
Every two days	93	38.3
Every week or le	141	58
Consumption of tea/coffee immediately after meal		
Consumed	36	34.6
Not consumed	59	42.5
Do you take iron supplementation in this ANC period		
Yes	204	83.9
No	39	16.1
Level of supplement taken		
<30 days	92	44
30-60 days	79	38.7
60-90 days	33	16.2

Table 2: Dietary habits and other factors included in the study.

Determinant characteristics (n=132)	Number	%
Is there excessive blood loss during previous delivery		
Yes	16	12.1
No	116	87.9
Did you have ANC follow up in the previous pregnancy		
Yes	58	43.9
No	74	56.1
Was any abortion committed before		
Yes	15	14.3
No	117	88.6
Level of birth spacing by the mothers		
<2 years	39	29.5
>2 years	93	70.5

Table 3: Maternal blood loss and related issue.

Parameter	Number	%
Overall prevalence of anemia n=243		
Anemia	95	39.1
No anemia	148	60.9
Severity of anemia n=95		
Mild	86	90.5
Sever	9	9.5

Table 4: Prevalence of anemia in Woldia general hospital.

Overall prevalence of anemia among antenatal women attending clinic at Woldia general hospital

In Table 4 below shows that among 243 pregnant mothers who attended ANC visit in Woldia General Hospital 39.1% (95 mother) were anemic based on their hemoglobin test result (Hb <11.1 g/dl) and the rest 148 (60.9%) did not show iron deficiency anemia (Hb >11.1 g/dl). Hence, the overall prevalence of anemia among mothers attending ANC clinic at Woldia general Hospital was 39.1% (95). Eighty six women (90.5%) had mild anemia (Hb 11.1-8 g/dl), and nine mothers (9.5%) had sever anemia (Hb <7 g/dl).

Prevalence of iron deficiency anemia in relation to reproductive and socio-demographic characteristics among pregnant mothers at Woldia general hospital

Anemia was found to be more prevalent in women aged between 21-30 years at 44.5% as compared to 20.0% in the age 15-20years of age group and 32.7% in the above thirty age group. Mothers who had schooling grade 1-8 were taking the highest coverage 37.8% and 8.2% illiterate, 18.5% were mothers who can read and write only. Only 8.6% of mothers attend college and university.

There were as many housewife as were merchant in this study (67.0% and 11.1% respectively). Anemia was found to be more prevalent in those who were farmers at 55.0% as compared to those who were housewife and merchant (35.6% and 29.6% respectively) However, level of work and knowledge has the most significant relation with the prevalence of Anemia (Table 5).

Prevalence of anemia in relation to reproductive characteristics

90.5% of all the women in this study initiated antenatal visits in their second or third trimesters, with only 9.5% coming in their first trimester. Majority of the women were visited in their second trimester (60.5%) and 30.04% in their third trimester.

Socio Demographic Characteristics	Anemia		Total
	Yes Number/%	No Number/%	
Age			
15-20	6 (20.0)	24 (80)	30
21-30	73 (44.5)	91 (55.5)	164
>30	16 (32.7)	33 (67.3)	49
Educational status			
Illiterate	12 (60.0)	8 (40)	20
Read and write	23 (51.1)	22 (48.9)	45
Grade 1-8	34 (36.9)	58 (63.1)	92
Grade 9-12	21 (32.3)	44 (67.7)	65
College and University	5 (23.8)	16 (76.2)	21
Marital status			
Married	78 (40.6)	114 (59.4)	192
Single	4 (30.8)	9 (69.2)	13
Other	13 (34.2)	25 (65.8)	38
Occupation			
Farmer	11 (55.0)	9 (45.0)	20
Housewife	63 (38.7)	100 (61.3)	163
Merchant	8 (29.6)	19 (69.4)	27
Other	13 (39.4)	20 (59.6)	33

Table 5: Prevalence of anemia in relation to socio-demographic characteristics of antenatal mothers at Woldia General Hospital.

The highest percentage of women with anemia was noted in the first trimester at 52.2%, followed by the second trimester at 43.5%. Only 26.03% of the women in their third trimester had anemia.

The highest percentage of anemia was found in the grandmultigravida (45.0%) as compared to 34.2% and 42.4% for the primigravidae and multigravida respectively. As the data shows that as the parity increases the prevalence of Anemia also increases (Table 6).

The prevalence of Anemia in pregnant women who did not consume meat and animal products are higher than the mothers who did consume 44.4% and 38.9% respectively. The highest prevalence of anemia (50%) were found in pregnant women who eat meat and animal product weekly or less. The pregnant women who eat meat and animal products every day and every two days has the lowest prevalence for anemia, 14.2 and 26.9 respectively.

All of the pregnant women at ANC consumed green leaf vegetables and fruits in different consumption pattern. Mothers whom they eat green leaf vegetable less regularly have high prevalence of iron deficiency anemia (51.7%) than mothers who eat daily and every two days 11.1%, and 22.6% respectively (Table 7).

Anemia prevalence has relation with previous excessive blood loss 87.5% than women that not have history of excessive blood loss in the last delivery (69.8%). On the other hand pregnant mother who attended ANC at the previous pregnancy has less prevalence rate 48.2% than the mother who do not have history of ANC attendance in the previous pregnancy (94.4%).

Discussion

Anemia in pregnancy is one of the most widespread public health problems especially in developing countries and has important health and welfare, social and economic consequences.

Anemia in pregnancy increase in overall risk of maternal death related to pregnancy and delivery. Non-fatal maternal complications

during antenatal period includes: poor weight gain, preterm labors, pregnancy induced hypertension, placenta previa, accidental hemorrhage, eclampsia, premature rupture of membranes and increased susceptibility to infections like urinary tract infections. Plus to that this problem has largest effect on the fetus welfare and proper development. These complications include prematurity, low birth weight, low APGAR scores, fetal mental impairment and infant deaths.

The prevalence of anemia as seen in this study 39.1%, is an indication that anemia during pregnancy is still a major problem in Ethiopia (Table 5). More than one third of pregnant women were found to be anemic. This prevalence is higher than what was in the study on Ethiopian women from June to July 2005 and a study conducted on Mekele Ethiopia prevalence of 30.4% and 19.7% respectively [22,24]. The variance could be attributed to differences between urban and rural prevalence probably as a result of diet differences. The other study

Reproductive characteristic	Anemia		Total
	Yes Number %	No Number %	
Parity			
Primigravida	38 (34.2)	73 (65.8)	111
Multigravida	39 (42.4)	53 (57.6)	92
Grandmultigravida	18 (45.0)	22 (55.0)	40
Gestational age			
First trimester (0-13 week)	12 (52.2)	11 (47.8)	23
Second trimester (14-27 week)	64 (43.5)	83 (56.5)	147
Third trimester (>28 week)	19 (26.0)	54 (74.0)	73

Table 6: Prevalence of anemia in relation to reproductive characteristics among antenatal mothers at Woldia General Hospital.

Parameter (n=243)	Anemia		Total
	Yes Number %	No Number %	
Consumption of meat and animal product during the recent pregnancy			
Consumed	91 (38.9)	143 (61.1)	234
Not consumed	4 (44.4)	5 (55.6)	9
Level of consumption of meat and animal product			
Every day	3 (14.3)	8 (85.7)	21
Every two days	17 (26.9)	46 (73.1)	63
Every week or less	75 (50.0)	75 (50.0)	150
Consumption of green leaf vegetables and fruits			
Consumed	95 (39.1)	148 (59.9)	243
No consumed	0	0	0
Level of Consumption of green leafy vegetables and fruits			
Every day	1 (11.1)	8 (89.9)	9
Every two days	21 (22.6)	72 (77.4)	93
Every week	73 (51.8)	68 (48.2)	141
Consumption of tea/coffee immediately after meal			
Consumed	59 (42.5)	80 (57.5)	139
Not consumed	36 (34.6)	68 (65.4)	104
Do you take iron supplementation in this ANC period			
Yes	66 (32.4)	138 (67.6)	204
No	29 (74.3)	10 (25.7)	39
Level of supplement taken			
<30 days	34 (80.9)	58 (19.1)	92
30-60 days	53 (67.9)	26 (32.1)	79
60-90 days	8 (24.3)	25 (74.7)	33

Table 7: Prevalence of anemia in relation to dietary characteristics among antenatal mothers at Woldia General Hospital.

conducted in the western Ethiopia, Jimma (WHO 1993) [21]. The prevalence of anemia in pregnancy were 57% this difference would be the geographical location and the difference of the feeding habit and related factors.

Level of education and the employment situation has a relation with the anemia, as the result indicates that 60% of the illiterate were anemic when compared to the mothers who are of grade 9-12 and those attend college and University (32.3% and 23.8% respectively). Even though there are women who are anemic even they have better access to education, the level of knowledge and educational status were the better indicator to improve the problem.

The prevalence of Anemia were high in age group of 21-30 years (44.5%), education status of non educated (illiterate) at 60%. Whereas the primigravida and multigravida were highly susceptible to anemia (45.0%) than the primigravida and multigravida (34.2% and 42.4% respectively).

Feeding habit of the pregnant women were known as one factor per the prevalence of anemia in pregnancy [22,23] was also found to be significant factor for the study as there consumption of meat and animal product increases the prevalence of anemia also decreases, women who were eating meat and animal products every day has less prevalence (14.3%) than those were eating every two days and weekly or less as 26.9% and 50% respectively.

Coffee and tea consumption immediately after meal could reduce the iron absorption in the gastrointestinal system and this could increase the prevalence of anemia. This research also confirms this idea properly among the anemic women who were enrolled in this research 42.5% were consuming coffee or tea immediately after meal. However consumption of coffee or tea immediately only will not be the major factor but the iron content of the consumed food will be the factor (Table 8).

Excessive blood loss in the previous delivery and ANC attendant history of the last pregnancy were important determinant to identify the prevalence of anemia secondary to the previous factors. Hence mothers who were manifested excessive blood loss previous delivery exhibited high prevalence of anemia in the recent pregnancy (87.5%). ANC attendant history in the previous pregnancy were the other factor that determines the prevalence of Anemia in the recent pregnancy i.e., the prevalence of anemia on those who were not attended ANC in the previous pregnancy were registered higher (94.4%) than were they attend (45.2%) (Table 8).

Determinants (n=132)	Anemia		Total
	Yes	No	
	Number %	Number %	
Excessive blood loss in the previous pregnancy			
Yes	14 (87.5)	2 (12.5)	16
No	81 (69.8)	35 (30.2)	116
Previous ANC follow up			
Yes	27 (48.2)	29 (51.8)	56
No	68 (94.4)	4 (5.6)	72
Was any abortion previously			
Yes	9 (60.0)	6 (40.0)	15
No	86 (73.5)	31 (26.5)	117
At what interval did your birth spacing			
<2 years	29 (74.4)	10 (25.6)	39
>2 years	66 (70.9)	27 (29.1)	93

Table 8: Prevalence of anemia in relation to previous blood loss and other.

Conclusion

This study shows that anemia in pregnancy is still a significant problem whereby more than one third of the women attending antenatal care were found to be anemic. Then major cause of this high prevalence is that the food consumption habit (unable to feed variety of food), educational level; of the mother, in appropriate iron supplementation taken and others. Birth spacing and multiparity also the other factors that has great contribution to the prevalence of anemia.

There is also need for improvement of diagnostic ability of anemia by the health workers. Routine iron supplementation should be encouraged as prophylactic measure. Other interventional measures and programs to educate the mothers on the need to initiate antenatal care early should be instituted. Health education talks on nutrition needs for the mother and the growing fetus should also be carried out.

Acknowledgment

First of all we would like to acknowledge Bahir Dar University which gives us this opportunity to do this research. We would like to heart fully to Woldia General Hospital MCH department staff for their great patient and kind full cooperation to complete the data collection properly.

Reference

- http://www.who.int/nutrition/publications/micronutrients/anaemia_iron_deficiency/WHO_NHD_01.3/en/
- Hercberg S, Galan P (1992) Nutritional anaemia baillieres. *Clin Haematol* 5: 143-168.
- Hotez P, Bethony J, Bottazzi E, Brooker S, Buss P (2005) Hookworm: "The great infection of mankind". *PLoS Med* 2: 67.
- Sifakis S, Pharmackides G (2000) Anaemia in pregnancy. *Ann NY Acad Sci* 90: 125-136.
- Zavaleta N, Berlanga R, Lonnerdal B, Brown H (1993) Prevalence and determinants of iron deficiency anaemia in a representative sample of pregnant women in Lima, Peru. Pan American Health Organization.
- Steketee W (2003) Pregnancy nutrition and parasitic diseases. *J Nutr* 133: 1661-16675.
- Frewin R, Hensen A, Provan D (1997) ABC of clinical haematology: iron deficiency anaemia. *Br Med J* 314: 360-363.
- <http://apps.who.int/medicinedocs/documents/s21694en/s21694en.pdf>
- Wharton B (1999) Iron deficiency in children: detection and prevention. *Br J Haematol* 106: 270-280.
- Allen LH (2000) Anemia and iron deficiency: effects on pregnancy outcome. *Am J Clin Nutr* 71: 1280S-1284S.
- Yip R, Ramakrishnan U (2002) Experiences and challenges in developing countries. *J Nutr* 132: 827S-830S.
- Berhane Y, Gossaye Y, Emmelin M, Hogberg H (2001) Women's health in rural setting in societal transition in Ethiopia. *Soc Sci Med* 53: 1525-1539.
- Gibson MA, Mace R (2006) An energy-saving development initiative increases birth rate and childhood malnutrition in rural Ethiopia. *PLoS Med* 3: e87.
- Ethiopia Central Statistical Agency (2006) Ethiopia demographic and health survey 2005: preliminary report. Central Statistical Agency, Addis Ababa. pp: 156-157.
- Wolde-Gebriel Z, West CE, Gebru H, Tadesse AS, Fisseha T, et al. (1993) Inter-relationship between vitamin A, iodine, and iron status in schoolchildren in Shoa region, central Ethiopia. *Br J Nutr* 70: 593-607.
- Ethiopia Federal Ministry of Health (2004) National guideline for control and prevention of micronutrient deficiencies. Family Health Department, Federal Ministry of Health, Government of Ethiopia, Addis Ababa.
- Haidar J, Nekatibeb H, Urga K (1999) Iron deficiency anemia in pregnant and lactating mothers in rural Ethiopia. *East Afr Med J* 76: 618-622.

18. Haider J, Muroki NM, Omwega AM, Ayana G (2003) Malnutrition and iron deficiency in lactating women in urban slum communities from Addis Ababa, Ethiopia. *East Afr Med* 80: 191-194.
19. http://www.unscn.org/layout/modules/resources/files/Policy_paper_No_9.pdf
20. Crompton W (2000) The public health importance of hook worm disease. *Parasitology* 121: 39-50.
21. Raut BK, Jha MK, Shrestha A, Sah A, Sapkota A, et al. (2014) Prevalence of iron deficiency anemia among pregnant women before iron supplementation in Kathmandu university hospital/Dhulikhel hospital. *Journal of Gynecology and Obstetrics* 2: 54-58.
22. Desalegn S (1993) Prevalence of anaemia in pregnancy in Jimma town, Southwestern Ethiopia. *Ethiop Med J* 31: 251-258.
23. Haider J (2010) Prevalence of anaemia, deficiencies of iron and folic acid and their determinants in Ethiopian women. *J Health Popul Nutr* 28: 359-368.
24. Kefyalew A, Abdulahi M (2014) Prevalence of Anemia and associated factors among pregnant women in an urban area of eastern Ethiopia 2014: 561567.
25. Abriha (2014) On prevalence and associated factors of anemia among pregnant women in, Mekelle town. *BMC Research* 7: 888
26. https://en.wikipedia.org/wiki/North_Wollo_Zone
27. Agency CS (2007) The 2007 population and housing census of Ethiopia. Central Statistical Agency, Addis Ababa, Ethiopia.