

RESEARCH ARTICLE

Prevalence and Associated Factors among Pregnant Women with Anemia Attending Al-Thawra Hospital, Sana'a City, Yemen

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Abstract

Background: The occurrence of anemia during pregnancy is usually associated with an increased risk of maternal, fetal, and newborn morbidity and mortality, particularly in low-income countries like Yemen. This study, therefore, aimed to assess prevalence and factors associated with anemia among pregnant women attending Al-Thawra Hospital, Sana'a City, Yemen.

Method: A cross-sectional based study was conducted on 237 pregnant women to assess prevalence and factors associated with anemia among cases housed in the obstetrics and gynecology department at Al-Thawra Hospital, Sana'a City, Yemen. From February to May 2021. Sociodemographic and clinical data of the study participants were collected using structured questionnaires by interview and review of medical records. In all cases, P value less than 0.05 was considered statistically significant.

Result: The prevalence of anemia was found to be higher in the second trimester (48.4%) when compared to pregnant women in their first and second trimesters. Most of the participants had pregnancy with complications (78.9%). The highest number of the participates were 24-33 years old (58.6%) while the lowest number of the participate were between 34-45 years old (11.9%). The concentration of hemoglobin was low <11 mg/dl (95.7%) in the most participants. Pregnant women who did not receive iron/folic acid supplementation were more likely to be anemic when compared to pregnant women who did take supplementations.

Conclusion: In this study, the prevalence of anemia in pregnancy was mostly related to poor healthy diet and supplementations. Therefore, both nutrition and health education and promoting the benefits of early antenatal care visit to promote the awareness are highly recommended to reduce anemia.

Keywords: Anemia; Anemia; Pregnant Women; Hemoglobin; Iron; Folic acid; Bleeding.

Introduction

Anemia is a public health problem in both developed and developing countries. It affects 1.62 billion people globally, which corresponds to 24.8% of the world population. Global prevalence of anemia in pregnant women is 41.8% and the highest proportions of pregnant women affected are in Africa. The highest proportion of affected is in developing countries, particularly in Africa (while the greatest number affected is in South Asia where 315 million people suffer from anemia. [1-2].

During pregnancy the total blood volume increases by about 1.5 liter [3]. The plasma volume increases more compared to red cell mass which leading to hemodilution and reduced hemoglobin concentration. This is termed physiological anemia of pregnancy [3, 4]. The World Health Organization (WHO) has suggested that anemia is present in pregnancy when Hb level is <11g/dl. It also classified anemia in pregnancy 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 [5].

Anemia in pregnancy is an important public health problem worldwide. The WHO estimates that more than half of pregnant women in the world have a low hemoglobin level (<11.0 g/dl), the prevalence may, however, be as high as 61% in developing countries. During pregnancy, a balanced diet with an adequate intake of essential nutrients is important for fetal development and birth outcome, but for the mother's health. One of the micronutrients of special importance is iron. Being a vital constituent of hemoglobin, iron is essential for blood formation and oxygen supply, and it enables various enzymatic reactions in the human body [7-9]. During gestation, iron requirements increase. Most importantly due to an increase in the red blood cell mass and growth of the unborn child and placenta and mainly during the second and third trimester. Daily iron intake of approximately 11-12mg through normal diet [10-15].

In Yemen, few studies were conducted on prevalence of anemia among pregnant women, the prevalence range in the whole country was not being determined [11-13]. Studying the specific etiology and prevalence of anemia in the capital city and its population group is very important to prevent or treat anemia. However, there is very little data available in the study area. Therefore, this study is aimed to assess the prevalence and factors associated with anemia in pregnant women at Al-Thawra Hospital – Sana'a City – Yemen.

Methods

Study Design: This study is a description cross sectional study to determine the characteristics of anemia among pregnancy women in AL-thawra Hospital, Sana'a, Yemen. The face validation was made before the study was initiated on 15 women pregnant to ensure clarity, understanding and simplicity of the questionnaire in this study.

Study Location: This study was conducted in the department of obstetrics and gynecology, in AL-thawra hospital, Sana'a, Yemen. AL-thawra hospital is considered one of the main referral hospital at the capital Sana'a, where it is the number of cases that come to more than 600 cases per day. The departments of the hospital consists of orthopedic department, Ophthalmology department, a special section for neonatal care and mothers, the surgery and caesarean section and the in section departed represented by the department of women and childbirth.

Inclusion Criteria: All pregnant women with less than 11g/dl of hemoglobin were included in this study.

Exclusion Criteria: All pregnant women who have normal hemoglobin and less than 16 years have been excluded from this study.

Study Duration: Data collection were conducted during the period from 29-February. until 27-May (2021), (4 month).

Sample Size: 237 pregnancy woman. This sample size was calculated Based on WHO (2018) [45]. Systematic random sampling technique was used to recruit the study participants from their sequence of the obstetrics and gynecology Department visit in AL-Thawra Hospital during the study period. Strategies that include careful selection of the research questions, choosing an appropriate data collection method and study design, were the most appropriate way to avoid recall bias in this study.

Method of data collection: After obtaining the permission from AL-Hikma University, the permission also obtained from AL-thawra hospital to collect the data from pregnant woman from the obstetrics and gynecology Department.

All anemic woman were invited to complete the in this study and invited to complete the questionnaire. Clinical data such as Hb, CBC (RBC – WBC – Plt –MCV-MCH –MCHC –RDW) were collected from the laboratory department at AL-Thawra Hospital. We used questionnaires and asked pregnant woman face to face a group of question.

Study techniques: The questionnaire consist of three sections (General information about the participants, obstetric history characteristics, dietary factor characteristics). The questionnaire includes questions about the social characteristics of the demographic of the participant, medical history, iron supplements, folic acid, and dietary habits. Hemoglobin concentration was measured by using the SYSMEX tool. Hemoglobin concentration was recorded in the form of mg/ deciliter. The women who have blood sterilization levels between 10 and 11g / deciliter have been considered as mild poverty, and women with hemoglobin levels between 7and 9.9g (9.9) were considered that they are moderate and mandatory poverty.

Data analysis: Using the statistical package for social science (SPSS) version 21. The single variable analysis was used to check the relationship between anemia and potential associated factor. In addition, binary logistics analyzes was used to determine the factors associated with an independent of anemia. The amended odds and 95% CI was calculated. P <0.05 is considered statistically significant; Results were as persecuted percentage, tabulation.

Ethical consideration: Permission was granted from the university and the hospital. Verbal consent were obtained from all participants and they informed that participation is voluntary.

Results: Total number of pregnant women was 237 participated in the study he age of the pregnant women is start from 16 to 46 years old. General information about the participants.1 -Most of the participant were married (94. 5%). Most of the participant were Farmer (43.5%). Most of the participant were secondary (33.3%). Most of the participant were1-4 (household size) (69.2%). Table (1).

(%)N	Categorize	Variable
224 (94.5%)	Married	Marital status
12 (5.1%)	Divorced	
1 (0.4%)	Widowed	
78 (32.9%)	House wife	Occupation
103 (43.5%)	Farmer	
45 (19.0%)	Employees	
11 (4.6%)	Others	
42 (32.9%)	Diploma and above	Level of education
78 (33.3%)	Secondary	
62 (26.2%)	Primary	
54 (22.8%)	No formal education	
164 (69.2%)	1-4	Household size (Persons)
64 (27.5%)	5-7	
9 (3.8%)	>=8	

Table 1: General information about the study Participant. (n=237)

2-Obstetric history characteristics: Most of the participant were ever had abortion (56.5%). Most of the participant were birth interval <2 years (71.3%). Most of the participant were have ever still birth (71.7%). About of the participant were have got malaria in previous years Most of the participant were had excessive menstrual bleeding (yes) (66.2%). Most of the participant were had pregnancy related complication (yes) (78.9%). Most of the participant were planned pregnancy (No) (53.6%). Most of the participant were hemoglobin level <11 mg/dl (95.7%). Most of the participant were second trimester (49.4%). (Table 2).

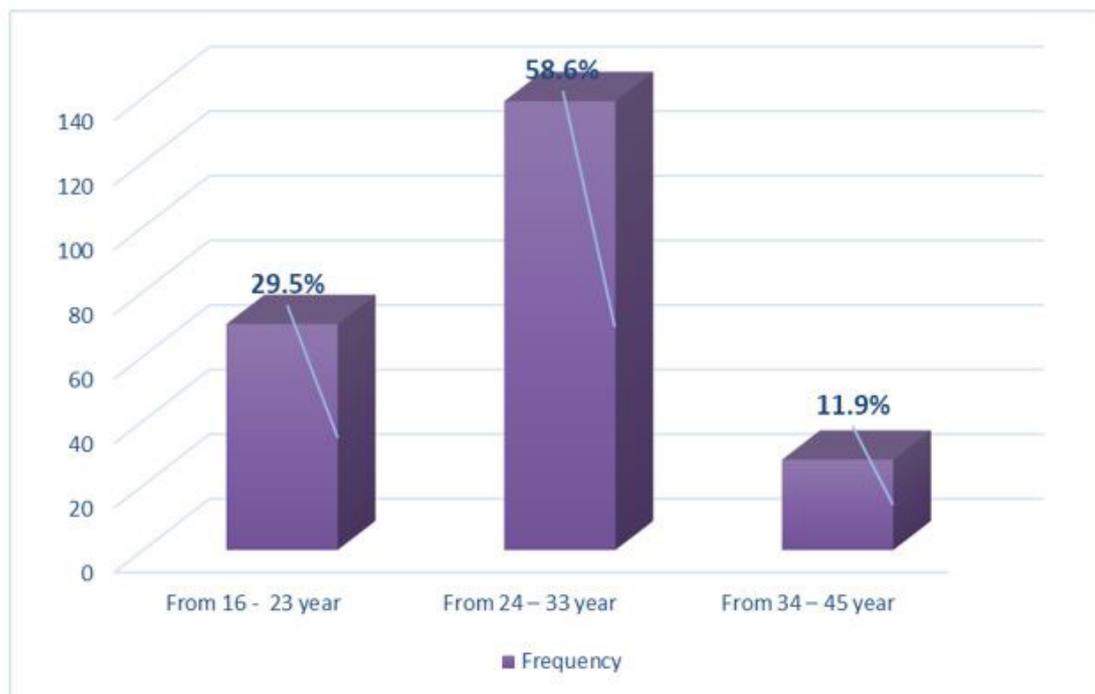
N (%)	Categorize	Variable
45 (19.0%)	Nulliparous	Parity
152 (64.1%)	1-4	
39 (16.5%)	7=5	
103 (43.5%)	No	Ever had abortion
134 (56.5%)	Yes	
169 (71.3%)	<2 years	Birth interval
68 (28.7%)	>=2 years	
66 (27.8%)	No	Have ever still birth
170 (71.7%)	Yes	
144 (60.8%)	No	Have got malaria in previous year
93 (39.2%)	Yes	
79 (33.3%)	No	Had excessive menstrual bleeding
157 (66.2%)	Yes	
50 (21.1%)	No	Had pregnancy related complication
187 (78.9%)	Yes	
127 (53.6%)	No	Planned pregnancy
109 (46.0%)	Yes	
15 (6.3%)	>11mg/dl	Hemoglobin level
222 (93.7%)	<11mg/dl	

Table 2: Obstetric history characteristics of the steady participant (n=237)

3-Hematological features: The pregnant women conducted by the study had a lake of Hb% (HGB) and HCT is where (100%). The table also shows its percentage MCV for pregnant women in this study most natural was (62.4%). Pregnant women to increase MCV it was (36.3%) follow this. In addition, pregnant women, which has been deficient in MCV the percentage, was at least (1.2%). From this table we note that most pregnant women had a natural MCH and a normal (57.4%). which they had an increase in MCH (7.2%). Which had a lake of accounts were equal (35.4%). The table shows that MCHC is in most of the factors that were normal by (91.1%). and formed the lowest percentage of factors with MCHC deficiency by (9.5%). We not from the table that the percentage of pregnant women who had normal RBC percentage constitutes the highest percentage and is equal to (71.8%). and which there have deficiencies were (28.2%). The table show that RDW increase the highest percentage and equal to (66.2%). and followed by the most important factors they have a natural RDW rate (12.5%). followed by the lowest percentage of factors with RDW minus (12.2%). Finally, we not from the table that the percentage of pregnant women who had normal WBC percentage constitutes the highest percentage and is equal to (58.2%). Women who have increase WBC percentage (31.0%) follow this. The lowest percentage women who have WBC deficiencies were (10.3%).

Frequency (%)	The result		Test name
0 0 237(100%)	11.5 – 16.5 g/dl >11.5 – 16.5 g/dl <11.5 – 16.5 g/dl	Normal Increase Decrease	HGB
148 (62.4%) 86 (36.3%) 3 (1.2%)	76.0 -96.0 fl >76.0 -96.0 fl <76.0 -96.0 fl	Normal Increase Decrease	MCV
136 (57.4%) 17 (7.2%) 84 (35.4%)	27.0 – 32.0 pg >27.0 – 32.0 pg <27.0 – 32.0 pg	Normal Increase Decrease	MCH
216 (91.1%) 0 21 (9.5%)	30.0 – 36.0 g/dl >30.0 – 36.0 g/dl <30.0 – 36.0 g/dl	Normal Increase Decrease	MCHC
170(71.8%) 0 67(28.2%)	3.5 – 16.5 .10e6/ul >3.5 – 16.5 .10e6/ul <3.5 – 16.5 .10e6/ul	Normal Increase Decrease	RBC
51 (21.5%) 157 (66.2%) 29 (12.2%)	11.5 -36.0 % >11.5 -36.0 % <11.5 -36.0 %	Normal Increase Decrease	RDW
138(58.2%) 72(31.5%) 27(10.3%)	4.0 -11.0 .10e3/ul >4.0 -11.0 .10e3/ul <4.0 -11.0 .10e3/ul	Normal Increase Decrease	WBC
0 0 237 (100%)	37.0 – 47.0 % >37.0 – 47.0 % <37.0 – 47.0 %	Normal Increase Decrease	HCT

Table 3: Hematological features of among pregnant women in Yemen



The highest number of the participants were 24-33 years old (58.6%) Following by 16-23 years old (29.5%). The lowest number of the participate more 34-45 years old (11.9%).

Figure 1: Age and anemic in pregnancy women (n=237)

Discussion

Anemia during pregnancy is related to increased maternal and child mortality and morbidity in low-income countries. Thus, this study assessed the hematological and socio-economic factors that affect anemia during pregnancy in Yemen. Hemoglobin level among pregnant women in this study was 93.7%, this indicates that anemia among pregnant women in Yemen is a major public health problem. A Yemeni study showed that the overall prevalence of anemia among pregnant women at Safe Motherhood Specialized Hospital in Sho'ub District was 25.0% , of which of them had mild anemia, 28.2% had moderate 70-80% anemia, and only 1.04% of them had severe anemia [16-19]. Since we targeted anemia in pregnant women in our study, we found, after analyzing the data, that there is a large percentage of pregnant women who have a hemoglobin percentage of less than 11mg/dl and this is evidence of the high rate of anemia in Yemen among pregnant women. This is due to several reasons, including natural and physiological reasons, including nutrition and to some behaviors practiced by a pregnant woman during pregnancy.

Most of the study participants were married women accounting for 224 (94.5%), while the percentage of widows was 0.4% and the percentage of divorced women was 5.1%. Furthermore, the majority of anemic women were farmers. This may be explained by the living condition that they practice in their daily lives including hard work malnutrition ignorance and the lack of family planning. As for the level of education in this study, only 33.3% of the participants had secondary education. A previous study in Yemen showed similar findings that 35.4% of pregnant women had secondary education [20-22]. In this study, the group with the highest number of family members was 69.2%. Household size is important especially in a poor country like Yemen which increases the number of families inside the single house, and the income is not sufficient to cover all the necessary needs of food and other things. This is a main reason for family members in general and pregnant mother in particular, which leads to a deficiency of iron, vitamins and minerals in the pregnant mother and their fetus.

This study showed that 64.1% of the pregnant women have 1-4 children this percentage. Other study showed that parity is still a predisposing factor in Yemen, a country of a high fertility rate (6, 5). It could be one of the sole factors for uterine rupture [27, 28, 29]. This study has documented a very high parity among respondents. Only 35.1 % had 1 to children with the rest (64.9 %) having more than 5 up to 13.4. Age of women in this study ranged from 18 to 42 years, with a mean \pm SD of 32.5 (\pm 6.5 years). Only one woman was 18, almost one half of women were between 20 and 32 and more than half of the women were between 30 and 42 years old. Women older than 35 and women 35 having their fifth or later birth are at greatest risk for uterine rupture and the importance of fertility regulation and contraception usage could be clearly concluded [23-25].

In this study, 71.3% of women have a birth interval for 2 years or more. Globally, there should be five years as a time between the two pregnancies, to reduce the risk of pregnancy complications and other problems that the mother and fetus may face, and my study showed that most pregnant women had a time difference between the two pregnancies. Other study in regard to birth spacing, 37.02% of the women had 3-4 years birth spacing. The majority of the women had an iron and folic acid supplementation (85.9%) during their current pregnancy [26-28]. This result is consistent with the study done in Pakistan [Baig-Ansari et al. 2008]. This is due to the fact that short intervals between births may not provide women with enough time to replenish lost nutrient stores before another reproductive cycle begins [29-30].

About 66.2% of the participants had an excessive menstrual bleeding in their lives. The risk of anemia in pregnant women increases due to the bleeding that a woman is exposed to from her previous menstruation, which she loses from blood and the basic components of the blood. It is also known that the fetus feeds on the mother's blood, and this loses a large proportion of the components of the mother's blood. In this a previous study, pregnant women who had heavy menstrual blood flow before the index pregnancy were 2.6 times more likely to have a risk of developing anemia than who did not have history of heavy menstrual blood flow [31]. Other previous studies showed that having heavy menstrual flow was more likely to develop anemia. The possible reason may be that heavy menstrual blood flow leads a woman to heavy blood loss, which in turn leads to anemia.

Most of the pregnant women in this study had pregnancy related complication (78.9%). Risk are increased by high blood pressure, obesity, diabetes, epilepsy, thyroid disease, heart or blood disorders, uncontrollable asthma and infection disease. Pregnancy complication that occur during pregnancy can also pose risks. In perinatal laceration, women may had hyperemesis gravidarum, hypertension, preeclampsia, deep vein thrombosis, anemia, infections urinary incontinence and postpartum depression. But this condition may be exacerbated in cases of severe anemia or a low proportion of nutritious vitamins, which leads to a feeling of fatigue and general weakness in the body, and thus the pregnant woman becomes more vulnerable to complications that threaten her life and the life of her fetus, such as premature birth [32-35].

This study showed that there is a relationship between the spacing of pregnancy and the pre-planning of pregnancy, as most women had a spacing of pregnancies less than two years, meaning that there is no pregnancy planning. The percentage also showed us that (53.6%) of unplanned pregnancies, but there is a percentage (46.6 %) of women have pre-planned pregnancy.

Most of pregnant women (72.6%) in this study ate less than three meals per day. Eating is important for the health of the expectant mother and the health of the fetus. In our research and after analyzing the data, the highest percentage of pregnant women ate less than or equal to three meals a day for several reasons, including physical condition, large number of family members, and complications during pregnancy such as nausea and vomiting. This is consists with a previous study showed that pregnant women who had meal frequency less than two times per day were 3.9 times at higher risk of developing anemia than those whose meal frequency was more than three times per day [36]. This might be because pregnancy is a special period with increased energy and nutrient requirement, which can be fulfilled with increased meal frequency.

Consuming tea/coffee immediately after food has a negative association with anemia during pregnancy. In this study 43.9% of pregnant women consumed tea or coffee before meal. Tea is not only the only suspect in anemia, but coffee and soda water are shared with it, and the three drinks reduce the body's absorption of iron from food and cause difficulty in digestion, and eating it immediately after eating or with breakfast leads to severe anemia. This result is in agreement with a study done in Egypt and Ethiopia, which showed significant association between anemia and consumption of tea [37]. This could be drinking tea or coffee after food intake may affect iron absorption, which leads to inadequate dietary iron intake into the pregnant women.

In this study the most pregnant women ate fruits weekly 138 (53.2%), and the percentage of pregnant women who ate fruits per day was 41 (17.3%), and also the percentage of pregnant women who ate fruits in the month 58 (24.5%), and this is due to the economic situation. A previous study showed that 44.8% had the habit of eating fruit once [38]. Studies conducted in Pakistan and Turkey also suggested consumption of fruit two or more times per week is associated with a decreased risk of anemia [39-40]. Poor dietary diversity leads to deficiency of minerals and vitamins, which may increase bioavailability of iron, then affects Iron status. Pregnancy is the most nutritionally demanding period in a woman's life. Therefore, pregnant women are advised to eat more diversified diet than usual [41-44].

Our study is similar with studies conducted in Malaysia [45], west Algeria [46], and Tikur Anbessa hospital [47].

One of the limitation of this study is the cross-sectional method of the study design; it did not show causal links between anemia and risk factors. Despite this study tried to asses some related factors, other factors such as stool examination, malaria, inherited, or acquired disorders that affect hemoglobin or red blood cell synthesis were not addressed due to lack of time and resources. The second limitation is that this study is taken place only at single hospital; hence, further studies should be conducted in different hospitals in Sana'a to have findings representing the completely Yemeni population.

Conclusion

This study revealed that anemia is still a significant problem among Yemeni pregnant women, where a quarter of the studied

pregnant women in the second and third trimesters were found to be anemic. The study revealed that anemia during pregnancy is significantly associated with some factors, including income status, a short spacing between pregnancy, and presence of health problem during pregnancy. Based on the findings of this study, identification of these risk factors is a valuable consideration to reduce the anemia prevalence during and after delivery. This study recommends that socioeconomic factors, which may lead to limited access to healthy food and antenatal care, contribute to most of the anemia cases and, therefore, should be recognized as the main determinants for anemia in pregnant women. It is a time for the realization that the health system should focus on various factors that contribute to the occurrence of anemia and include them as important indicators in the National Health Policy.

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Competing Interests

The authors declare that they have no competing interests

References

1. Mayer EM, Tegman A (1998) Prevalence of anaemia in the World. *World Health Organ Qlty* 38: 302-16
2. Ezzati M, Lopez AD, Dogers A, Vander HS, Murray C (2002) Selected major risk factors and global and regional burden of disease. *Lancet* 360: 1347-60
3. USAID's (2006) A2Z micronutrient and child blindness project, ACCESS program, and food and nutrition technical assistance (FANTA) project. *Maternal Anemia*.
4. Levy A, Fraser D, Kartz M, Mazor M, Sheiner E (2005) Maternal anaemia during pregnancy is an independent risk factor for low birth weight and pre mature delivery. *Eur J Obstet Gynecol Reprod Biol* 122: 182-6.
5. Lone FW, Qureshi RN, Emanuel F (2004) Maternal anaemia and its impact on perinatal outcome. *Trop Med Int Health* 9: 486-90.
6. Zhang Q, Ananth CV, Rhoads GG, Li Z (2009) The impact of maternal Anemia on perinatal mortality: a population-based, prospective cohort study in China. *Annals Epidemiol* 19: 793-9.
7. Rusia U, Madan N, Agarwal N, Sikka M, Sood S (1995) Effect of maternal iron deficiency anaemia on foetal outcome. *Indian J Pathol Microbiol* 38: 273-9.
8. Stoltzfus RJ, Mullany L, Black RE (2004) Iron deficiency anemia. In Ezzati M., Lopez A. D., Rodgers A., Murray CJL. editor. *Comparative quantification of health risks: Global and regional burden of disease Int J Rep, Contraception, Obst and Gynecol Vol 5: 3505 attributable to selected major risk factors*. Geneva: World Health Organization 1: 163-209.
9. The second National Family Health Survey (NFHS-2). The database for implementation of the Reproductive and Child Health approach adopted by India. 1998-99.
10. National nutrition monitoring bureau (NNMB). NNMB micronutrient survey. Hyderabad: National Institute of Nutrition 2002.
11. The 2005-06 National Family Health Survey (NFHS-3). Series of national surveys. NFHS surveys: 1992-93 (NFHS-1) and 1998-99 (NFHS-2).
12. Toteja GS, Singh P. Micronutrient profile of Indian population. New Delhi. *Indian Council of Med Res* 2004: 46.
13. Salhan S, Tripathi V, Singh R, Gaikwad HS (2012) Evaluation of hematological parameters in partial exchange and packed cell transfusion in treatment of severe anaemia in pregnancy. *Anaemia*.
14. Statistics information, District Sonipat at a glance. Available at sonipat.nic.in/statistics.htm. Accessed on 16 May 2016.
15. Rajaratnam J, Abel R, Ganes C, Aseelan S (2000) Maternal anaemia: a persistent problem in rural Tamil Nadu. *National Med J India* 13: 242-5.

16. WHO SEARO (1995) Control of iron deficiency anemia in South-East Asia. Report of an intercountry Workshop. Salaya, Thailand. Institute Nutrition, Mahidol University 11-4.
17. Agarwal KN, Agarwal DK, Sharma A, Sharma K, Prasad K, et al. (2006) Prevalence of anaemia in pregnant and lactating women in India. *Indian J Med Res* 124: 173-84.
18. International Institute for Population Sciences (Deemed University) District Level Household and Facility Survey-4; State Fact Sheet Haryana. Mumbai:2012–13. Available at [http:// www.http:// www.rchiips.org /pdf/dlhs4/report/HR.pdf](http://www.rchiips.org/pdf/dlhs4/report/HR.pdf). Accessed on 16 May 2015.
19. Kaur K (2014) Anaemia 'a silent killer' among women in India: Present scenario. *Euro J Zool Res* 3: 32-6.
20. Brabin L, Nicholas S, Gogate A, Gogate S, Karande A (1998) High prevalence of anaemia among women in Mumbai, India. *Food Nutrition Bull* 19: 205-9.
21. Thangleela T, Vijaylakshmi P (1994) Prevalence of anemia in pregnancy. *Indian J Nutrit Diet* 31: 26-9.
22. Dutta PK, Nagraj T, Gopinath VP (1992) A case control study of anemia in pregnancy. *Ind J Preventive Social Med* 23: 1-5.
23. Koen MC, Lemson MS, Kumar S, Abel R (1992) Prevalence of anaemia among pregnant mothers in a rural south Indian population. *J Obstet Gynecol India* 42: 283-7.
24. Bisoi S, Haldar D, Majumdar T, Bhattacharya N, Sarkar G, et al. (2011) Correlates of anemia among pregnant women in a rural area of West Bengal. *J Family Welfare* 57: 72-8.
25. Niguse Obse, Andualem Mossie, Teshome Gobena (2013) "Magnitude of anemia and associated risk factors among pregnant women attending antenatal care in Shalla Woreda, West Arsi Zone, Oromia Region, Ethiopia," *Ethiop J Health Sci* 23: 165-73.
26. Morsy N, Alhady S (2014) "Nutritional status and socio-economic conditions influencing prevalence of anemia in pregnant women," *IJSTR*, 3: 54-60.
27. Rajeev Kumar Yadav, MK Swamy, Bijendra Banjade (2014) "Knowledge and practice of anemia among pregnant women attending antenatal clinic in Dr. Prabhakar Kore Hospital, Karnataka," *JDMS* 13: 74-80.
28. Tiwari LM, Jyoti Kotwal, Anupam Kotwal, Priyanka Mishra, Vibha Dutta, et al. (2013) "Correlation of hemoglobin and red cell indices with serum ferritin in Indian women in second and third trimester of Pregnancy," *Med J Armed Forces India* 69: 31-6.
29. Bruno F Casanova, Mary D Sammel, George A Macones (2005) "Development of a clinical prediction rule for iron deficiency anemia in pregnancy," *Am J Obstetr and Gynecol* 193: 460-6.
30. De Benoist B, McLean E, Egli I, Cogswell M (2008) Worldwide prevalence of anaemia 1993-2005: WHO Global Database on Anaemia. Geneva: World Health Organization
31. Hans PS, Garg S, Vohra R, Sharma U, Tiwari K, et al. (2015) Prevalence of anemia and its socio-demographic determinants in pregnant women at a tertiary care hospital in Jaipur, Rajasthan. *J Evol Med Dent Sci* 4: 7195-206.
32. Kassebaum NJ, Bertozzi-Villa A, Coggeshall MS, Shackelford KA, Steiner C, et al. (2014) Global, regional, and national levels

- and causes of maternal mortality during 1990-2013: A systematic analysis for the global burden of disease study 2013. *Lancet* 384: 980-1004.
33. Al-Mass M, Selim N, Al-Kuwari M (2016) Assessment of anemia, IDA and ID among pregnant in Qatar: Cross sectional survey. *SM J Public Health Epidemiol* 2: 1035.
34. World Health Organization (2015) *The Global Prevalence of Anaemia in 2011*. Geneva: World Health Organization.
35. Mahmoud E Abu Salem, Omiyma A Mahrous, Hewaida M El Shazly, Reda A Ibrahim, Samar HA, et al. (2016) Epidemiology of iron-deficiency anemia among pregnant women in menoufia governorate, Egypt and Taiz Governorate, Yemen: A comparative study. *Menoufia Med J* 29: 1005-11.
36. Stoltzfus RJ, Dreyfuss ML, Chwaya HM, Albonico M (1997) Hookworm control as a strategy to prevent iron deficiency. *Nutr Rev* 55: 223±232.
37. Abriha A, Edris M, Mesele M (2014) Prevalence and associated factors of anemia among pregnant women of Mekelle town, Ethiopia. *BMC Research Notes* 7: 888.
38. Gebremedhin S, Enquesselassie F (2011) Correlates of anemia among women of reproductive age in Ethiopia. *Ethiopia J of Health Dev* 25: 22±30.
39. Baig-Ansari N, Badruddin SH, Karmaliani R, Harris H, Jehan I, et al. (2008) Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan. *Food Nutr Bull* 29: 132±39.
40. Salhan S, Tripathi V, Singh R, Gaikwad HS (2012) Evaluation of hematological parameters in partial exchange and packed cell transfusion in treatment of severe anaemia in pregnancy. *Anaemia*.
41. Saaka M, Rauf A (2015) Role of dietary diversity in ensuring adequate haematological status during pregnancy. *Int J Med Res Health Sci* 4: 749±55
42. Wen LM, Flood VM, Simpson JM, Rissel C, Baur LA (2011) Dietary behaviours during pregnancy: findings from first-time mothers in southwest Sydney, Australia. *Int J Behav Nutr Phys Act* 2010; 7(13):1±7.
43. Sharma JB (2003) Nutritional anaemia during pregnancy in non-industrialized countries. In: Studd J (Edtr), *Progress in obstetrics and gynecology*. New Delhi: Churchill Livingstone 103-22.
44. Buzyan LO (2015) Mild anaemia as a protective factor against pregnancy loss. *Int J Risk Saf Med* 27: 7-8.
45. RN Nik, NS Mohd, Ismail IM (2012) "The Rate and Risk Factors for Anemia among Pregnant Mothers in Jerneh Terengganu, Malaysia," *J Comm Med & Health Edu* 2: 2161–0711.
46. A Demmouche, S Khelil, S Moulessehoul (2011) "Anemia among pregnant women in the Sidi Bel Abbes Region (West Algeria): an epidemiologic study," *Journal of Blood Disorders & Transfusion* 2: 1-6.
47. AH Jufar, T Zewde (2014) "Prevalence of anemia among pregnant women attending antenatal care at Tikur Anbessa Specialized