

Study of morphological types of anemia in pregnant women with low socioeconomic status attending antenatal care at rural tertiary care hospital

Patil JD.¹, Nagare MR.²


DOI: <https://doi.org/10.17511/jopm.2020.i03.07>

¹ Jayraj Devidas Patil, Undergraduate student, MIMER Medical College, Pune, Maharashtra, India. <https://orcid.org/0000-0002-5448-4472>

^{3*} Mangala Rajesh Nagare, Assistant Professor, Department of Pathology, MIMER Medical College, Pune, Maharashtra, India. <https://orcid.org/0000-0001-7107-5120>

Introduction: Anemia is a major public health problem affecting both the developed(14%) as well as the developing(51%) countries. India became the first developing country to take up a National Nutritional Anemia Prophylaxis Program (NNAPP) to prevent anemia among pregnant women. **Aims and objectives:** 1.To find out the prevalence of anemia in ANC patients with low socioeconomic status 2. To find out morphological types of anemia in this ANC patients 3.To study the various factors causing anemia in this group. **Material and Methods:** The type of this study is the Cross-Sectional Study, it was conducted on the ANC patients attending OPD and IPD of OBGY department at BhausahebSardesai Talegaon Rural Hospital, Maharashtra.The written consent of the pregnant women was obtained prior to the collection of the blood sample. **Results:** In the present study prevalence of anemia was found to be 72.58%. 15.32% of women found to be mildly anemic, 52.42% moderately anemic and 4.84% severely anemic followed by 27.42% not anemic. **Conclusion:** Microcytic hypochromic blood picture is predominant in the present study, it indicates there are deficient iron intake and lack of awareness about proper diet. Proper interaction, information, medication, proper diet containing all nutrients, cooking in iron utensils, fortification of food and salt with iron and birth control for proper spacing of pregnancies; such measures will go long way in improving maternal and fetal outcome.

Keywords: Anemia, Low socioeconomic group, Morphological types of anemia, Pregnant women, Prevalence

Corresponding Author	How to Cite this Article	To Browse
Mangala Rajesh Nagare, Assistant Professor, Department of Pathology, MIMER Medical College, Pune, Maharashtra, India. Email: mangalnagare@yahoo.co.in	Patil JD, Nagare MR. Study of morphological types of anemia in pregnant women with low socioeconomic status attending antenatal care at rural tertiary care hospital. Trop J Pathol Microbiol. 2020;6(3):253-260. Available From https://pathology.medresearch.in/index.php/jopm/article/view/433	

Manuscript Received
05-03-2020

Review Round 1
16-03-2020

Review Round 2
22-03-2020

Review Round 3

Accepted
28-03-2020

Conflict of Interest
No

Funding
Nil

Ethical Approval
Yes

Plagiarism X-checker
14%

Note



© 2020 by Jayraj Devidas Patil, Mangala Rajesh Nagare, Mangala Rajesh Nagare and Published by Siddharth Health Research and Social Welfare Society. This is an Open Access article licensed under a Creative Commons Attribution 4.0 International License <https://creativecommons.org/licenses/by/4.0/> unported [CC BY 4.0].



Introduction

Anemia is a major public health problem affecting both the developed as well as developing countries. According to the World Health Organization, the prevalence of anemia among pregnant women in developed countries is about 14%, whereas it is still as high as 51% in the developing world [1].

Anemia refers to a condition in which the hemoglobin content of the blood is lower than normal for a person's age, gender, and environment, resulting in the oxygen-carrying capacity of the blood being reduced [2].

India became the first developing country to take up a National Nutritional Anemia Prophylaxis Program (NNAPP) to prevent anemia among pregnant women. NNAPP was initiated in 1970 during the fourth 5-year health plan with the aim of reducing the prevalence of anemia to 25% [1,3,5,6].

Anemia is known to be associated with multiple factors, but in the pregnant women, the common factors include - Poor socioeconomic status, high parity, short birth interval, poor diet both in quantity and quality, lack of health and nutrition awareness, and a high rate of infectious diseases [7].

The mean minimum acceptable hemoglobin level during pregnancy by WHO criteria are taken to be 11.0 g/dL. WHO and ICMR (Indian Council of Medical Research) further divides anemia in pregnancy into: mild anemia (hemoglobin 10-10.9 g/dL), moderate anemia (hemoglobin 7.0-9.9 g/dL) and severe anemia (hemoglobin <7 g/dL) [2,4,6,8,9].

While malnutrition is prevailing among all segments of the population, poor nutrition among women begins in the early years and continues during their lifetime. Usually, female members of the family are last to eat. Consequently, if there is not enough food they are the ones to suffer mainly.

Unequal access to food, heavy work demands, nutritional deficiencies including iron, makes Indian women susceptible to illness, and anemia. Low intake of ascorbic acid and meat due to low income reduces the absorption of iron [10,11].

It is not enough to just report that patient has anemia, morphological subtyping of anemia is also equally required so that the clinician can be properly guided for the proper management and follow up of the patient. Morphologically, in peripheral blood

Smear examination, anemia can be microcytic hypochromic type, macrocytic type, dimorphic type, and normocytic normochromic type. Each of these morphological types has varied etiologies and can be known by correlating with the patient's clinical history, clinical examination, and by further suitable investigations [12].

Hence the present study will be carried out with objectives to study the prevalence of anemia among rural pregnant women and to find out the morphological type of anemia as well as to study the various factors causing anemia among these patients.

Aims and Objectives

1. To find out the prevalence of anemia in ANC patients with low socioeconomic status.
2. To find out morphological types of anemia in these ANC patients.
3. To study the various factors causing anemia in this group.

Material and Methods

Study Design: Cross-Sectional study

Study period: 2 months (conducted in the month of 5 May 2018 - 5 July 2018)

This study was conducted on the ANC patients attending OPD and IPD of the OBGY department at Bhausaheb Sardesai Talegaon Rural Hospital, Maharashtra, India. The written consent of the pregnant women was obtained prior to the collection of the blood sample. Data was collected with the help of proforma. A blood sample was collected in the anticoagulant bulb. The diagnosis of anemia done by Hb estimation and estimation of blood indices. Morphological typing is done with the help of Peripheral blood smear stained with Leishman stain.

Sample size: Prevalence of anemia in previous studies was 60% [1]. Considering allowable error 15% of prevalence and 95% confidence interval ($\alpha = 0.05$).

Formula used for sample size is,

$$N = (z)^2 pq / (l)^2$$

Where, n = sample size

Z = level of significance

P= positive prevalence

Q= non- prevalence

L= allowable error

$$N = \frac{(1.96 \times 1.96) \times 60 \times 40}{9 \times 9}$$

= 113

Considering 10% drop out rate total sample size =113+11= 124

J) Selection Criteria: Type of sample will be purposive. Consecutive 124 **ANC patients** coming to the OBGY OPD and IPD at Bhausahes Sardesai Talegaon Rural Hospital Maharashtra, satisfying inclusion and exclusion criteria.

Inclusion criteria: ANC patients with low socioeconomic status having an orange or yellow ration card/below the poverty line. Based on the occupation of the head of the family, education of the head of the family and total monthly income of the family; socioeconomic classes can be classified as follows according to Modified Kuppuswamy socioeconomic scale,

Table-1 Kuppuswamy socioeconomic status scale.

Total score	Socioeconomic class
26-29	Upper (I)
16-25	Upper middle(II)
11-15	Lower middle(III)
5-10	Upper lower(IV)
<5	Lower(V)

Women belonging to lower socioeconomic classes were included.

Exclusion criteria: ANC patients with other complications related to pregnancy, obesity, diabetes, multiple pregnancies.

Data was collected using a prepared proforma sheet which was to be filled. Which includes biodata of patient, her obstetric history, personal history including dietary habits, treatment history, past history, family history, and investigations to be performed.

Sample collection: 2ml blood in EDTA vacutainer for Hb estimation, estimation of blood indices, and PBS examination.

Statistical Analysis: Statistical analysis will be

Done with appropriate tests in consultation with a statistician

H) Risks involved: No major risk involved, hematoma formation, or dizziness following sample collection may occur.

Ethical clearance: Ethical clearance was obtained from the Institutional ethics committee, and the procedures are followed in accordance with the ethical standards of this ethical committee.

Results

Study Design

The present study was carried out in a rural tertiary care hospital over a period of 2 months, out of 124, in which 90 were anemic showing the prevalence of 72.58%.

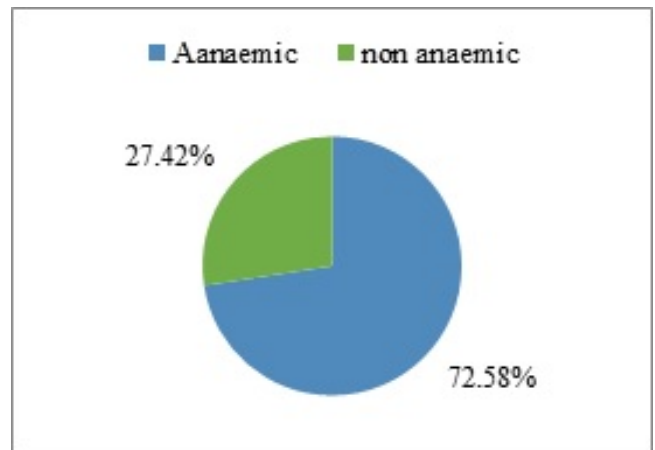


Fig-1: Prevalence of anemia.

Table-2: Summary of hematological parameters of Anemic women.

Hematological Parameters	Mean values	Standard Deviation	Normal values
Hb (gm/dl)	9.01	1.89	11
MCV (fl)	71.28	11.21	80-96
MCH (pg)	23.21	3.81	27-33
MCHC (%)	32.00	2.13	33-36
PCV (%)	28.17	3.56	37
RDW-CV (%)	15.46	3.63	11.6-14.6

The above table summarizes mean values, standard deviation, and the normal value of the parameters viz. Hb, MCV, MCH, MCHC, PCV, and RDW-CV (Red cell distribution width coefficient of variation). According to table no:2 mean values of hemoglobin (9.01 g/dl), MCV (71.28 fl), PCV (28.17%) are below their normal values and mean value of RDW-CV is 15.46%.

Table-3: Grading of anemia amongst study subjects.

Hb concentration (g/dl)	No. of women	Percentage %
Mildly Anemic (10-10.9)	19	15.32
Moderately Anemic (7-9.9)	65	52.42
Severely Anemic (<7)	6	4.84
Not Anemic (>11)	34	27.42
Total	124	100

52.42% of women were found to be moderately anemic followed by 27.42% not anemic, 15.32% mildly anemic and 4.84% severely anemic.

Table-4: Morphological subtypes of anemia.

Morphology of RBC	No. of smears	Percentage%
Microcytic hypochromic	67	74.44
Microcytic normochromic	3	3.33
Normocytic normochromic	18	20
Normocytic hypochromic	2	2.22

PBS examination of anemic women shows microcytic hypochromic anemia (74.44%), microcytic normochromic (3.33%), normocytic normochromic (20%), and normocytic hypochromic (2.22%).

Table-5: Age-wise distribution of grading of anemia.

Age in years	Mild	Moderate	Severe	Total	Percentage%
≤ 20	4	8	1	13	14.44
21-25	5	36	1	42	46.67
26-30	10	14	2	26	28.89
≥ 31	-	7	2	9	10

Anemia is most commonly found in the age group 21- 25 (46.67%) and It was least commonly found in the age group ≥ 31year.

Table-6: Factors associated with anemia in pregnancy.

Factor	Anemia present	No Anemia	χ ² - value	p-value
Age (in years)				
≤ 20	13 (72.22%)	5 (27.78%)	11.68	0.0029
21-30	68 (80%)	17 (20%)		
>30	9 (42.86%)	12 (57.14%)		
Literacy				
Literate	44 (60.27%)	29 (39.73%)	6.07	0.014
Illiterate	46 (83.84%)	9 (16.36%)		
Diet				
Vegetarian	59 (90.77%)	6 (9.23%)	22.71	< 0.00001
Non-vegetarian	31 (52.54%)	28 (47.46%)		
Birth interval				
≤2 years	65 (72.22%)	25 (27.78%)	40.05	< 0.00001
>2 years	3 (8.82%)	31 (91.18%)		

Treatment				
Not taking	28(82.35%)	6(17.65%)	0.017	0.87
Taking	75 (75%)	25 (25%)		
Awareness of anemia and Antenatal care				
Aware	17(18.89%)	73(81.11%)	16.39	0.000052
Not aware	19(55.88%)	15(44.12%)		

A highly significant association of anemia was found with diet ($\chi^2=22.71$, $p<0.05$) and birth interval ($\chi^2=40.05$, $p<0.05$). other factors associated with anemia were found to be age ($\chi^2=11.68$, $p<0.05$), literacy ($\chi^2=6.07$, $p<0.05$), and awareness of anemia and ANC ($\chi^2= 16.39$, $p<0.05$). Treatment history was not significantly associated with anemia ($\chi^2=0.017$, $p>0.05$).

Discussion

Anemia during pregnancy is a global public health challenge facing the world today, especially in developing countries.

The onset of anemia occurs in childhood, degrades in the adolescence period in girls, and gets intensified during pregnancy. It is the most common nutritional deficiency disorder in the world. When compared with other developing countries, India shows a higher prevalence of anemia in all age groups[7].

In the present study, the prevalence of anemia in pregnant women is found to be 72.58%. Similar findings were reported by Prashant D et.al (72.75%) and Nadeem Ahmad et.al(74.80%)[3,16]. However, studies conducted by Suryanarayana etal, Sharma etal, and Bisoi etal shows the prevalence of anemia 64%,63%, and 67.8% respectively [7,23,24]. Whereas the study conducted by Kaul et.al prevalence of anemia is observed to be very high (91%) [25]. The mean hemoglobin level in the present study is found to be 9.01±1.89 gm/dl comparable findings (9.77±0.92 gm/dl) were found in the study conducted by Ashish Bhattacharjee et.al in northeast India [8]. Women belonging to low socioeconomic stratum are deprived of a diet rich in iron and folic acid as well as due to unhygienic conditions they are more prone to infections which causes chronic blood loss. A high prevalence of anemia found in the present study is attributed factors.

It is observed that in the present study the majority (46.67%) of the anemic pregnant women belong to the age group 21-25. Kaul et. al in Kashmir valley observed a very high prevalence (93.67%) of

Anemia in a similar age group [25]. A study conducted by Suryanarayana et.al also observed high prevalence(73%) of anemia in a similar age group[7] and in the study conducted by Sharma et.al in Rajasthan city, only 38% of women were anemic in similar age group[23].Among the women belonging to low socioeconomic class, food habits during childhood and adolescent age group play a major role; poor Intake of iron-containing food during this age and its poor bioavailability increases the risk of anemia among them. Their early marriage and adolescent pregnancy make them prone to anemia, contributing to the high prevalence of anemia in this age group.

In the present study, the prevalence of moderate anemia is found to be 52.42% followed by mild anemia 15.32% and severe anemia 4.84%.This study highlights the high prevalence of moderate anemia and low prevalence of severe anemiasimilar findings can be observed in studies conducted by Suryanarayana et al, Sharma etal and Wadgave HV[7,23,26].Lack of awareness and poor health education results in failure to utilize available medical facilities by low socioeconomic class, as well as other factors like poverty and ignorance contribute to the various degrees of anemia.

In rural India, a blood loss of even 200 mL in severe anemia will lead to shock and death, indirectly contributing to maternal mortality owing to anemia[7].

In the present study, PBS examination of blood samples highlights the microcytic hypochromic blood picture (74.44%)as the predominant morphological type of anemia followed by normocytic normochromic(20%), microcytic normochromic (3.33%) and normocytic hypochromic (2.22%). The study conducted by KanyesigyeHamson MD etal also shows the predominance of microcytic hypochromic picture (76.7%) followed by normocytic normochromic anemia (13.5%),macrocytic hypochromic anemia(8.7%) and normocytic hypochromic anemia (1.2%)[18]. A very high prevalence(93%) of microcytic hypochromic anemia has been found in a study conducted by Anjali Kiran Bhirudetal [17]. The high percentage of Microcytic hypochromic pictures of PBS is suggestive of the predominance of iron deficiency anemia in pregnant women. Lack of awareness about diet and medication to be taken for prevention of anemia, poor bioavailability of iron,chronic infections, and poverty contribute to the unavailability of wholesome diet to ANC women

All these factors are responsible for various types of anemia among women belonging to the low socioeconomic group.

In the present study, the predominant morphological type is the microcytic hypochromic,mean value of hemoglobin (9.01±1.89 g/dl), and packed cell volume (28.17±3.56%) is found to be decreased. All blood indices were below normal limits, however, MCV was too low (71.28±11.21 fl) compared to other indices; suggestive of iron deficiency anemia. The value of RDW-CV found to be 15.46±3.63% which is above the normal value. Increased RDW-CV and low MCV in the present study can be due to iron deficiency anemia. A similar study conducted by Jaahnavee Trivedi et al have also concluded that increased RDW-CV with low MCV which confirms iron deficiency anemia[22].

A highly significant association of anemia was found with diet ($\chi^2=22.71$, $p<0.05$) and birth interval ($\chi^2=40.05$, $p<0.05$). These findings correspond to the study conducted by Anjali Kiran Bhirud et.al[17]. Meat, chicken, and fish which are very rich sources of iron are missing in diet due to poverty and lack of knowledge, even a vegetarian diet is rarely wholesome, making dietary deficiencies even worse in the women belonging to low socioeconomic class. Birth interval less than two years depletes the iron stores in the women's body.In the present study ,other factors associated with anemia were found to be age ($\chi^2=11.68$, $p<0.05$), literacy ($\chi^2=6.07$, $p<0.05$) and awareness of anemiaandAntenatal care ($\chi^2= 16.39$, $p<0.05$). Similar factors were also noted to be responsible for anemia in the study conducted by Dr. Maya Khandat [19]. Pregnancy at adolescent age, illiteracy, and lack of awareness of anemia in rural pregnant women are predisposing factors for nutritional deficiency and anemia. Treatment history was not significantly associated with anemia ($\chi^2=0.017$, $p>0.05$) in the present study. Instead of the consumption of iron-folic acid tablets, the majority (75%) of the women were found to be anemic in the present study. A study conducted by Srilatha J.highlights that, although many control programs for anemia have been implemented for many years, the magnitude of the problem remains the same with no significant changes even after folic acid and iron supplements [13]. The probable reason behind this is; among women belonging to the low socioeconomic group or a rural area there is of lack of awareness of anemia, there is the failure

To complete prophylactic treatment, there are noncompliance and lack of awareness about repercussions of taking incomplete prophylactic treatment. However, studies conducted by KnysesigyeHamson et al and Yakob et al shows that the use of hematinic protective against anemia in pregnancy, it reduces the risk of developing anemia at term by 73%[18,27]. So proper information, antenatal care, follow up and vigilance on antenatal treatment will improve the maternal and fetal outcome.

Limitations

This study is conducted only in a single institution. Hence, further studies have to be conducted in different hospitals in rural areas of Maharashtra to have findings representing the whole population and to access the actual extent of the problem and factors associated with it. In addition to these further laboratory investigations like serum iron and serum ferritin should be done so as to guide clinicians to work alleviating the existing problems.

Conclusion

India became the first developing country to take up a National Nutritional Anemia Prophylaxis Program (NNAPP) to prevent anemia among pregnant women, but these programs are not reaching the rural women upto the expected extent. The high prevalence of anemia in this study is probably related to the low socioeconomic status of the women, which may have an impact on their nutritional status. Microcytic hypochromic blood picture is predominant in the present study, it indicates there are deficient iron intake and lack of awareness about proper diet. Proper interaction, information, medication, proper diet containing all nutrients, cooking in iron utensils, fortification of food and salt with iron and birth control for proper spacing of pregnancies; such measures will go long way in improving maternal and fetal outcome.

What does the study add to the existing knowledge?

The present study highlights the prevalence of anemia in pregnant women belonging to the low socioeconomic group, the most prevalent morphological type of anemia among this group, and the factors associated with it. So that clinicians can be properly guided for the further management of the problem.

Authors contribution

Dr. Jayraj Devidas Patil: Sample collection, collection of references, data analysis, statistical analysis, manuscript preparation.

Dr. Mangala Rajesh Nagare: Concept and study design.

Reference

- World Health Organization. The prevalence of anemia in women- A tabulation of available information. WHO/MCH/MSM922Geneva. 1992. Available from: [Article:<http://whqlibdoc.who.int>] [Crossref]
- Jufar AH, Zewde T. Prevalence of anemia among pregnantwomen attending antenatal care at TikurAnbessa specialized hospital, AddisAbaba Ethiopia. *J Hematol Thromb Dis.* 2014;2(1)125. doi: [Article:<https://doi.org/10.4172/2329-8790.1000125>][Crossref]
- Prashant D, Jaideep KC, Girija A, Mallapur MD. Prevalence of anemia among pregnant women attending antenatal clinics in rural field practice area of Jawaharlal Nehru Medical college, Belagavi, Karnataka, India. *Int J Community Med Public Health.* 2017;4(2)537-41. doi:[Article:<http://dx.doi.org/10.18203/2394-6040.ijcmph20170287>][Crossref]
- Ngonzi J, Julius M. Prevalence, Morphological Types and Factors Associated With Anemia among Mothers Attending Antenatal Clinic at Mbarara Regional Referral Hospital, South Western Uganda, Prevalence. *J Health Med Nur.* 2016;25. Available at [Article:<https://iiste.org/Journals/index.php/JHMN/article/view/30117>][Crossref]
- Rajamouli J, Ravinder A, Reddy S, Pambi S. Study on Prevalence of Anemia among Pregnant Women attending Antenatal Clinic at Rural Health Training Centre (RHTC) and Chalmeda Anand Rao Institute of Medical Sciences Teaching Hospital, Karimnagar, Telangana, India. *Int J Contemp Med Res.* 2016;3(8)2388-2391. Available at [Article:https://www.ijcmr.com/uploads/7/7/4/6/77464738/ijcmr_832_aug_15.pdf][Crossref]

06. Kalaivani K. Prevalence and consequences of anemia in pregnancy. *Indian J Med Res.* 2009;130(5)627-633.
[Crossref]
07. Mangla M, Singla D. Prevalence of anemia among pregnant women in rural India: a longitudinal observational study. *Int J Reprod Contracept Obstet Gynecol.* 2016;5(10)3500-3505.
doi: [Article: <http://dx.doi.org/10.18203/2320-1770.ijrcog20163431>][Crossref]
08. Suryanarayana R, Santhuram AN, Chandrappa M, Shivajirao P, Rangappa SS. Prevalence of anemia among pregnant women in rural population of Kolar district. *Int J Med Sci Public Health.* 2016;5(3)454-458.
doi: [Article: <https://doi.org/10.5455/ijmsph.2016.2307201575>][Crossref]
09. Bhattacharjee A, Begum F, Bayan M, Das R. Study of the Prevalence of Anemia among Antenatal Women Visiting a Tertiary Care Hospital- A Report from North-East India. *SJAMS.* 2017;5(8B)3087-3091.
doi: [Article: <https://doi.org/10.21276/sjams>][Crossref]
10. K Park. *Park's Textbook of Preventive and Social Medicine, Nutrition and Health.* 24th edition M/S Banarsidas Bhanot publishers, Jabalpur. 661,658,679.
[Crossref]
11. Debalina S, Harshida G, Yash S, Ujjwal S, Harsoda JM. A Screening study on prevalence of anemia in pregnant women during different trimester. *Sch J App Med Sci.* 2014;2(5B)1639-1642.
[Crossref]
12. Seshadri S. Nutritional anemia in South Asia, In *Malnutrition in South Asia-A regional profile* Ed, Stuart Gillespie UNICEF. ROSA Publication. 1997;5;145-159.
[Crossref]
13. Sharma P, Mehta S, Nagar R. Prevalence of anemia and sociodemographic factors associated with anemia among pregnant women attending antenatal hospital in Jaipur city India. *IOSR J Pharm Biol Sci.* 2013;6(3)1-5.
Available at [Article: <https://pdfs.semanticscholar.org/81a6/394d57782c134aaf9af1694c5fab12b481be.pdf>][Crossref]
14. Bangera IS. A study of morphological types of anemia. *IJSR.* 2017;6(6)1181-1182.
Available from: [Article: <https://www.ijsr.net/archive/v6i6/ART20174380.pdf>][Crossref]
15. Srilatha J. Prevalence of anemia in pregnant mothers and their outcome- a study in a semi urban area. *Int J Reprod Contracept Obstet Gynecol.* 2017;6(11)4886-4889.
doi: [Article: <http://dx.doi.org/10.18203/2320-1770.ijrcog20174994>][Crossref]
16. Grewal A. Anemia and pregnancy- Anaesthetic implications. *Indian J Anaesth.* 2010;54(5)380-386.
doi: [Article: <https://doi.org/10.4103/0019-5049.71026>][Crossref]
17. Naigamwalla DZ, Webb JA, Giger U. Iron deficiency anemia. *Can Veter J.* 2012;53(3)250-256.
[Crossref]
18. Ahmad N, Kalakoti P, Bano R, Syed MMA. The prevalence of anemia and associated factors in pregnant women in a rural Indian community. *AM J.* 2010;3(5)276-280.
doi: [Article: <https://doi.org/10.4066/AMJ.2010.286:276-280>][Crossref]
19. Bhirud AK, Bhole VD. A study of prevalence of anemia in pregnancy and associated factors at tertiary health care. *Int J Gynaecol.* 2017;3(3)122-124.
doi: [Article: <https://doi.org/10.26611/10123312>][Crossref]
20. Trivedi J, Saiyad S. Study of haematological parameters in anemic pregnant women. *Int J Basic Appl Physiol.* 2016;5(1)165-167.
[Crossref]
21. Khandat M. Nutritional status of rural pregnant women in Beed district of Maharashtra of India. *IPCBE.* 2014;67(18)92-96.
doi: [Article: <https://doi.org/10.7763/IPCBE>][Crossref]
22. Yakoob MY, Bhutta ZA. Effect of routine iron supplementation with or without folic acid on anemia during pregnancy. *Biomed central Public Health.* 2011;11(3)1-10.
doi: [Article: <https://doi.org/10.1186/1471-2458-11-S3-S21>][Crossref]

23. Wadgave HV. Burden of anemia among the pregnant women in rural area. Healthline. 2011;2(2)76-77.
[Crossref]
24. JB Sharma, Shankar M. Anemia in pregnancy. JIMSA. 2010;23(4)253-260.
Available at
[Article:<http://medind.nic.in/jav/t10/i4/javt10i4p253.pdf>][Crossref]
25. Government of India;162. Central Bureau of Health Intelligence, Directorate General of health Services Ministry of Health and Family Welfare. National Health Profile. 2018, 13th issue.
Available at [Article:<https://www.cbhidghs.gov.in>]
[Crossref]
26. Kaul R, Ahmad J, Baba TA, Sheikh S, Ahmad A, Ashraf M. Anemia in pregnant women in a rural block of Kashmir valley- its prevalence and socio-demographic associates. Int J Med Sci Public Health. 2013;2(4)814-818.
doi:
[Article:<https://doi.org/10.5455/ijmsph.2013.130620131>][Crossref]
27. Bisoi S, Haldar D, Majumdar TK, Bhattacharya N, Sarkar GN, Ray SK. Correlates of anemia among pregnant women in a rural area of West Bengal. J Fam Welfare. 2011;57(1)72-78.
Available from:
[Article:<http://medind.nic.in/jah/t11/i1/jaht11i1p72.pdf>][Crossref]