

## ORIGINAL ARTICLE

# Hematological Profile of Women in Pregnancy in a Hilly District of Himachal Pradesh

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## Abstract

**Introduction:** Anemia during pregnancy is a major public health problem throughout the world, especially in the developing countries. Anemia during pregnancy can lead to morbidity and mortality in mother as well as fetus. Anemia cannot be diagnosed only clinically; several blood tests are required for complete characterization. Aim of the present study was to know the prevalence of Anemia during pregnancy in District Solan of Himachal Pradesh, classify its types and determine the effect of pregnancy on hematological parameters in Anemia. **Material and Methods:** In the present study Hematological parameters of 150 pregnant females in advanced pregnancy (of gestational age 32 to 40 weeks) were analyzed and the results were compared with 90 age matched control cases. **Results:** The pregnant study group exhibited statistically significant lower values of haemoglobin, PCV, MCV, MCHC and lymphocyte and platelets while neutrophil and total WBC counts were significantly elevated. **Conclusion:** Hematological parameters are a simple and cost-effective investigation which can aid in early recognition of anemia during pregnancy and thereby improve the outcome of pregnancy.

## Keywords

Anemia; Hemoglobin; Pregnancy

## Introduction

Anemia is defined as decreased hemoglobin or red cells mass and is the most common hematological disorder seen in pregnancy. Anemia during pregnancy can lead to morbidity and mortality in mother as well as fetus. Anemia during pregnancy is one of the major factors of Low Birth Weight babies in the Indian context, which results in subsequent infections in early infancy. In mothers this is an indirect cause of infection/sepsis during child birth, Post-Partum Hemorrhage and maternal mortality. It

also affects the growth and development of child. This affects directly and indirectly the family income and GDP of the nation.

Fetuses are at risk of preterm deliveries, low birth weights, morbidity and perinatal mortality due to the impairment of oxygen delivery to placenta and fetus. Thus, routine screening tests for anemia are recommended in pregnant women. (1) WHO has estimated the prevalence of Anemia in pregnant women as 14% in developed, 51% in developing countries and 65-75% in India. About one third of the

global population (over 2 billion) is anemic. Prevalence of Anemia in all the groups is higher in India as compared to other developing countries.(2) In most developing countries, Anemia in pregnancy makes an important contribution to maternal mortality and morbidity.(3)It is a startling fact that about half of the global maternal deaths due to Anemia occur in South Asian countries.(4) In India 16% of maternal deaths are due to Anemia. (5) The lower limit of normal range of Hb is reduced during pregnancy as the plasma volume increases producing a fall in the Hb level. Throughout normal pregnancy, blood volume expands by an average of 50% compared with the nonpregnant state. This rapid expansion of blood volume starts in the first trimester. (6) Plasma volume increases more than does red cell mass, which produces hemodilution and a declining hemoglobin concentration during the first half of pregnancy. This is known as the physiologic anemia of pregnancy. (7) Criteria of Physiological Anemia include Hb 10 gm%, RBC 3.2 million/cmm, PCV 30% and PBF with normal morphology (normocytic normochromic).(8) Hemoglobin concentration of < 11.0 g/dl is commonly taken as indicator of anemia in pregnancy.(3)According to W.H.O guidelines, mild anemia is defined as Hb between 10.0-10.9 g/dL, moderate anemia as 7.0-9.9 g/dl and severe anemia as <7 g/dl.(9)Anemia can be classified in a variety of ways, based on the morphology of RBCs, underlying etiologic mechanisms, and discernible clinical spectra. The diagnosis of Anemia in pregnancy is difficult to establish based on clinical picture alone; yet it is important that treatment should be initiated early because of the high morbidity and mortality associated with anemia during pregnancy.(10) Microcytic hypochromic Anemia resulting from iron deficiency is the most frequent form of Anemia followed by folate deficiency and combined iron and folate deficiency.(11,12) WHO data indicates that iron deficiency Anemia is a significant problem throughout the world ranging from 1% (average of 14%) in the industrialized countries to an average of 56% (ranging from 35-75%) in developing countries. The most common causes include; nutritional deficiencies of iron, parasitic diseases such as Malaria and hookworm and hemoglobinopathies such as Sickle cell disease.(13) A number of diagnostic tests are currently available in assessing Anemia in pregnant women such as hemoglobin concentration (Hb), total leucocyte count (TLC),

differential leucocyte count (DLC), platelet count, blood indices, haematocrit (HCT), peripheral blood smear, reticulocyte count also some biochemical tests like Vitamin B12 and Serum ferritin which have important diagnostic role.(1)

### Aims & Objectives

1. To know the prevalence of Anemia in pregnancy in the hill region of Solan (Himachal Pradesh).
2. To assess different hematological parameters for anemia in pregnant and non-pregnant women.
3. To classify the morphologic types of anemia in pregnant females in order to differentiate physiological from pathological anemia of pregnancy based on these hematological parameters.

### Material & Methods

**Study Type:** It was a Cross sectional study.

**Study Population:** Antenatal cases coming to the Obstetrical and Gynecology department of Maharishi Markandeshwar Medical College, who have given the consent to be enrolled in the study and meet the criteria of the inclusion. For the Control the Non-Pregnant women of reproductive age group accompanying the patients to the department have also been included.

**Study Population:** The study subjects.

The study subjects attending Obstetrics and Gynecology clinic of the tertiary care health facility of Solan district of Himachal Pradesh hospital fulfilling the inclusion criteria.

#### Inclusion Criteria:

- 1) All pregnant women reporting to department of Obstetrics MMMCH with age group: 18-35 years, Gestational age: 8th to 40th weeks, primipara or multipara, Single ton pregnancy.
- 2) The subjects who give the informed consent to be enrolled in the study voluntarily.

#### Exclusion Criteria:

- 1) Nonconsenting study participants
- 2) Obesity
- 3) Diabetes
- 4) Any complication of pregnancy like APH, PIH, Preterm labour
- 5) Multiple pregnancies
- 6) Pregnant women with history of smoking cigarettes, tobacco use, alcohol or narcotic use
- 7) Age less than 18 yrs and more than 35 years
- 8) History of any chronic illness

9) Liver, kidney and/or heart disease, Diabetes, chronic hypertension, severe sepsis or history of menorrhagia or blood loss in last 12 months

**Study Duration:** 6 Months

**Ethical Approval:** From Institutional Ethical Committee vide approval letter number MMM&CH/IEC/17/62.

**Consent:** Written informed Consent was obtained from the study subject in the approved format.

**Methodology:** The study was carried out on the women visiting the department of Obstetrics & Gynaecology of Maharishi Markandeshwar Medical College and Hospital, Solan as a part of routine antenatal checkup/ treatment and included both pregnant and non pregnant females. The blood samples were collected in EDTA vials. A detailed history taking and clinical examination of subjects after taking informed consent from each participant. The hematological parameters studied included Hemoglobin (Hb), Red blood cell (RBC) count, Hematocrit (PCV - packed cell volume), Mean Corpuscular volume(MCV), Mean Corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC), Total Leucocyte count (TLC), Differential Leucocyte count (DLC), Platelet count and Peripheral smear (PBF). The Hb, RBC count, PCV, RBC indices, TLC, DLC, and Platelet count were estimated using Automated Blood cell counter and PBF stained by Leishman's stain examined under microscope for the accurate morphological type of anemia.

**Statistical Analysis:** A database of findings of both groups in the form of master chart was prepared. All values were expressed as Mean±SD. All results were analyzed statistically using unpaired Student 't'-test in SPSS software version 20.

## Results

In the present study 50% of the total pregnant females studied at our antenatal clinic were anemic with mean Hb 10.91 g/dl. The anemic pregnant females were categorized into mild, moderate and severe according to WHO criteria. It was observed that 35 (46.67%) had mild anemia, 38 (50.67%) were moderately anemic, while 2 (2.66%) had severe anemia. (Figure 1). Based on PBF picture five morphologic types of anemia were diagnosed in anemic pregnant women (Figure 2). The most common was microcytic hypochromic 29 (38.67%), followed by normocytic normochromic 25 (33.33%), normocytic hypochromic 10 (13.33%), microcytic

and macrocytic anemia (dimorphic) 8 (10.67%), and macrocytic anemia 3 (4%). Mean hemoglobin values were 10.91 g/dL and 12.80 g/dL respectively in pregnant females and non-pregnant controls. The values were significantly lower in pregnant women in comparison to control group. Mean RBC count, PCV, MCV and MCHC and platelet count were significantly lower and Mean WBC count and neutrophilic count significantly higher in pregnant women in comparison to non-pregnant women. There was a significantly lower platelet count during pregnancy as compared to non pregnant controls. [Table 1]

## Discussion

The present study was conducted in hospital setting of Maharishi Markandeshwar Medical College and hospital, Solan, which is a tertiary hospital catering to the needs of mostly the rural areas of the hilly state of Himachal Pradesh. In the present study, half of the women were found to be Anemic. In the NFHS 4 (2015-16) also, 50.5% of pregnant women were found to be Anemic in rural parts of Himachal Pradesh, which matches with our study results.(14) Mean hemoglobin value in our study was 10.91 g/dL in pregnant females which was close to national average of 10.93 g/dL as highlighted by Bharati et al in their survey on Zone-wise and State-wise distribution of Mean Hb. They also stated that women from Himachal Pradesh have lower prevalence (<40%) of Anemia than the other states. The difference in our prevalence vs theirs (50% vs 40%) might be due to our study group being predominantly rural and local area differences.(15) Our study carried out in the high altitude region also showed relatively higher mean Hb, RBC count and PCV than many other Indian studies carried out in the plains.(16,17,18,19)

Distribution in our study as per degree of severity of anemia was mild anemia (46.67%), moderate anemia (50.67%) and severe anemia (2.66%) showing that mild and moderate anemia constituted majority of anemia cases. Our study showed results similar to other studies in finding moderate anemia as commonest during pregnancy however severe anemia cases were minimal in our study.(1,10) Our study also corroborates with the ICMR data showing relative prevalence of mild, moderate, and severe anemia as 13%, 57% and 12% respectively in India.(8) The most common morphologic type of Anemia in our study was microcytic hypochromic type. Such

picture of microcytic hypochromic type is classical of Iron Deficiency Anemia which is globally prevalent and the most common type of Anemia of pregnancy. In a study by Panigrahi et al peripheral smear examination showed 63% of subjects with Anemia had microcytic hypochromic anemia indicative of iron deficiency anemia, and 21.2% subjects with early stages of iron deficiency reflected by normocytic hypochromic picture.(20) In the present study microcytic hypochromic and normocytic hypochromic picture together constituted more than half of the morphologic types of Anemia indicating iron deficiency being the cause in half of pregnant study group. These findings indicate that the Iron deficiency Anemia is the leading cause of anemia but there were other causes as well such as physiologic Anemia of pregnancy (normocytic normochromic) and macrocytic Anemia. Physiologic Anemia of pregnancy (normocytic normochromic) constituted 33.3% of cases in our study group. Red Cell formation is affected by food and other essential materials such as vitamin B-12 and folic acid which has a bearing on the process of red blood cell formation. Macrocytic Anemia or Megaloblastic Anemias results due to lack of vitamin B12 or folic acid. Deficiency of folic acid is the most valid reason for megaloblastic Anemia in pregnancy, since vitamin B12 is stored adequately in the body for many years. Singh et al reported the incidence of megaloblastic Anemia as 6.25% and in the our study incidence was 4%.(10)

On comparison of red cell parameters between pregnant and non-pregnant women, it was found that the differences in mean hemoglobin concentration, RBC count, PCV, MCV and MCHC were statistically significant. We justify this difference by the fact that women Pregnant women mother requires the micronutrients and the proximate food components, for the growing fetus, for the growth of various body parts, body fluids etc. required for the newborn. Our results were similar to other studies which also found significant differences between the above hematological parameters.(16,17,18,19)

White cell count is increased in pregnancy with a typical reference range of  $6 \times 10^9$ – $16 \times 10^9$ /L.(21) In our study also, total WBC count (TLC) was found to be significantly higher during pregnancy with neutrophils contributing significantly to this increase. Out of other white cells, Eosinophil and monocyte count differences were not statistically significant, but lymphocyte difference

was found to be statistically significant ( $p < 0.001$ ). Lymphocyte count decreases during pregnancy through first and second trimesters, increases during the third trimester.(21)

Large cross-sectional studies in pregnancy of healthy women have shown that the platelet count decreases during pregnancy, particularly in the third trimester, termed as “gestational thrombocytopenia”. (17,21) Although there was no case of gestational thrombocytopenia in our study but a significantly lower platelet count during pregnancy as compared to non pregnant controls was another finding which correlated well with other studies.(17)

## Conclusion

Anemia is one of the major Public Health Problems of the country and Anemia in pregnancy contributes to significant morbidity and mortality in a developing country like India especially in rural set up. In our study also we have Anaemia in half of the Antenatal cases. Severe Anaemia is in 2.66 % of the Anaemic Antenatal mothers. Mild and Moderate Antenatal cases are 46.67% and 50.67% respectively. Hematological parameters can be easily performed and monitored during pregnancy and when carefully interpreted, these parameters can aid in early recognition of type of Anemia and differentiating physiological from pathological causes of Anemia. Microcytic Hypochromic and normocytic hypochromic Anaemia are in 38.67% and 13.33% respectively, which indicate classical of Iron Deficiency Anemia and early Iron deficiency Anaemia. Iron deficiency Anaemia and the Folic acid deficiency is taken care of by distribution of IFA tablets to Antenatal mothers under National Health Programme. Dietary intake of Iron is to be also encouraged with the locally available food that increases the bioavailability of Iron like Amla, citrus fruits etc.

## Recommendation

Anaemia in Pregnant women in this rural hilly region of Himachal Pradesh is a matter of concern and requires proper attention. Nutrition Education in the VHND by the AWW and ASHA needs to be strengthened. Distribution of IFA to be monitored strictly by the health administrators for compliance. The investigation for Anaemia in Antenatal mothers needs to be monitored and analyzed by health managers.

## Limitation of the study

As the study subjects are drawn from the women attending Obs. & Gyn. department of a tertiary health care facility, it does not represent the women as a whole of the State of Himachal Pradesh, but it helps us to draw some conclusions.

## Relevance of the study

The study helped us to assess the prevalence of anaemia, its grade and its types, though limited to women attending medical college OPD, it helps us to find out some associated factors and draw some limited recommendations as explained.

## Authors Contribution

AS: The Principal investigator and he drafted the manuscript of the study; JGV: is the Corresponding author and co-investigator. He also participated in writing the manuscript and doing data analysis; MB: Prof Obstetrics, co-investigator, Collection of data and helping in writing Manuscript; SB: Statistical data analysis and processing data.

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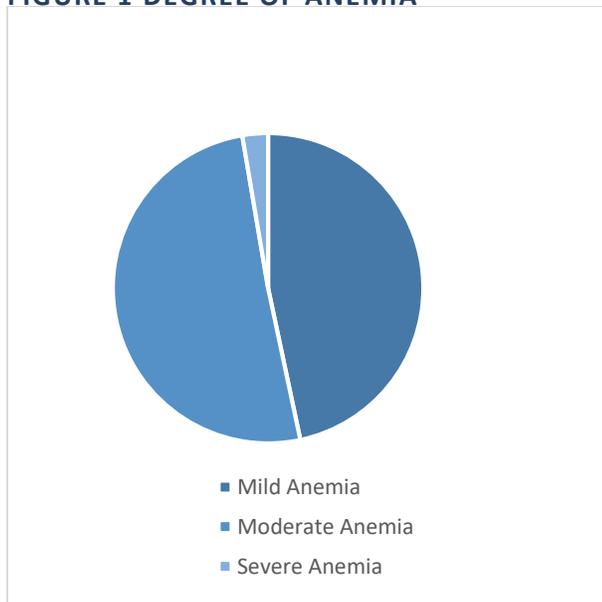
**Tables**

**TABLE 1 HEMATOLOGICAL PARAMETERS OF PREGNANT AND NON PREGNANT FEMALES**

Hematological Parameters (Unit)	Pregnant Women (N=150) Mean±SD	Non pregnant Women (N=90) Mean±SD	Level of Significance (p value)
RBC count(millions/cmm)	4.17±0.54	4.71±0.36	< 0.001
PCV (%)	32.64±4.12	37.21±2.61	< 0.001
MCV (fL)	79.16±9.26	81.56±2.53	< 0.05
MCH (pg)	27.43±6.46	27.94±1.19	> 0.05
MCHC (g/dL)	33.34±1.81	34.35±1.28	< 0.001
TLC (x10 <sup>3</sup> /μL)	10.09±2.29	7.82±1.68	< 0.001
Neutrophils(%)	70.86±6.93	64.24±6.41	< 0.001
Lymphocytes (%)	24.05±6.55	30.58±6.11	< 0.001
Monocytes (%)	2.70±1.18	2.59±1.18	> 0.05
Eosinophils (%)	2.04±0.96	2.05±0.81	> 0.05
Basophils (%)	0.36±0.48	0.57±0.50	< 0.05
Platelets (Lac/cmm)	2.51±0.73	2.76±0.71	< 0.05

**Figures**

**FIGURE 1 DEGREE OF ANEMIA**



**FIGURE 2 MORPHOLOGIC TYPES OF ANAEMIA**

