Pattern Of Reticulocyte Count And Hemoglobin Concentration In Pregnant And Non-Pregnant Women In Rural Haryana.

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Abstracts: Background & Objective**:** Anemia is a common nutritional health problem in women's child bearing age. Pregnant women are at higher risk particularly during 3rd trimester of pregnancy. By definition, it is decrease in number of RBCs below 4.5 million or Hb level below 11.0 gm % and hematocrit < 0.33 in pregnant women. Anemia contributes significantly to maternal mortality and morbidity and also carries a risk factor for infant iron deficiency anemia. Main causes of maternal anemia are blood loss, increased menstrual bleeding and nutritional iron & folate deficiency. Anemia can be estimated by Hb estimation and Reticulocyte count (RC), which is a quantitative measure of Bone marrow production of new RBCs, with a range of 0.5-2.5%(adults) and 2.6% in infants. Reticulocyte Index (RI) is a calculation of ratio b/w level of anemia in response to which, RC has risen. Objective is to study pattern of reticulocyte count in pregnant and non-pregnant women, 2) To compare Hb level in pregnant women in 3 trimesters and non-pregnant women.3) To analyze pattern of reticulocyte count and compare levels of Hb concentration in pregnant women in 3 trimesters and non- pregnant women. Methodology**:** A total of 100 women with age range of 18-40 yrs were examined (50 pregnant and 50 healthy non pregnant women) presenting to Obstetrical O.P.D. Blood samples from subjects were collected, tested and hematologically analyzed. Both Inclusion and Exclusion criteria strictly followed. Results & Conclusion**:** Hb level in pregnant women was significantly low as compared to non pregnant women, whereas Reticulocyte count was higher in pregnant women than non pregnant women. Variation of Hb concentration was seen as, high in 3rd Trimester. R C was raised in 2nd Trimester and reached peak in 3rd trimester, while it remained normal or decreased in 1st trimester. Non-pregnant women showed normal range of R C. So values of all red cell parameters in pregnant women was significantly low, as compared to age matched controls except Reticulocyte count, which was raised during pregnancy. [Bedi S NJIRM 2016; 7(3): 40 - 44]

Key Words: Haemoglobin, Anemia, Reticulocyte count, Trimester, Hematological, Bone marrow.

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Introduction: Anemia is one of the commonest and intractable nutritional health problems in today's world. Pregnant women are at higher risk, especially during last trimester of pregnancy. It is defined as, a decrease in number of RBCs below 4.5 million or Hb level < 11gms% and a Hematocrit of less than 0.33, in pregnant women. Anemia contributes significantly to maternal mortality and morbidity and is also a risk factor for infant iron deficiency anemia (IDA). Frequent causes are maternal blood loss, menstrual bleeding and nutritional deficiency of iron and folic acid. Reticulocyte production Index (RI) is a calculation of ratio b/w level of anemia and to the extent to which, the reticulocyte count has risen, in response. High RC may mean more RBCs are being made by bone marrow and vice a versa. Reticulocyte index (RI) is required for falsely high RC and persistently low RC,that is an indication for bone marrow biopsy. This decrease in Reticulocyte number may be due to Iron deficiency or Aplastic anemia. Therefore, It also helps to determine cause of anemia. Retics are immature RBCs produced by bone marrow and released into blood stream. Counts are lower in IDA, bleeding and Aplastic anemia. Reticulocytosis noted in pregnancy is associated with anemia and thus reported as, a response of haemopoietic system.[1]

Consequently, when %age of retics in the blood is abnormally high, the MCV increases above normal & is a sign of anemia. Calculating RPI is an important step in understanding, whether or not RC is appropriate to the situation. This is often a more important question than, whether the %age is in the normal range; Eg, if someone is anemic, but has a reticulocyte %age of only 1%, the bone marrow is likely not producing new blood cells at a rate to correct anemia. So, no of retics is a good indicator of marrow activity, representing recent release and allows determination of RC and RPI. These values can be used to determine, problem of production and be used also, to monitor progress of treatment. When, there is an increased production of RBCs to overcome chronic or severe loss of mature RBCs, Eg haemolytic anemia, there is increase in number and %age of reticulocytes. Abnormally low

number of retics can be attributed to chemotherapy, aplastic anemia, pernicious anemia, bone marrow malignancies, problems of erythropoietin production, various vitamin or mineral deficiencies (B_9, B_{12}, iron), disease states (anemia of chronic disease) and other causes of anemia due to poor RBC production.

High values: A high RC may be due to RBCs destruction(hemolytic anemia) ,Bleeding/ Blood disorder in a fetus or newborn (Erythroblastosis fetalis) and Kidney disease with increased Erythropoietin levels, Post-treatment Pernicious anemia, IDA or FDA and during pregnancy.

Low values: A low RC may be caused by Bone marrow failure eg; drug toxicity, Radiotherapy, or infection, liver cirrhosis, chronic kidney disease and Vitamin B12 or folate deficiency.

Material and Methods:

Inclusion Criteria: All subjects whether pregnant or non pregnant with Hb value ≤11g/dl were included in the study. Same, inclusion and exclusion criterias were used for RC.

Exclusion Criteria: Study Subjects having abnormal bleeding, recent intake of iron and multivitamin supplements, smoking or alcoholic use during pregnancy were excluded.

Statistical Analysis: Data thus obtained, was analyzed using statistical software EPI info 6.0. For all hematologic variables parametric analysis using mean, standard deviation (S.D), Standard Error (S.E) was done. For validation of observations, Student's "t" test was employed to compare two mean values. All tests were at 5% statistical level (P<0.05).

Results: Mean Hb concentration in Pregnant women estimated In 1st trimester, was 9.42±1.14g/dl, 2nd trimester as 8.81±1.71 and 3rd trimester as around 9.25±1.36 of blood, whereas for non-pregnant women, it was 9.31±1.27 g/dl of blood. Mean reticulocyte count in 1st trimester was 1.5±.87%, 2nd trimester 1.483±.75% and 3rd trimester as 1.405 ±0.71%, whereas for non-pregnant women was 0.926±0.39. Mean age in pregnant women estimated in 1st trimester was 26.33±3.55, 2nd trimester as 25.56±2.87 and 3rd trimester as 24.05±3.16 respectively, whereas in non-pregnant women, it was 26.96±4.15.

Table 1: ??????????????

Table 2: Distribution As Per Parity

Parity	non pregnant	Pregnant
0	3	12
1	26	20
2	18	15
3	3	3

chi-square = 2.12 probability = 0.548

Table 3: Haemoglobin Levels In Different Groups

Haemoglobin (gm/ dl)	Non pregnant	Pregnant
<7	4	8
7 to 9	15	14
9 to 11	31	27
>11	0	1

Table 4: Hb Levels In 3 Trimesters Of Pregnancy

Haemoglobin (gm/ dl)	non pregnant	Pregnant		
		First	Second	Third
<7	4	1	4	3
7 to 9	15	4	6	4
9 to 11	31	6	8	13
>11	0	1	0	0

chi-square = 9.66 probability = 0.008

Table 5: Reticulocyte Count In Different Groups

Reticulocyte count	Non pregnant	Pregnant
<0.5	2	2
0.5 to 1.5	43	30
>1.5	5	18

Table 6: Reticulocyte Count In Different Trimesters Of Pregnancy

Reticulocyte count	non pregnant	Pregnant		
		First	Second	Third
<0.5	2	2	0	0
0.5 to 1.5	43	5	13	12
>1.5	5	5	5	8

Table 7: Mean Values In Different Groups

Parameters	Non pregnant	Pregnant		
		First	Second	Third
Age (yr)	26.96±4.15±	26.33±3.55	25.56±2.87	24.05±3.16
Haemoglobin (gm/dl)	9.31±1.27	9.42±1.14	8.81±1.71	9.25±1.36
Reticulocyte count (%)	0.926±.39	1.5±.87	1.483±.75	1.405±.71

Discussion: Hb in pregnant women was significantly low as compared to non-pregnant women, whereas RC was comparatively high in pregnant women. Hb concentration in different trimesters was seen as high in 3rd trimester in comparison, whereas RC was high in 2nd trimester and reached peak in 3rd trimester .In contrast, RC decreased in 1st trimester. Thus subjects with same Hb-value, variation in RC observed. During normal pregnancy, characteristic changes were observed in Hb conc and RBC indices. These changes may be attributed mainly to physiological Hemodilution. Study also indicated that Hb conc in most of the cases, decreased in pregnant women, when compared with non-pregnant women and RC increased during pregnancy, while it remained normal in non-pregnant women. So significant decrease in Hb of pregnant women observed.

Commonest type of anemia was of macro-normoblastic type (megaloblastic anemia) followed by Microcytic Hypochromic type (iron deficiency), and least commonly dimorphic subtype. Increased RC production is seen less commonly in dimorphic subtype. Increased RC production index may result from prophylactic iron therapy. Values of all erythrocytic parameters in pregnant women were significantly low as compared to age matched controls, except RC during pregnancy. Thus Reticulocytosis was found in association with anemia and represented a response of hematopoietic system to physiologic stimulation of maternal erythropoeisis during pregnancy. In this geospecific region, typically hot & dry climate, all erythrocyte indices in 3rd trimester were significantly low except RC, which was found to be high as compared to non- pregnant women. As pregnancy advances, serum iron falls and total iron binding capacity (TIBC) increases due to rise in plasma volume. For low value of mean Hb found in pregnant ladies with hydraemia of pregnancy could be ascertained as one of the possible cause. So this physiologic anemia of pregnancy is thought to be a dilutional process, secondary to an increase in plasma volume (approx 48%).

Anemia is the late manifestation of deficiency of nutrients like like iron, folate and vitamin B12, proteins, amino acids, vitamins A, C, and other vitamins of B-complex group i.e. niacin. It is also associated with increased maternal and perinatal mortality, premature delivery and low birth weight babies. [2,3,4] Iron deficiency in late pregnancy results in poor fetal iron stores.[5] Latent iron deficiency is known to alter brain iron content and neurotransmitters irreversibly in fetal life and postnatal babies.[6,7]

Pregnant women with even mild anemia have increased perinatal mortality and early neonatal mortality, mainly associated with preterm birth and growth restriction.[8] Even though anemia, if noted early in pregnancy and treated promptly, there is an increased risk of preterm birth.[9] More severe cases of anemia (Hb <8 g/dL) are associated with greater risks of preterm birth and low birth weight.[10,11] There are also quality of life issues associated with maternal anemia, that are also seen in individuals with serious chronic diseases, are difficulty in concentration, cognition, disturbed mother–infant interactions and depression.[12] Postpartum fatigue and reduced immune function associated with increased risks of infection were also shown to have a relationship with anemia.[13,14,15] Anemia has also been linked to postpartum depression[16] and, if severe, can be associated with cardiovascular symptoms, like dizziness, and may need prolonged hospitalization.[17] Cognitive functions and emotional distress have also been noted in anemic women.[18] Other potential causes of anemia include malaria, hookworm infestation and placental hormones.[19]

Diagnostically, it is important to remember that, there may be more than one causative factors involved, like folate deficiency, chronic infection with iron deficiency. All yield different RBC indices in their pure

form; if combined, however, a mixed pattern results, which may render these diagnostic tests less useful Study subjects showed significant and positive correlation between their Hemoglobin levels, physical performance and blood pressure. Significant and negative correlation between Hemoglobin level and blood pressure was seen in rural women. Women having low Hb level have reduced grip strength and work capacity and carries high morbidity in chronic heart failure because, it reduces availability of oxygen to tissues, which in turn affects cardiac output. So it is recommended that all patients be assessed for anemia during their initial prenatal visit, late in pregnancy (34–36 weeks), and at postpartum visit. Laboratory assessment includes a complete blood count (RBC indices, hematocrit, Hb-conc, WBC count, and platelet count). A peripheral smear and a reticulocyte count should be considered if the initial CBC is abnormal.

Conclusion: Hemoglobin level in pregnant women was significantly low in comparison with non pregnant women, whereas Reticulocyte count was comparatively high in pregnant women and remained normal non pregnant women. Hb concentration was seen as high in 3rd Trimester, with high Reticulocyte count in 2nd Trimester and reaching peak in 3rd trimester. While RC was normal or decreased in 1st trimester. Subjects having equal Hb values, variation in RC observed. Study also indicated that Hb-conc was comparatively decreased in pregnant women in majority of cases. RC increased during pregnancy, while it remained normal in non-pregnant women So values of all red cell parameters in pregnant women was significantly low, as compared to age matched controls except Reticulocyte count during pregnancy.

References:

1. Kothari R, Bokariya P, Kothari V. A study of erythron status in pregnant and non-pregnant age matched females of Jodhpur Region. J Pharmacy 2013;3(1):35-9.
2. Lee GR, Herbert V. Nutritional factor in the production and function of erythrocytes. In Lukens J, Paraskevas P, Greer JP, Rodgers GM editors. Wintrobe's clinical hematology. Baltimore, Maryland USA: William $ Wilkins;1998. P 228-66.
3. Ezzati M, Lopez AD, Dogers A, Vander HS, Murray CJ. Selected major risk factors and global and regional burden of disease. Lancet 2002; 360:1347-60.
4. Agarwal KN.The effects of maternal iron deficiency on placenta and fetus. In Jelliffe DB, Jelliffe FEP, editors. Advances in international maternal child health. Oxford calarendon Press; 1984;4. P 26-35.
5. Agarwal RMD, Tripathi AM, Agarwal KN. Cord blood hemoglobin, iron and serum ferrite status in maternal anaemia. Acta Paediatr Scand 1983; 74:545-8l .
6. Agarwal KN. Iron and brain; neurotransmitter receptors and magnetic response spectroscopy. Br J Nutr 2001;85 (Suppl 2) :S147-50.
7. Kapur D, Agarwal KN, Agarwal DK .Nutritional anemia and its control. Indian J Pediatr 2002; 69:607-16.
8. Little MP, Brocard P, Elliot P, Steer PJ. Hemoglobin concentration pregnancy and perinatal mortality: A London – based cohort Study. Am J Obstet G ynecol 2005; 193:220- 6.
9. Xiong X, Buekens P, Alexender S, Demianczuk N, Wollast E. Anemia during pregnancy and birth outcome: a meta-analysis. Am J Perinat 2000;17(3)
10. Steer P, Alam MA, Wadsworth J, Welch A. Relation between maternal hemoglobin concentration and birth weight in different ethnic groups. BMJ 1995; 310:489-91.
11. Bodnar LM, Scanlon KS, Freedman DS, Siega-Riz AM, Cogswell ME. High prevalence of postpartum anemia among low-income women in the United States. Am J Obstet Gynecol 2001; 185:438-43.
12. Van Vyck DB, Martens MG, Sied MH. Intravenous ferric carboxymaltose compared with oral iron in the treatment of postpartum anemia. A randomized controlled trial. Obstet Gynecol 2007;110: 267-78.
13. Corwin EJ, Arbour M. Postpartum fatigue and evidence-based interventions. Abstract MCN;32(4)
14. Weiss G. Modification of iron regulation by the inflammatory response. Best Practice Research Clin Hematol 2005;18: 183-201.
15. Weyermann M, Rothenbacher D, Gayer L, Bode G. Role of helicobactor pylori infection in iron deficiency during pregnancy. Am J Obstet Gynecol 2005; 192: 548-53.
16. Troy NW. Is the significance of postpartum fatigue being over looked in the lives of Women? MCN The Am J Maternal /Child Nursing 2003;28: 252-257.
17. Breymann C, Zimmermann R , Huch R, Huch A. Use of recombinant human erythropoietin in combination with parenteral iron in the treatment

of postpartum anemia. European J Clin Invest 1992;26: 123-130.
18. Beard J,Hendricks M, Perez E, Murray-Kolb L,Berg A, Vernon-Feagans l, Irlam J, Isaacs W,Sive A, Tomlinson M. Maternal iron deficiency anaemia affects postpartum emotion and cognition. Am Society for Nutritional Science 2005;267-271.
19. Hoffbrand A.V,| Moss P.A.H. Erythropoiesis and general aspects of anaemia. In:Essential Haematology. Hoboken, New Jersey USA: Wiley – Blackwell; 2011p.17-32.
20. Pritchard JA , Adams RH. Erythrocyte production and destruction during pregnancy. Amer J Obestet Gynec 1960;79: 750-57

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