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A study of iron deficiency anemia in pregnancy at tertiary care hospital in Rajkot, Gujarat, India

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Abstract

Introduction: Anemia affects 24.8% of the population (>1.62 billion people) worldwide. Among >2 billion people were affected by iron deficiency anemia which was the most common nutritional anemia. A prevalence of anemia globally on regression-base analysis by world health organization is 14% Recent data shows the prevalence of iron deficiency anemia in developed countries is 17.4%, while 56% in developing countries so it important to monitor regularly level of hemoglobin (Hb) and factors associated with it.

Aims and objectives: The aim of this study is to assess the prevalence and determinants of iron deficiency anemia (IDA) in pregnant women attending antenatal clinic (ANC) of a tertiary referral hospital, P.D.U. Medical College & Civil Hospital in Rajkot.

Material and methodology: Study involving pregnant women receiving antenatal care in, P.D.U. Medical College & Hospital, were conducted by estimating hemoglobin (Hb) level and red cell indices of the pregnant women by the automated cell counter, methods are works on the principle of the colorimetric method to determine hemoglobin (Hb) concentration. For confirmation of iron deficiency anemia, serum ferritin was done.

Results: In pregnant women as per the WHO nutritional anemia "Tools for effective prevention and control, 2017", Were mild (10.0–10.9 g%), moderate (7.0–9.9 g%), and severe (<7.0 g%). The prevalence of anemia was 68.72% using the WHO criteria. About 75.67% of women had moderate anemia, mild anemia (21.36%) and severe anemia (2.37%) seen of the 4597 women, the prediction of iron deficiency was obtained from the optimal cut-off values of Hb < 10.0 g/dL, MCV < 80.0 fl, MCH < 26.9 pg and MCHC 33.2 g/dL.

Conclusion: Iron deficiency can be predicted in early stages using Hb and red cell indices, which is much less expensive method in areas with limited resources and a high prevalence.

Keywords: Iron deficiency anemia (IDA), Hemoglobin (Hb), Red cell indices, Pregnancy.

Introduction

A decreased in cell hemoglobin (Hb) concentration is defined as anemia. Approximately 25% of world people (>1.62billion) were affected by nutritional deficiency diseases which one of the most common observed globally, among 56 million are pregnant women [1, 2]. In the world, women throughout life serious derailment of physiology are anemia. It is a serious condition in developed and developing countries and it becomes a very serious condition in least developed countries. Approximately 40% have low iron reserves in non-pregnant women. Among fertile women, anemia causing an unfavorable status for upcoming pregnancy and is major public health problem. Inability of the woman to react postpartum blood loss leading to serious consequences and it involves issues of morbidity and mortality. For the prevention and treatment of this severe maternal and perinatal complication in pregnancy the main purpose to right concern for anemia during gestation by updated and clear guidelines [3]. iron deficiency results deficient erythropoiesis where hemoglobin (Hb) concentration starts to fall due to impaired red blood cell synthesis, resulting in iron deficiency anemia. Correspondingly, it causes a detectable change in the mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and mean corpuscular volume (MCV) [4,5].

The gold standard for assessing iron deficiency is bone marrow analysis, which is too invasive as a screening tool in the routine clinical practice [6]. Serum ferritin, serum transferrin and serum iron are good markers to diagnose iron deficiency [7] but these too are relatively expensive assays. Compared to these, red cell indices that are a component of the full blood count determined by automated hematology analyzers are less invasive, less cumbersome and inexpensive. Therefore, we aimed to evaluate the validity of each red cell index including Hb as a screening tool to detect early iron deficiency at an early stage of pregnancy.

Material and methods

The Cross-sectional study “Study of Iron deficiency anemia (IDA) in pregnancy” was conducted in Department of Pathology at tertiary health care center PDU Medical College and Hospital Rajkot as at India for the period August 2020 to July 2021. All the antenatal care women had undergone for antenatal clinic (ANC) for checkup and necessary investigation. Socio-demographic information were evaluated along with the blood collection. Estimating a hemoglobin (Hb) level, MCV, MCH, MCHC, RDW, RBC and packed cell volume (PCV) were obtained by Automated cell counter machine, method was work on the principle of colorimetric method to determine hemoglobin (Hb) concentration, method uses a non-cyanide hemoglobin (Hb) method.[8]. Classification of Anemia was - severe when hemoglobin (Hb) concentration is less than 7.0 g/dL, moderate when hemoglobin (Hb) falls between 7.0 and 9.9 g/dL, and mild when hemoglobin (Hb) concentration is from 10.0 to 11 g/dL [9]. Morphological typing of anemia was done on the basis of peripheral blood smear examination. The associated factors were evaluated. The data was presented in tabular form and expressed in percentages. Serum ferritin level was done in patient with microcytic hypochromic anemia for confirmation of iron deficiency anemia.

Inclusion criteria: Pregnant women age ≥18 years attending ANC clinic.

Exclusion criteria: Pregnant women with hemoglobin (Hb) concentration >11.0 g/dL.

Result

Table 1: Monthly Prevalence of Anemia in Pregnancy

August 2020-JULY 2021	Total ANC Patients	Hemoglobin (Hb) gm/dL			Total Anemic Patient
		<7	7-9.9	10-10.9	
August 2020	1022	8	473	120	614
September 2020	715	10	389	89	488
October 2020	449	9	192	76	277
November 2020	336	8	138	87	233
December 2020	340	7	277	62	346
January 2021	434	14	251	73	338
February 2021	620	18	395	69	482
March 2021	908	1	404	113	518
April 2021	770	2	421	109	532
May 2021	638	9	318	72	399
June 2021	169	3	83	40	126
July 2021	311	7	165	72	244
Total	6712	109	3506	982	4597

Table 2: Distribution of red cell indices according to severity of anemia

Mean Red cell indices	RBC (x 10^9/L)	Hb (g/dL)	HCT (%)	MCV (fl)	MCH (pg)	MCHC (g/dL)	RDWCV (%)
Sever	2.27	3.5	13.3	58.8	15.5	26.4	19.5
Moderate	3.74	9.9	28.6	76.3	26.5	34.7	18.7
Mild	4.06	10.5	31.8	78.4	25.8	33.0	16.5

Chart 1: Prevalence of Anemia in Pregnancy according to severity

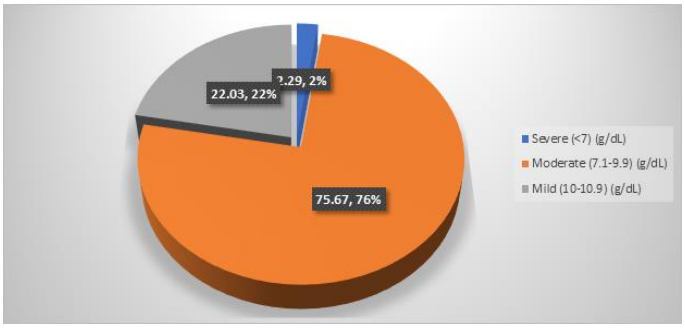
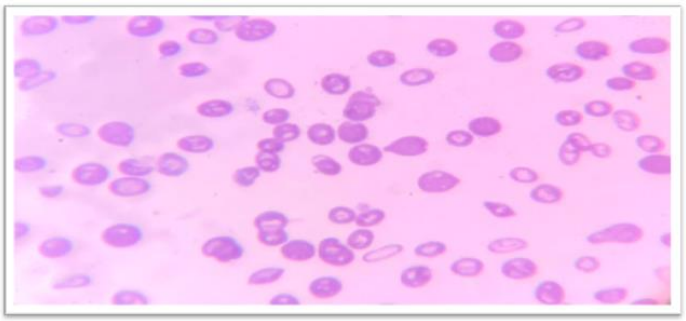


Figure 1: Peripheral smear examination of iron deficiency anemia

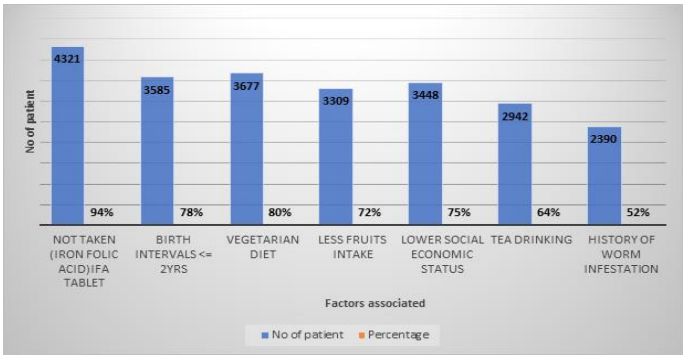


Result: A prevalence of anemia was observed among 4597 pregnant women, among which majority had moderate anemia (76.26%), mild anemia (21.36%) and severe anemia (2.37%) seen.

As MCV, MCH, MCHC value & peripheral blood smear examination Microcytic Hypochromic anemia (78.03%) was the commonest morphological type of anemia. In pregnancy the commonest cause of anemia is iron deficiency anemia.

Chart 2: Factors associated with iron deficiency anemia

Factors associated with anemia



The most common factors associated were not taken (iron folic acid) IFA tablets -94%, Vegetarian Diet were 80%, Birth interval <=2yrs -78%, Lower social economic status -75% (Sociodemographic information were collected along with the blood samples.), Less fruits -72%, Drinking Tea, 64%, history of worm infestation 52%.

Discussion

In the world, anemia is the most common nutritional deficiency disorder. In developing countries >50%

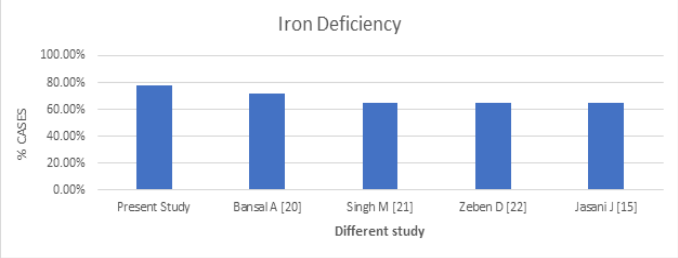
pregnant women are anemic worldwide as compared to developed countries. In present study prevalence of mild, moderate, and severe anemia was observed as 21.36%, 76.26%, 2.37% respectively. The Hb concentration of 11 g/dL was selected as an optimal cut-off for the detection of iron deficiency in early pregnancy. This value is considerably the WHO recommended cut-off (Hb = 11 g/dL) for anemia in women during early pregnancy [10]. Similarly, a study conducted among Mexican pregnant women demonstrated a Hb concentration of 11.5 g/dL as predictive of iron deficiency during late pregnancy [11]. When considering the other red cell indices, there are no recognized cut-off values for MCV, MCH and MCHC during pregnancy. A study conducted among Sri Lankan pregnant women suggested optimal cut-off values of Hb < 12.2 g/dL, MCV < 83.2 fl, MCH < 26.9 pg and MCHC 33.2 g/dL in predicting iron deficiency anemia during second and third trimesters [12]. The optimum cut-off derived for MCV in the other study is higher than the cut-off (80 fl) widely used to identify microcytic anemia which is caused by iron deficiency [13]. This may be due to the increase in MCV during pregnancy [14].

Table 3: Prevalence of anemia in pregnancy in comparison with other studies

Severity of anemia Year Region	Present Study Aug'20-July'21 Rajkot, Gujrat	Jasani J[15] 2019 Vadodara Gujrat	Pereira E[16] 2019 Mumbai Maharastra	Seema BN[17] 2017 Koppal, India	Mangla M[18] 2016 Hariyana, India	Prashant D[19] 2016 Karnataka, India
Severe anemia	02.37%	12.0%	1.6%	17.7%	19%	2%
Moderate anemia	76.26%	57.0%	48.4%	56.30 %	37%	37%
Mild anemia	21.36%	31.0%	50.0%	22.47 %	42%	34%
Total	100%	100%	100%	96.5%	98%	73%

Our study correlate with other study the percentage of severe anemia are similar to Pereira E [16] and Prashant D [19], the percentage of mild anemia are similar to Seema BN [17].

Chart 3: Iron deficiency anemia as compared to developed countries



In our present study iron deficiency anemia 78.03% cases. Our study correlates with Bansal A [20] Singh M [21] Zeben D [22] Jasani J [15]. Other study also showed that iron deficiency anemia is commonest morphological type of anemia.

Factors associated with anemia in our present study correlates with other study the percentage of not taken IFA Tablet, Birth intervals <= 2yrs & Lower social economic status are similar to Mangla M [18], Seema BN [17], Prashant D [19]. Due to low dietary iron and folic acid intake, lack of bioavailability of iron, chronic blood loss by worm infestation the high prevalence of anemia can be attributed. Regarding timings and spacing of child birth Women rarely to get choose. Majority of women in our country are vegetarians, Irregular ANC visits by pregnant patients.

Table 4: Percentage of Serum Ferritin in Iron deficiency anemia

Authors	Serum Ferritin (<30µg/l)
Present study	78.03%
Thoradeniya T [23]	74.20%
Zeben VD [22]	90.00%
Mast AE [24]	73.00%
Alper BS [2]	54.00%
Jasani J [15]	65.00%

Serum ferritin measurements provide a reliable indication of early iron deficiency during pregnancy. A Serum ferritin (SF) concentration < 15 µg/dL indicates depleted iron stores, serum Ferritin levels <30 µg/l to be indicative of iron deficiency anemia. [26]. In our present study serum ferritin levels were <30ug/l in 78.03% correlates with Zeben D [22] (90%), Jasani J [15] (65%)

Conclusion

1. Automated cell counter was simple, economical, cheap, reliable instrument used during this study period. Iron deficiency could be predicted using haematological indices that are produced when a full blood count is ordered.

2. Some of social economic status, birth interval that contribute to such high prevalence of iron deficiency anemia.

3. The present study concluded that health education, good nutrition, thorough clinical and haematological examination with iron and folic acid supplements during antenatal period should be implemented to reduce the prevalence of anemia, thus decreasing maternal and fetal morbidity and mortality during pregnancy.

4. This study has given promising results, iron replacement and vigilance on the improvement of serum ferritin and these red cell indices will enhance the clinical interpretations.

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