Prevalence of anaemia in pregnant women among rural population of Kurhani block, Muzaffarpur district Bihar: A cross-sectional Primary Health Center based study

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Abstract: **Anaemia is a major public problem which is a matter of great concern for developing countries. In India, about 63% of women of aged between15 to 49 years are anaemic. Anaemia has severe consequences on the growing child and pregnant women. In this study, pregnant women in the age range 18- 45 years who consulted the Kurhani PHC of Muzaffarpur district for regular antenatal check-up were recruited. The participants were grouped on the basis of age. The blood samples from the recruited subjects were collected and a complete blood profile was done. The median age of the pregnant women participants was 25 years. Among 345 participants, 95% of the participants were of the age group 18 - 30 years. A total of 156 (45%) pregnant women were found anaemic with 72 (20.03%) having mild anaemia, 76 (22.87%) with moderate anaemia and 8 (2.31%) were severely anaemic. The findings from this study reveal the status of anaemia among the pregnant women of the local population; which will be used to design further epidemiological studies, and will pave the ways to explore the various aspects of anaemia in pregnancy; thus contribute to fulfill the mandate of the setup of Model Rural Health Research Unit at Kurhani-Muzaffarpur, Bihar.**

*Keywords:***Anaemia prevalence, Age Group, Pregnant Women, Haemoglobin level, Kurhani PHC**

I. INTRODUCTION

Anaemia is a worldwide problem affecting all countries of the world. It's a major public health problem, especially in the developing countries. Anaemia becomes more severe in children less than 5 years and women of reproductive age group due to its linked consequences of morbidity and mortality(Harison, 1988; Brabin and Pelletier; 2001). An estimated, about 500 million of reproductive aged women are affected with anaemia(WHO, 2015). World Health Organization (WHO) reported 29.9% of women aged between 15 to 49 years were anaemic; the percentage was higher in pregnant women in the same age group category, where 36.5% pregnant women were reported anaemic(WHO, 2021). About 53% of Indian women of reproductive age group (15 to 49 years) suffer from anaemia (WHO, 2021). According to National Family Health Survey reports 2019-21 (NFHS-5), 52.2% of pregnant Indian women suffer from anaemia. In Muzaffarpur, Bihar, 61.7 % of pregnant women aged between 15 to 49 years were anaemic(NFHS, 2021).

Primarily, anaemia is nutritional i.e. iron deficiency anaemia due to insufficient intake of blood forming micronutrients like iron, Vitamin A, Vitamin B12, folate, riboflavin (Dreyfuss et al., 2000; Stevens et al., 2013). In reproductive age women heavy mensuration or increased iron requirement during pregnancy may also be the prominent cause(Gautam et al., 2019). In growing children, hookworm infection or poor iron absorption may also be the reason of anaemia(Simbauranga et al., 2015). However, iron deficiency anaemia is the main contributor to the disease burden globally(Miller, 2013; Safiri et al., 2019; Turawa et al., 2021).

Anaemia has deep impact on the health, growth & development of infants. In pregnant women, anaemia has severe adverse effect on foetus and maternal health. Anaemia in pregnant women leads to high infant mortality, low birth-weight, foetal growth retardation, child's miscarriage and retard growth of the new born (Steer et al., 2000; Kozuki et al., 2012). It has also similar adverse effect on maternal morbidity and mortality(Smith et al., 2019).

The present study is a survey on anaemia conducted by ICMR-RMRIMS in their Model Rural Health Research Unit (MRHRU) at Kurhani block of Muzaffarpur, Bihar. The MRHRUs are the conceptualization of Indian Government to develop infrastructure for promotion of health research across the country at rural level. The Kurhani block is the largest one of Muzaffarpur district with 166 villages and a total population of around 4.3 lakhs(District Rural Census, 2011). This survey study was conducted on pregnant women who consulted the Primary Health Center (PHC)-Kurhani during their pregnancy for their periodic antenatal check-ups. The prevalence of anaemia among pregnant women was determined by established indicators; total Red Blood Cell count and the haemoglobin percent on the basis of their normal range as per WHO norms (WHO, 2011). Our observations showed a high presence of anaemia in the pregnant women who are visiting the PHC-Kurhani. This preliminary study will help further to investigate the exact causes of high anaemic prevalence in the pregnant women of the local population of kurhani block.

II. MATERIALS AND METHODS

A. *Study design & subject enrolment:*

The study was designed to explore the anaemia prevalence in pregnant women of local population of kurhani block. In this study, those pregnant women were enrolled who consulted the Community Health Center of kurhani (CHC-Kurhani) block for their regular antenatal check-up. Inclusion criteria were: Pregnant women, local resident (any female residing more than 6 months) and aged between 18 to 45 years, ready to give consent for the study. *Exclusion criteria*: Apart from not fulfilling the above mentioned inclusion criteria, the subject had any chronic disease, had blood loss due to surgery or accident in

last 3 months, the subjects who took iron supplement in last 3 months, were also not included in this study. The sampling was done in the period of July 2021 to Dec 2021.

B. *Ethical committee consideration:*

The study was approved through "Institutional Human Ethical Committee" of the ICMR-Rajendra Memorial Research Institute of Medical Sciences (Patna).

C. *Sample Size:*

Calculation of the sample size was on the basis of reported 63.5% anaemia prevalence in reproductive aged women (15 to 49 years) in Bihar (NFHS-5, 2019-21). Considering 5% precision and 95% confidence interval, sample size, $n=Z^2 (1-P)P/d^2$ where "P" denotes the prevalence, "d" denotes precision and "Z" denotes 95% confidence interval. The calculated sample for the study comes to 356.

D. *Sample collection and processing:*

For determininghaemoglobin concentration and total RBC count (CBC), 5ml of venous blood was drawn from each recruited subject in EDTA vacutainer by trained phlebotomist. For Blood profile, 2ml blood was used and from the remaining blood, serum was isolated and stored at -80°C for other investigations.

E. *Complete Blood Count assay:*

The Complete Blood Count (CBC) of the subjects was performed from the drawn venous blood on fully automated cell counter machine "HORIRIBA MDICAL PENTRA ES60/910PES15342". The WHO and NFHS norms for determining anaemia in pregnant women was considered. For being anaemic, the cut off value for Hemoglobin [Hb] was less than 11 g/dl. Anaemia grading: mild anaemic ([Hb]: 10–10.9 g/dl), moderate anaemic ([Hb]: 7–9.9 g/dl), and severe anaemic ([Hb] : <7 g/dl) (WHO, 2011).

F. *Data for male & female sterilization:*

Data regarding sterilization was obtained from the Kurhani PHC data store. Detailed data for the period July 2021- June 2022 was taken for reference.

G. *Statistical analysis and representation:*

Microsoft Excel version 2007 was used for data entry, analysis, graphical representation and for report writing. Independent t-test was used to test the statistical significant.

III. RESULTS

Age group of pregnant women consulting PHC-Kurhani

Surveys conducted by WHO and NFHS for anaemia prevalence in women or pregnant women recruited subjects in the age range of 15 - 49 years. In our study, we considered pregnant women between the age group of 18 - 45 years. A total of 345 subjects were recruited in this study in which the calculated median age as observed was 25 years. The age distribution is shown in Table

1. The maximum proportions of participants were fall in age group of 21 - 25 years and 26 - 30 years. Out of 345 participants, 328 were in the age range of 18 to 30 years, which is 95.07 % of the total subjects recruited. In 31 - 35 years age group, 15 subjects, and only 2 participants were above 35 years of age. Hence, the analysis of the age distribution of pregnant women suggests a sharp decline in the number of participants beyond the age of 30 years (Table 1).

Table 1: Age Classification of Participants

Class Interval	No. of Participants	Percentage
<=20	65	18.84
21--25	150	43.48
26--30	113	32.75
31--35	15	4.35
36--40	1	0.29
>40	1	0.29
Total	**345**	**100**

Table 1: Categorization of participants on the basis of age.

Complete Blood count of the recruited pregnant women

CBC investigation displays the overall health and used to detect any infection and a wide range of disorders. It is the widely accepted test to detect anaemia by haemoglobin concentration and red blood cell (RBC) count(Buttarello, 2016). In this study, CBC of the blood samples collected from the subjects was performed. The size of the samples include in the study was 356 but 11 samples were haemolysed during transportation. So the study was based on 345 recruited subjects. A significant change in two parameters was observed; in total RBC count and haemoglobin concentration. The RBC count in 44.93 % subjects i.e. in 155 pregnant women was below the normal range. Similarly, the haemoglobin concentration in 156 pregnant women was also found below the normal range, which was 45.22% of the total (Table 2).

Table 2: Parameters of blood examination

Parameters	Normal Range N	Normal Range %	Below Range N	Below Range %	Above Range N	Above Range %
RBC	187	54.20	155	44.93	3	0.87
HB (gm%)	189	54.78	156	45.22	0	0.00
WBC	293	84.93	4	1.16	48	13.91
Neutrophils	272	78.84	0	0.00	73	21.16
Lymphocytes	341	98.84	0	0.00	4	1.16
Monocytes	345	100.00	0	0.00	0	0.00
Eosinophil	243	70.43	0	0.00	102	29.57
Platelets	332	96.23	3	0.87	10	2.90

Table 2: Complete blood count of pregnant women participated in the study.

Monocytes and lymphocytes count was almost in normal range for all the participants. Eosinophil, Neutrophil and White blood

cells (WBC) was found above normal range in ~ 29%, ~ 21% and ~ 14% of pregnant women; which was statically non-significant. Hence the CBC investigation indicates that a significant number of participants recruited were anaemic on the basis of RBC count and haemoglobin concentration. The CBC investigation is also represented by the bar graph diagram in Figure 1.
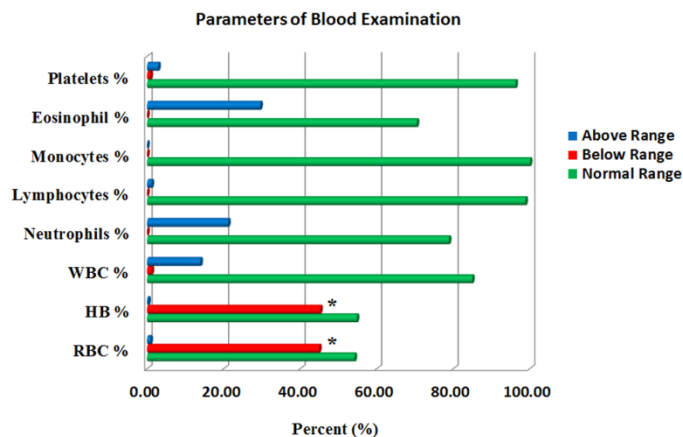

Figure 1: Graph representing Complete Blood Count of pregnant women recruited in the study. The different components are represented in the percentage of all participants. The parameters evaluated for participants (n=345) were categorized into three; normal range, above the normal range and, below the normal range (significant *P≤ 0.05)

Status of anaemia in pregnant women of Kurhani Block

The CBC investigation of pregnant women participated in the study reveal that ~ 55% of the subjects were anaemic on the basis of haemoglobin concentration. Further we graded the found anaemic subjects as mild anaemia (10.0 - 10.9 g/dl), moderate (7.1 - 9.9/dl) and severe (< 7.0g/dl), according to NFHS & WHO norms (Table 3).

Table 3: Anaemia status by Haemoglobin level

Age group (years)	Anaemic Severe (less than 7.0 g/dl) n	Anaemic Moderate (7.1 – 9.9 g/dl) n	Anaemic Mild (10.0 – 10.9 g/dl) n	Anaemic Total n	Non-anaemic Total n	Total subject n
18 - 20	2	13	19	34	31	65
21 - 25	5	32	34	71	79	150
26 - 30	1	28	16	45	68	113
31 – 35	0	3	3	6	9	15
36 – 40	0	0	0	0	1	1
40 – 45	0	0	0	0	1	1
Total	**8**	**76**	**72**	**156**	**189**	**345**

Table 3: Grading of anaemic participants on the basis of haemoglobin level

In the group 18 - 20 years, total 65 participants were enrolled; of which, 34 women were anaemic. Out of 34, 19 participants have mild, 13 have moderate and 2 have severe anaemia. In 21 - 25

years of age group, 71 subjects were anaemic; of which, 34 participants have mild, 32 have moderate and 5 have severe anaemia. Similarly, in 26 - 30 years age group, the mild cases were 16, 28 subjects were moderate and 1 was with severe anaemia. None of the pregnant women above the age of 30 years enrolled in the study was diagnosed with severe anaemia. We also calculated the percent of all anaemia grades, represented by bar graph (Figure 2). It was observed that out of 345 total recruited subjects, 20.87 % (n=72) had mild anaemia, 22.03% (n=76) had moderate anaemia while 2.31 % (n=8) had severe anaemia. Hence, the findings suggest that the maximum anaemia cases are of either mild or of moderate type. However, authors can organize the contents of the manuscript according to their requirements.
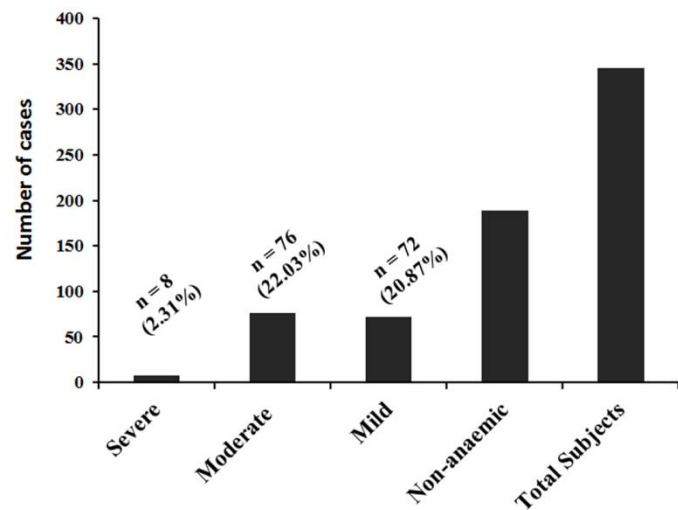

Figure 2: Graph representing the different grades of anaemia i.e. Mild, Moderate and Severe. The percent prevalence for each grade was calculated on the basis of number of anaemic women in each grade; out of the total participants (n=345) recruited in the study.

IV. DISCUSSION

Anaemia is primarily defined on the basis of RBC count and the concentration of haemoglobin present in an individual's blood. During pregnancy, the women body requires more nutrients than usual, for the developing foetus (Marangoni et al., 2016;Forbes et al., 2018); being anaemic, affects the growing child. In our study, we surveyed the pregnant women who consulted the PHC Kurhani for antenatal check-up. The median age derived for the pregnant women participated in the study was 25, and about 95% of the pregnant women were below the age of 30. This reflects the average age of pregnant women of the local population of Kurhani block. It is reported that fertility in women is related to age and decreases with increasing age(Committee Opinion, 2014; Owen et al., 2021), which we also observed in our study. A decreasing trend in the number of

pregnant women with increasing age was observed in our study; after 27 years of age, there was a steady decline in the number of pregnant women (Fig3)
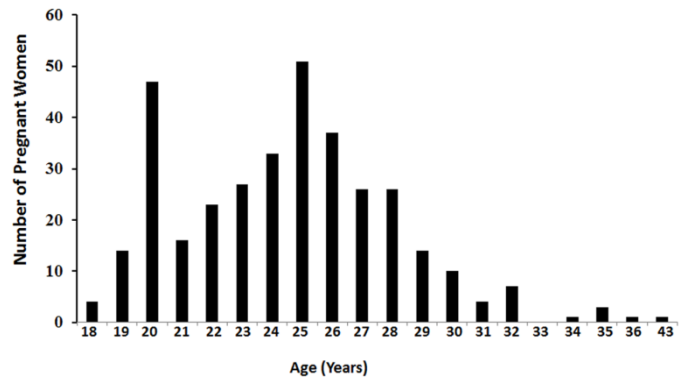

Figure 3:Bar graph representing the number of participants of the corresponding age, out of all the pregnant women who participated (n=345) in the study.

State Government encourages sterilization for females who have completed their family. We analyzed the female sterilization data of kurhani PHC and observed that 96.80% females undergoing for sterilization were below the age of 30 years (Fig 4), which might be the another possible reason for sharp decline in the age of pregnant women beyond 30.
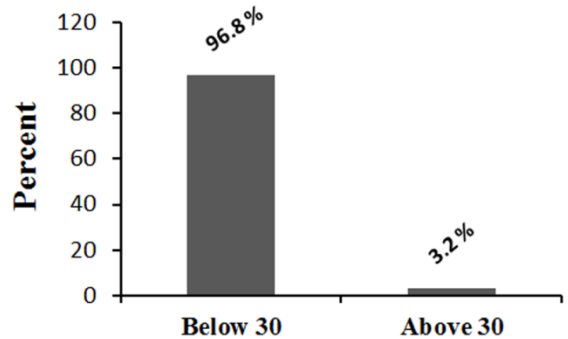

Figure 4:Bar graph representing the percentage of women undergoing female sterilization at Kurhani- Primary Health Center, grouped into the age group of below 30 years and above 30 years.

Blood profile through CBC is a routine test to evaluate the different types of blood cells. It is used to detect a wide range of disorders especially blood related disorders including anaemia. The CBC test results of pregnant women enrolled in this study showed that the differential leucocyte count was in normal range for majority of participants. A significant deviation for total RBC count and haemoglobin concentration was observed among the participants. The RBC count was below normal range in 44.93% of the pregnant women. Similarly, the concentration of haemoglobin was observed below the normal range in 45.22% of the participants. The findings suggest that a major proportion of

pregnant women recruited for this study were anaemic. The observed value of prevalence of anaemia was less than the reported average value for Bihar by NFHS-5 (2019-21) reports; however, our study was bounded by the age group range 18 - 45 years against the NFHS-5 survey in which the age group of 15 - 49 years was used. Additionally, the level of platelets in 96.23% participants was under normal range; which roughly suggests no loss of blood due to abnormal bleeding.

Anaemia determined by haemoglobin concentration in blood is also defined and sub-categorized into mild, moderate and severe. The participated pregnant women in the study who were found anaemic were further sub-categorized. Out of total participants, 20.87% subjects were having mild anaemia, 22.03% having moderate anaemia and 2.31% were suffering from severe anaemia, while the proportion was 24.4%, 26.3% and 1.4% for mild, moderate and severe respectively, for pregnant women as per NHFS-5. Hence, the survey data reflects the actual situation of anaemia among the pregnant women of the local population of Kurhani block of Muzaffarpur district who consulted PHC-Kurhani for their antenatal check-up.

V. CONCLUSION

This study conducted at the Primary Health Center showed that the maximum pregnant women fall in the group of 18 to30 years of age. The findings reveal high anaemia prevalence among the pregnant women of the local village population of Kurhani block; however the observed anaemia prevalence was low compared to the reported national survey for the state of Bihar. Among the anaemic pregnant women, most of the women were having mild or moderate category of anaemia while less than 5% of them falls in the severe category. The findings from this study reveal the actual prevalence of anaemia among the pregnant women of local population which will be used to design the further epidemiological studies accurately with more precision and helps to provide better facilities to the local population of Kurhani block; thus contribute to fulfill the mandate of Model Rural Health Research Unit at Kurhani-Muzaffarpur, Bihar.

VI. RECOMMENDATIONS

About 45% of the anaemic cases were in the mild category which can be prevented/ or cured by iron supplement and proper diet. Thus, the interventions like community awareness and dietary support will help to reduce the anaemia.

VII. ACKNOWLEDGEMENT

VIII. CONFLICT OF INTEREST

The authors declared no conflict of interest.

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