Prevalence and Consequences of Anaemia in lactating women in rural areas of India

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Abstract :- Anaemia is the late manifestation of deficiency of nutrient(s) needed for hemoglobin synthesis. Most of the anaemias are due to inadequate supply of nutrients like iron, folic acid and vitamin B_{12}, proteins, amino acids, vitamins A, C, and other vitamins of B-complex group *i.e.*, niacin and pantothenic acid are also involved in the maintenance of hemoglobin level.

The context

In India, anaemia affects an estimated 50 per cent of the population. In women, anaemia may become the underlying cause of maternal mortality and perinatal mortality.[1] Anaemia also results in an increased risk of premature delivery and low birth weights. Iron deficiency in late pregnancy results in poor foetal iron stores. Latent iron deficiency is known to alter brain iron content and neurotransmitters irreversibly in foetal life and postnatal babies.[2]

In a study of the Indian Council of Medical Research (ICMR) in 1989, prevalence of anaemia in 4181 pregnant rural women of 11 States was estimated and it was demonstrated that 87.6 per cent women had haemoglobin (Hb) <10.9 g/dl. Further, ICMR in 1992 reported that in 6 States supplementation of iron-folate tablets to control anaemia (women with haemoglobin < 7.0 g/dl were excluded) had 62 per cent women as responders (anaemic-those responding to haematinic therapy by showing rise in haemoglobin). Even after consuming 90 tablets, 37.8 per cent women had haemoglobin less than 10.0 g/dl and 19.4 per cent had less than 9.0 g/dl. During 1986 - 1991 haemoglobin estimations in rural pregnant women in Varanasi showed 94.5, 95.3 and 95.9 per cent prevalence of anaemia in I, II and III trimesters.[3] ICMR district nutrition survey 1999-2000 also reported prevalence of anaemia as 84.2 per cent with 13.1 per cent with severe anaemia in pregnancy. Haemoglobin in all these studies was estimated by

cyanmethaemoglobin method. Contrary to the above studies, the NFHS-4 (National Family Health Survey, 1998-1999) data using hemocue system reported prevalence of anaemia as 49.7 per cent in pregnant women; 56.4 per cent in breastfeeding non pregnant; and 50.4 per cent among non pregnant non breastfeeding women. Hemocue system estimates higher levels of haemoglobin, thus is difficult to compare with the earlier studies. The Hemocue method is costlier, but operationally easier, more portable and requires less training; hence it can be optimally used in the field work.[4]

It became necessary to assess whether the lower prevalence reported in NFHS-4 was due to the improvement in haemoglobin levels following improved antenatal coverage, nutrition support, *etc.*, or due to difference in the method used for estimation of haemoglobin. Further, the interstate differences in prevalence and severity of anaemia in NFHS-4[5] were striking and needed investigations.

The present study was therefore planned to estimate haemoglobin levels in pregnant and lactating women from seven States earlier covered in the NFHS-4, using the cyanmethaemoglobin method, and to estimate anaemia prevalence in these women to observe the changing trend; and to study the likely aetiological factors influencing the haemoglobin level such as maternal age of marriage, fertility, literacy, occupation, standard living index, nutritional status, dietary intakes, antenatal care, and awareness about anaemia and supplementation of iron folate tablets; and to identify the factors responsible for interstate differences in prevalence and severity of anaemia observed in the study data (NFHS-4 data).[6]

Material and Method

The number of panchayats, villages and the target women were selected from Mushari Block of Muzaffarpur district of Bihar. The sample of households and villages for the present study in each State was drawn as a sub-sample of households and villages investigated in the NFHS-4 sample. The sample selection was done in two stages. The selected villages were stratified into tertiles on the basis of prevalence of anaemia as per NFHS-4. A total of 20 villages were selected from the different tertiles, the number of villages being proportional to the tertile/size. From each of the 20 villages, all households with pregnant and lactating women (up to 3 months of exclusive breast feeding) were identified. Using a simple random sample technique 15 pregnant and

lactating women were selected. In case the selected village did not have 15 women, the neighbouring village was taken out of the selected reserve list. However, number of villages was limited to 30.

The following information was collected on a pre-tested proforma:

Socio-demographic particulars of a household: Age at marriage, literacy status and occupation of woman and her husband.

Reproductive behaviour: Age, sex, number of live children and inter-pregnancy interval were recorded. Any pregnancy loss with birth order and gestational age was noted (foetal loss). Current pregnancy details were also recorded.

Antenatal care (ANC): ANC availability, frequency of check-ups if conducted in first trimester and if provided by the medical doctor, were recorded.

Nutrition and health education (NE): Availability of facility of imparting NE (with special reference to anaemia of pregnancy) in the respondent's area was assessed.

Availability of supplements: Availability of iron folic acid (IFA) tablets.

Behaviour regarding food consumption: Information on increased food consumption, frequency of smoking and consumption of alcohol was collected.

Dietary intake: The trained field workers calculated the amount of intake of each nutrient by the woman as per cent RDA (recommended dietary allowances) as well as amount using the 'Nutritive value tables.[7]

Height and weight of the subjects were measured using anthropometric rod and platform weighing scale, which were standardized repeatedly.

Haemoglobin (Hb) estimation was done by cyanmethaemoglobin method, using the filter paper technique. Finger tip was cleaned with spirit, dried and clean puncture made with a sterilized disposable lancet. First drop of the free flowing blood was wiped off and second and if needed third drop was used for haemoglobin estimation. In this, an accurate volume (20 µl) of blood is drawn into the Hb pipette and immediately delivered on to dry Whatman No.1 filter paper (cut into 1.5 x 1.5 cm squares, and kept dry in an envelope). It is allowed to dry and the squares of paper are labeled. These squares are then dropped into 5 ml of Drabkin's solution (within 48-72 h), and the blood is

allowed to diffuse out of the filter paper into the diluent. The solution is then centrifuged. The supernatant was separated and its absorbance was read at 540 nm in a photoelectric colorimeter (AIMIL Model no.014, same in all centres). Altitude correction for haemoglobin was applied for the values obtained in Himachal Pradesh. The variation in haemoglobin level on two consecutive determinations (separate finger prick samples) by two field workers was £2.8 per cent. The intra-individual variation was £1.59 per cent. Every fifth sample was checked by the field worker at the center and every 10th sample was sent to the NIN, Hyderabad for Hb estimation, in the same week. The variation of ±<0.5 g/dl in haemoglobin estimation between the centres and the NIN, Hyderabad was considered acceptable.

Calculation of standard of living index (SLI; modified from NFHS-4). The standard of living index was calculated taking into consideration certain items. These items were scored in ascending order and scores were calculated for family of each participating woman. From the total scores of each State, the upper, middle and lower quartiles were calculated and the family was accordingly placed in the upper, middle and lower SLI.

Items of household included in the calculation of SLI are given below and SLI was calculated by adding the following scores: *(i)* Type of house: kutcha-1, semi-pucca-2, pucca-3; *(ii)* Source of drinking water: stream/canal/river-1, open well and pond/tank-2, tap and tube well-3; (*iii*) Garbage/waste water disposal: compost pit-3, away from house-2, indiscriminate-1; (*iv*) Type of latrine: open field defecation -1, manually cleaned -2, sanitary latrine -3; (*v*) Source of lighting : no -1, yes -2; (*vi*) Separate kitchen : no - 1, yes - 2; (*vii*) Main fuel for cooking : fire wood -1, kerosene - 2, LPG, biogas and electricity -3; (*viii*) Access to media: Television - no-1, yes-2. radio/transistor - no-1, yes-2. newspaper - no-1, yes-2.

The data for intestinal parasites or malaria in the subjects could not be obtained as collection of stool samples was very difficult. However, no subject had clinical features of malaria at the time of blood collection.

Standardization and training of investigators: To ensure uniform and consistent methodology for haemoglobin estimation, anthropometry and for the interviews to be followed in all centres for data collection, the selected field workers (three in each) were trained. The field training was for haemoglobin estimation (one field worker was trained, exclusively); anthropometric

assessment; enumeration of target women in the villages; use of random number tables to select the study women; dietary survey and to record history of early reproductive life, utilization of health services, education related to health and nutrition, *etc*.

These centres were provided standardized tools: (*i*) anthropometeric rod; (*ii*) Drabkin's solution (cyanmethaemoglobin solution for haemoglobin estimation); (*iii*) haemoglobin standard; (*iv*) deonised water; (*v*) Whatmann filter paper; (*vi*) haemoglobin pipettes; and (*vii*) weighing measurement sets for dietary survey. These were checked and standardized at NIN, Hyderabad. The field workers were made to practice during the training period. The blood collectors were trained carefully and taught not to "milk" the finger for blood collection. For weighing scales and colorimeters specifications were given to procure locally. The colorimeter and cuvettes were similar, weighting scale standardized repeatedly, thus unlikely to affect measurements.

Analysis of data: Data were analyzed for pregnant and lactating women separately for likely differences. SPSS package was used for analysis. Parametric tests such as t-tests or ANOVA were used to test significance of differences. In case of access to and utilization of health services, the data were presented in percentages as well as numbers. Multivariate analysis was undertaken to study the influence of the maternal socio - demographic status, age of marriage, fertility, nutritional, awareness about anaemia and contribution of iron folic acid tablet (IFAT) consumption on her haemoglobin level.

For comparison with the NFHS-4 haemoglobin data for the studied villages were specially obtained. The consumption of alcohol and smoking was negligible, and was therefore not analyzed.

Results

Prevalence and severity of anaemia: A total of 84 per cent pregnant and 92.2 per cent lactating women were anaemic with severe anaemia in 9.2 and 7.3 per cent respectively. In the present study prevalence as well as severity (moderate to severe) of anaemia was more as compared to the NFHS-4 study data.

Around 51 per cent women in pregnancy and lactation had moderate degree of anaemia (Hb 7.0-9.9 g/dl).

Socio-demographic characteristics :

Literacy status- The illiteracy (those who neither can read nor write) among women was highest in Rohua (68.0%) followed by 46.3, 45.3, 30.7, 28.7, 8.8 and 1.3 per cent in the Panchayat of Prahaladpur, Sherpur, Nazirpur, Bhagwanur, Patahi and Dumri of respectively; 37.8 per cent husbands were illiterate followed by (31.4%), (28.9%), (22.1%), and (19.3%).

Occupation- In only 43.8 per cent women were housewives followed by 61.8 per cent in. In other States more than 80 per cent women were housewives; maximum being in Rohua 94.3 per cent. The working women were engaged in agriculture, road or other employment as labourer.

Age of marriage - The mean age of marriage was 18.3 ± 1.5 yr in Rohua; 17.5 ± 2.9 yr in Manika Bishunpur Chand; 22.0 ± 3.5 in Sherpur; 25.3 ± 4.7 in Patahi; 17.1 ± 2.5 in Kanhauli; 19.3 ± 2.5 in Jhaphan and 19.1 ± 2.9 in Dumri.

Pregnancy and nutritional status-Dumri with anaemia prevalence of 68.1 and 65.8 per cent in pregnancy and lactation respectively, women had higher mean age of marriage, lower parity (1.5) and foetal loss than Sherpur. In contrast, neighbouring Blocks of Bihar had lower age of marriage ($P< 0.001$), higher parity of 2.6 ($P< 0.001$), and foetal loss of 0.33. Manika Bishunpur Chand women were taller by >6.0 cm, but had lower weight by 3.0 kg. Rohua women consumed significantly higher quantity of fat and had lower intakes of energy and protein. In and women with similar pattern for parity, and IPI (inter pregnancy interval) but higher foetal loss showed significant differences in the prevalence of anaemia.

Women in Rohua Panchayat significantly lower ($P<0.01$) in Dumri women . Women in Patahi consumed. Jhapahan significantly lower amount of protein ($P<0.003$). Panchayat of Dumri and Sherpur had anaemia prevalence of > 90 per cent in pregnancy as well as in lactation. These Panchayats have lower marriage age, poor fertility indices and lower weight and height as compared to others States.

Antenatal care: Over 80 per cent women received antenatal care in first trimester in Dumri and Patahi followed by Sherpur (61.9%); 94.1 per cent in Manika Bishunpur Chand, 73.5 per cent in Manika, 71 per cent in Kanhauli and 50.2 per cent in Rohua received antenatal care from a medical doctor. Availability of the doctor in pregnancy was poor in Patahi. In Manika, 61.8 per

cent pregnant women never received any ANC. In Sherpur and Shekhpur availability and consumption of iron folate tablets for 3 months or more, in pregnancy was significantly higher, as compared to other States. The consumption of IFAT (iron folic acid tablet) was lowest in Rohua and Patahi had lower prevalence of severe anaemia as significantly more women were aware about anaemia and consumed IFAT for 3 months as compared to Manika and Manika Bishunpur Chand.

Dietary intakes: For the current pregnancy, energy and protein intakes were lower than the recommended dietary allowances (RDA) in all the States. This was true for the pregnant as well as lactating women. The intake of important dietary items necessary for haemoglobin synthesis *i.e.*, iron and FFA (free folic acid) were much lower than the RDA in all the Panchayats, consumed 30 mg iron (82.3% of RDA) and 77 µg FFA (< 20% of RDA) and corresponding figures for Sherpur were 17 mg and 64.3 µg, in Sherpur and Manika respectively. Women in Sherpur consumed less than or closer to 50 per cent of the RDA. FFA intakes were much lower than the RDA; Sherpur women consumed only 45.5 µg with 14 mg iron per day (the lowest values among all the States). Vitamin A intake was lower than the RDA in all the Panchayats, except Patahi 890 µg/day (RDA 600 mg/day), the fat consumption was more than the RDA in pregnancy and further increased in lactation. Vitamin C intake was close to the RDA except for Prahladpur and Manika Bushunpur Chand.

In lactation, RDA for energy during lactation (2425 kcal/day) is higher by 250 Kcal/day than the RDA for pregnancy. Women in all States were consuming energy lower than the RDA during lactation. There was marginal increase in energy intake during pregnancy *i.e.*, Prahaladpur 269, Manika 100, Manika Bishunur Chand 90, Sherpur (no change), Dumri 59 and Rohua 45 Kcal/day. Surprisingly, in Dumri, the energy intake for lactating women further reduced by 75 Kcal/day and was lower by 535 Kcal/day as compared to the RDA. Protein intake in lactation is 75 g/day (RDA), higher by 10 g than in pregnancy; only Sherpur Panchayat consumed the desired RDA.

The analysis of variance also showed that intakes for all nutrients was significantly more in higher haemoglobin groups, except for vitamins A and free folic acid.

Multiple regression analysis: Multiple regression analysis taking haemoglobin as dependent variable against maternal characteristics in the

current pregnancy, demonstrated that women with more education, height, age of marriage, in higher SLI, with higher consumption of IFAT and energy contributed positively to haemoglobin level. Women working as labourer, having higher parity and foetal loss and those not consuming IFAT regularly or not aware about anaemia negatively affected the haemoglobin. Health and nutrition education, literacy and occupation of the husband and interpregnancy interval did not show any relationship with.

Discussion

The present study demonstrated higher prevalence of anaemia both in pregnancy and lactation as compared to the reported levels in NFHS-4, in the study States. Inspite of the significantly higher haemoglobin levels and lower prevalence of anaemia reported in NFHS-4 survey, the pattern of interstate differences was similar to the present study. The prevalence of anaemia was lowest in Dumri Panchayat. The ICMR district nutrition survey data reported anaemia prevalence of 84.2 per cent (with severe anaemia 13.1%) closer to the present study rural data. Comparative data (as compared to the present study States) for four States in the National Nutrition Monitoring Bureau (NNMB-2003) and seven States in the District Level Household Survey (DLHS), Ministry of Health & Family Welfare phase-1 2004, using cyanmethaemoglobin method also showed higher prevalence of anaemia as compared to the NFHS-4.

The present study showed 1.8 per cent women with haemoglobin <5.0 g/dl, 19.3 per cent with <8.0 g/dl and 9.2 per cent with <7 g/dl haemoglobin level, in pregnancy; being similar to the ICMR 1989 (rural data-1985-86)[8] having 22.7 per cent pregnant women <8 g/dl and 10.4 per cent <7.0 g/dl haemoglobin levels. Thus showing no change in severity of anaemia in last 15 yr.

The present study suggested that (*i*) the cyanmethaemoglobin method using filter paper collection technique was feasible in field studies, (*ii*) there was higher prevalence of anaemia in rural pregnant and lactating women compared to that reported in the NFHS-4; (*iii*) there were interstate differences in prevalence of anaemia and its causative factors; (*iv*) the key to controlling anaemia could be in providing ANC services in the first trimester preferably by a doctor and more consumption of iron-folate tablets in pregnancy and lactation.

To conclude, prevalence of anaemia and severity in rural pregnant and lactating women was much higher than that reflected in NFHS-4; this being mainly due to difference in haemoglobin estimation technique.

Screening for anaemia, treatment of anaemic women, and availability of food fortification (wheat flour with iron and folic acid), milk sugar and salt with iron to build long term iron stores remains the key to reduce anaemia. Even cooking in cast iron utensils improves iron content in diet.

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