Prevalence of anemia among pregnant women and adolescent girls in 16 districts of India

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Abstract

Background. *Nutritional anemia is one of India's major public health problems. The prevalence of anemia ranges from 33% to 89% among pregnant women and is more than 60% among adolescent girls. Under the anemia prevention and control program of the Government of India, iron and folic acid tablets are distributed to pregnant women, but no such program exists for adolescent girls.*

Objective. *To assess the status of anemia among pregnant women and adolescent girls from 16 districts of 11 states of India.*

Methods. *A two-stage random sampling method was used to select 30 clusters on the basis of probability proportional to size. Anemia was diagnosed by estimating the hemoglobin concentration in the blood with the use of the indirect cyanmethemoglobin method.*

Results. *The survey data showed that 84.9% of pregnant women (*n = *6,923) were anemic (hemoglobin < 110 g/L); 13.1% had severe anemia (hemoglobin < 70 g/L), and 60.1% had moderate anemia (hemoglobin ≥ 70 to 100 g/L). Among adolescent girls (*n = *4,337) from 16 districts, the overall prevalence of anemia (defined as hemoglobin < 120 g/L) was 90.1%, with 7.1% having severe anemia (hemoglobin < 70 g/L).*

Conclusions. *Any intervention strategy for this population must address not only the problem of iron deficiency, but also deficiencies of other micronutrients, such as B12 and folic acid and other possible causal factors.*

Key words: Adolescent girls, anemia, pregnant women, prevalence

Introduction

Anemia in pregnant women and adolescent girls has serious health implications. Severe anemia during pregnancy significantly contributes to maternal mortality and morbidity [1, 2]. There is evidence that severe anemia also increases perinatal morbidity and mortality by causing intrauterine growth retardation and preterm delivery [3]. Anemia in adolescent girls affects their physical work capacity and reproductive physiology [4]. According to a World Health Organization (WHO) report [5], the global prevalence of anemia among pregnant women is 55.9%. In India, the prevalence of anemia in pregnant women has been reported to be in the range of 33% to 89% [6–12]. According to the limited number of studies from India, the prevalence of anemia in adolescent girls is also fairly high [13, 14]. Anemia results both from nutrition-related causes and from inflammatory or infectious diseases, as well as from blood loss. Iron-deficiency anemia resulting from inadequate intake and low absorption of dietary iron is the most common form of anemia in India [15, 16]. India launched the National Nutritional Anaemia Prophylaxis Programme (NNAPP) in 1970. Under the program, iron and folic acid tablets are distributed to pregnant women. However, no impact of this program

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on the prevalence of anemia was observed in an evaluation conducted during 1985–86 [8]. Consequently, certain modifications were made in the NNAPP to make it more effective and efficient [14]. The present paper reports the prevalence of anemia among pregnant women and adolescent girls in 16 districts from 11 states of India.

Methods

Sixteen districts were selected for the study: eight from the northern, six from the eastern and northeastern, and one each from the southern and western regions of India. The survey was conducted by two-stage random sampling, and 30 clusters were selected on the basis of probability proportional to size, with operational feasibility kept in view and on the assumptions of an expected prevalence of 70% among pregnant women, a confidence level of 95%, a relative margin of error of 10%, and a design effect of 3 [17]. A total of 495 pregnant women per district (17 per cluster) were selected at random. Assessment of anemia in unmarried adolescent girls (11 to 18 years old) was carried out with a sample size of 10 girls per cluster. Informed consent was obtained in writing from the subjects prior to the collection of blood samples after explaining the purpose of the study.* The hemoglobin concentration in the blood of the pregnant women and adolescent girls was estimated by the indirect cyanmethemoglobin method [18, 19]. Hemoglobin concentrations were not adjusted for altitude, since only two high-altitude locations were sampled in the study.

Blood (in 20-μl samples) was transferred to Whatman filter paper no. 1 and dried at room temperature. After the blood had dried, the filter paper was placed in an envelope and transported to the laboratory. The portion of the filter paper with blood was placed in 5 ml of Drabkin's solution and vortexed for 5 minutes. The solution was allowed to stand for 2 hours, and the hemoglobin concentration was measured at a wavelength of 540 nm by a spectrophotometer. The estimates were performed within 6 days of sample collection. Blood samples collected on Whatman filter paper by this method have been reported to be completely eluted, and the hemoglobin concentration values simultaneously estimated by the direct and indirect cyanmethemoglobin methods were in close agreement [19].

Anemia was assessed according to WHO criteria [20]. A hemoglobin concentration of less than 110 g/L in a pregnant woman or less than 120 g/L in an adolescent girl was considered an indication of anemia. In the case of pregnant women, hemoglobin concentrations of less than 70, 70 to 100, and 100 to 109 g/L were considered to indicate severe, moderate, and mild anemia, respectively. In the case of adolescent girls, hemoglobin concentrations of less than 70, 70 to 100, and 100 to 119 g/L were considered to indicate severe, moderate, and mild anemia, respectively.

*This multicenter study was approved by the Project Review Group of the Indian Council of Medical Research (ICMR).

Results

Prevalence of anemia in pregnant women

The measurements of hemoglobin concentration indicated that the prevalence of anemia among the 6,923 pregnant women from the 16 districts was 84.9%. The prevalence within districts ranged from 61.0% in Mandi District to 96.8% in Srinagar District (**table 1**). The average prevalence of anemia was 83.0% in the eight districts from northern India and 86.8% in the six districts from eastern India. The prevalence rates in the single districts from southern India (Mehboob Nagar) and western India (Raigarh) were 92.1% and 87.2%, respectively.

The average prevalence of severe anemia was 13.1%; the highest prevalence (38.2%) was in Bikaner District and the lowest (zero) was in Kohima District. The prevalence of severe anemia was 13.5% in the eight districts from northern India, 12.1% in the six districts from eastern India, 12.7% in the single district from southern India, and 14.8% in the single district from western India.

The overall prevalence of moderate and mild anemia in pregnant women was 60.1% and 11.8%, respectively. The highest prevalence of moderate anemia was found in Nagaon District (82.7%) and the highest prevalence of mild anemia (31.0%) in Mandi District (**table 1**). The lowest prevalence rates of moderate (28.0%) and mild (4.7%) anemia were recorded in pregnant women of Mandi and Gaya Districts, respectively.

Prevalence of anemia in adolescent girls

Table 2 presents the hemoglobin concentrations of the 4,337 unmarried adolescent girls from the 16 districts. The results indicate that 90.1% of the girls were anemic. The prevalence of anemia ranged from 58.2% in Dehradun District to 100% in Badaun District. The average prevalence of anemia was 89.4% in the eight districts from northern India, 91.4% in the six districts from eastern India, and 91.8% and 87.0% in the single districts from southern India (Mehboob Nagar) and western India (Raigarh), respectively.

The overall prevalence of severe anemia was 7.1%, with the highest prevalence (24.3%) in Bikaner District. No severely anemic girls were found in Bishnupur and Kohima Districts. The average prevalence of severe

TABLE 1. Prevalence of anemia among pregnant women

District	No. of women	No. (%) with anemia			
		Total (Hb < 110 g/L)	Mild (Hb 100–109 g/L)	Moderate (Hb 70–100 g/L)	Severe (Hb < 70 g/L)
North					
Mandi	507	309 (61.0)	157 (31.0)	142 (28.0)	10 (2.0)
Dehradun	340	220 (64.7)	43 (12.6)	158 (46.5)	19 (5.6)
Lakhimpur Kheri	593	471 (79.4)	88 (14.8)	325 (54.8)	58 (9.8)
Badaun	488	395 (80.9)	96 (19.7)	283 (58.0)	16 (3.3)
Baramullah	504	460 (91.3)	46 (9.1)	342 (67.9)	72 (14.3)
Bikaner	510	484 (94.9)	34 (6.7)	255 (50.0)	195 (38.2)
Mainpuri	253	243 (96.0)	18 (7.1)	182 (71.9)	43 (17.0)
Srinagar	498	482 (96.8)	26 (5.2)	370 (74.3)	86 (17.3)
East					
Kohima	69	47 (68.1)	10 (14.5)	37 (53.6)	0
Bishnupur	508	391 (77.0)	76 (15.0)	313 (61.6)	2 (0.4)
Gaya	446	375 (84.1)	21 (4.7)	267 (59.9)	87 (19.5)
Patna	512	462 (90.2)	28 (5.5)	298 (58.2)	136 (26.6)
Dibrugarh	525	480 (91.4)	52 (9.9)	371 (70.7)	57 (10.8)
Nagaon	475	446 (93.9)	29 (6.1)	393 (82.7)	24 (5.1)
South					
Mehboob Nagar	189	174 (92.1)	14 (7.4)	136 (72.0)	24 (12.7)
West					
Raigarh	506	441 (87.2)	79 (15.6)	287 (56.7)	75 (14.8)
All districts	6,923	5,880 (84.9)	817 (11.8)	4,159 (60.1)	904 (13.1)

Hb, hemoglobin

anemia was 7.4% in the eight northern districts, 5.7% in the six eastern districts, 9.2% in the single southern district, and 11.1% in the single western district.

The overall prevalence rates of moderate and mild anemia were 50.9% and 32.1%, respectively. Patna District had the highest prevalence of moderate anemia (72.2%), and Mandi District had the highest prevalence of mild anemia (57.9%) (**table 2**). Dehradun District had the lowest prevalence of moderate anemia (27.7%), and Gaya District had the lowest prevalence of mild anemia (14.4%).

Discussion

The average prevalence of anemia among pregnant women from 16 districts of 11 states of India during the present survey was 84.9%. A previous multicenter study carried out during 1985–86 in 11 states found an overall prevalence of anemia of 87.5% among pregnant women [8]. These prevalence values are essentially the same as those reported in earlier studies carried out in India during the 1940s, 1950s, and 1960s [21, 22]. However, the National Family Health Survey 2 (NFHS-2) conducted during 1998–99 found an overall prevalence of 49.7% among 5,654 pregnant women from 25 states [23]. The lower prevalence observed during the NFHS-2 survey could be due to the use of the HemoCue method, which gives higher estimates of hemoglobin concentration than the standard method [24, 25].

Sari et al. [26], however, reported that the prevalence of anemia was significantly higher when hemoglobin concentrations were estimated by the indirect cyanmethemoglobin method than when they were estimated by the direct cyanmethemoglobin and HemoCue methods. Sari and coworkers suggested that the higher estimates obtained by the indirect method may have been due to incomplete dissolution of blood from the filter paper into Drabkin's solution. Comparison of findings of the prevalence of anemia obtained by different methods of hemoglobin estimation, therefore, may not be strictly valid without critical evaluation of methodologic differences. Although the complete dissolution of blood from filter paper into Drabkin's solution was ensured in the present study, the results obtained through the use of indirect methods may not be strictly comparable to results reported from other studies that used the direct cyanmethemoglobin method.

Thus, anemia remains endemic among pregnant women in India despite intervention measures such as the distribution of 100 Folifer tablets (containing 100 mg of elemental iron and 500 μg of folic acid) to each

TABLE 2. Prevalence of anemia among adolescent girls

District	No. of girls	No. (%) with anemia			
		Total (Hb < 120 g/L)	Mild (Hb 100–119 g/L)	Moderate (Hb 70–100 g/L)	Severe (Hb < 70 g/L)
North					
Dehradun	213	124 (58.2)	62 (29.1)	59 (27.7)	3 (1.4)
Baramullah	300	259 (86.3)	101 (33.7)	153 (51.0)	5 (1.7)
Mandi	285	250 (87.7)	165 (57.9)	83 (29.1)	2 (0.7)
Bikaner	300	271 (90.3)	56 (18.7)	142 (47.3)	73 (24.3)
Lakhimpur Kheri	294	271 (92.2)	97 (33.0)	148 (50.3)	26 (8.8)
Mainpuri	147	140 (95.2)	43 (29.3)	92 (62.6)	5 (3.4)
Srinagar	296	294 (99.3)	80 (27.0)	199 (67.2)	15 (5.1)
Badaun	299	299 (100.0)	121 (40.5)	150 (50.2)	28 (9.4)
East					
Bishnupur	300	238 (79.3)	123 (41.0)	115 (38.3)	0
Kohima	99	88 (88.9)	39 (39.4)	49 (49.5)	0
Gaya	285	262 (91.9)	41 (14.4)	178 (62.4)	43 (15.1)
Dibrugarh	296	278 (93.9)	105 (35.5)	147 (49.7)	26 (8.8)
Nagaon	297	281 (94.6)	97 (32.7)	178 (59.9)	6 (2.0)
Patna	317	310 (97.8)	65 (20.5)	229 (72.2)	16 (5.1)
South					
Mehboob Nagar	294	270 (91.8)	105 (35.7)	138 (46.9)	27 (9.2)
West					
Raigarh	315	274 (87.0)	92 (29.2)	147 (46.7)	35 (11.1)
All districts	4,337	3,909 (90.1)	1,392 (32.1)	2,207 (50.9)	310 (7.1)

Hb, hemoglobin

woman to be taken during pregnancy.

Some of the reasons that iron supplementation programs are ineffective may be that the programs do not always reach the target people, health staff are inadequately trained and mobilized to ensure the effective distribution of supplements, and compliance is low, due, in particular, to the side effects associated with iron supplements [8, 27]. Stoltzfus [27] considered that a more fundamental reason why strategies to tackle anemia have difficulty in succeeding is that they too often confine themselves solely to the correction of iron deficiency. It is unlikely that all anemia results from iron deficiency, because other nutritional deficiencies, as well as malaria, heavy loads of some helminths, and other inflammatory or infectious diseases, also cause anemia. A successful strategy to combat anemia, therefore, should address all of the causal factors after their elucidation.

The overall prevalence of severe anemia (hemoglobin < 70 g/L) among pregnant women was 13.1%, ranging up to 38.2% in Bikaner District. A prevalence of 8.3% for severe anemia has been reported among lactating and pregnant women in the slums of Hyderabad [28]. However, the prevalence of severe anemia among pregnant women was as high as 56% in a population-based survey (1990–94) of rural and urban areas in Punjab. In the NFHS-2 study, the overall prevalence of severe anemia was only 2.5%. As stated above, such a low prevalence could be due to the use of the HemoCue method, which overestimates the level of hemoglobin.

The overall prevalence of anemia among adolescent girls was 90.1%; the prevalence rates of mild, moderate, and severe anemia were 32.1%, 50.9%, and 7.1% respectively. In a study of 1,500 rural girls 10 to 19 years of age from 10 villages in Gujarat, the prevalence of anemia (hemoglobin < 120 g/L) was reported to be 60% [4]. A recent study conducted in rural, tribal, and urban areas in Vadodara District of Gujarat found a 74.7% prevalence of anemia. After weekly supplementation with iron–folic acid tablets, the prevalence was reduced by 20.5%, with a mean rise in hemoglobin level of 6.9 g/L, a result suggesting that iron deficiency was the predominant causal factor of anemia [29]. The anemia prevalence among adolescent girls in Delhi was 46.6% for those in the high socioeconomic group and 56% for those in the lower-middle socioeconomic group [30]. An 11-country study found that more than 40% of adolescents in Asian countries, including India, were anemic (hemoglobin < 115 g/L) [31]. A review of Indian studies by Kanani and Ghanekar [13] found that more than 70% of adolescent girls from low-income families had hemoglobin levels of less than 110 g/L. When the WHO cutoff value of 120 g/L was applied,

the prevalence was even higher (80% to 90%). The poor nutritional status of adolescent girls has important implications for physical work capacity and adverse reproductive outcome. The median age of marriage in India is around 18 years. When a woman enters pregnancy with a large iron deficit and is subjected to the added demands for iron during pregnancy, it may be too late to address the problem of anemia during pregnancy. We therefore suggest that the health-care system should not miss the opportunities afforded during the precious years of adolescence before marriage and childbearing. Adolescent girls should be supplied with iron–folic acid supplements so that they enter pregnancy with no serious iron-deficiency handicaps.

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