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Anemia and Undernutrition Among Preschool Children in Uttar Pradesh, India

Shally Awasthi, Rohini Das, Tuhina Verma and Sheila Vir*

From the Department of Pediatrics and Institute of Clinical Epidemiology, King George Medical College, Lucknow, U.P. and UNICEF, India.*

Correspondence to: Prof. Shally Awasthi, Department of Pediatrics and Institute of Clinical Epidemiology, Shahmina Road, Lucknow (UP) 226 003, U.P., India.
E-mail: sawasthi@sancharnet.in

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Abstract:

This study was conducted to assess the prevalence of anemia among preschool children (3-5 years) and its association with malnutrition in rural Barabanki district of Uttar Pradesh, India. Three out of 18 sub-centers in Nindura block, Barabanki, each with six villages, were randomly selected for this survey and 654 boys and 546 girls were included. Mean hemoglobin level in g/dL among boys and girls was 10.1 (SD: 1.66) and 9.9 (SD: 1.67) (P <0.06) respectively. The proportion of anemic children (Hb <11 g/dL) was 70%. Boys were heavier and taller as compared to girls. Among the 67.3% underweight children the mean hemoglobin level was 9.85 (SD: 1.67) as compared to 10.39 (SD: 1.62) in those without malnutrition (P <0.0001). Likewise, stunted children (87.6%) had statistically significantly lower mean hemoglobin levels than those not stunted. The odds ratio of an underweight and stunted child having moderate to severe anemia was 1.66. While more than half caretakers knew about the term "anemia" and associated physical weakness with it, only very few (2.5%) knew that iron intake will improve it. They relied on "doctors" (86.7%) for anemia prevention.

Key words: *Anemia, Preschool children, Rural, Stunting, Underweight.*

More than 700 million persons in the world suffer from iron deficiency anemia (IDA) and about thrice the number from iron deficiency (ID) state(1). About half the population in the developing countries has IDA (2). Preschool, school and adolescent children and women in childbearing age are at increased risk(2) IDA is a leading cause of morbidity and mortality worldwide(3). Amongst children under 3 years, ID is most prevalent between 6 months and 2 years of age when requirement of iron increases significantly with rapid rate of tissue growth(4). Prevalence of anemia among children >3 years is reported to be 37%(2). A strong positive relationship between hemo-globin level of mothers and prevalence of anemia among children has been reported(5).

In India, the national program for prevention and control of anemia focuses on pregnant women and young children less than 5 years. However, the status of anemia in children is not well documented though information on underweight and stunting is available. Anemia in children therefore continues to be accorded a very low priority. As a part of an intervention program, a baseline survey was conducted to quantify the magnitude of the anemia among children who are at risk of it. As a secondary objective the association of anemia with undernutrition was also assessed.

Subjects and Methods

This study was conducted in 18 sub-centres of Nindura Block, Barabanki district, North India. This block has 145 villages and 18 sub-centers. Each sub-center caters to about 5-7 villages. There is an auxiliary nurse midwife (ANM) responsible for health of the village population, which includes distri-bution of iron and folic acid tablets to pregnant women and children and immunization. In this rural area, the Integrated Child Development Scheme (ICDS) is operating. Under this scheme, there is an ICDS center in each village with a population of about 1000. Each ICDS center has an anganwadi worker (AWW) who is responsible for running an informal school and supplementary nutrition program for the preschool children.

From the 18 sub-centers, 3 were selected by random draw for baseline survey of nutritional indices and qualitative assessment of perception and awareness of anemia in general among the caretakers and mothers of recruited children. All the villages within a sub-center and children aged 3-5 years were included. Excluded were those whose parents did not consent for the study or were likely to move out in the next 3 months. Sample size was calculated to estimate 50% (based on National Family Health Survey (NHFS) data(5). Prevalence of anemia with a required confidence interval of 5% with alpha level of 0.05 (two tailed) and power of 80% and taking into consideration design effect of 2. Four hundred children were required for this. Assuming the proportion of children in each age group (*i.e.*, age-group of 3-4 and 4-5 years) to be 3% the proportion of children in age group 3-5 years will be 6% (or 60 children in a village population of 1000). There would thus be about 420 children per sub- center with 7 villages. This baseline data is a part of an interventional study where children aged 3 -5 years of age in each of the three sub-centers received IFA supplementation under different regimens.

Each village was visited and eligible children enrolled. Their nutrition status was measured by estimating hemoglobin, weight and height. Pre-tested questionnaires were used for qualitative assessment. Hemocue was used for estimation of hemoglobin. The accuracy of the machine was tested daily using the standard strip provided along with the equipment. Weight was estimated using Uniscale 890 machines that could measure to the nearest 0.1 Kg. Daily measuring standard weights checked the weighing scale. Heights were measured by stadiometer. The staff was trained to use the instruments prior to fieldwork to minimize inter and intra-observer variations. A supervisor validated 10% of the measurements.

The instruments used for qualitative data collection were pilot tested for accuracy. Though responses were coded, an option was provided for an open response. They were administered by trained social workers. Wherever possible the respondent was the mother. In other situations respondent was a family member sharing the household. Questions about IFA consumption during last pregnancy and place of receiving the tablets were asked to the mother. Data was entered in dBase and analyzed using EPI 2000 statistical software. Univariate analysis was done to describe the distribution of nutritional and qualitative response variables.

Child was categorized as underweight when weight-for-age z-score was <–2 SD, stunted when height-for-age z-score was <–2 SD and wasted when weight-for-height z-score was <–2 SD. Anemia was defined as hemoglobin level <11 g/dL. Moderate to severe (MS) anemia was defined as hemo-globin level <10 g/dL(6) and severe anemia was defined as hemoglobin level <7g/dL(6). Comparisons of nutritional variables across confounders, like gender, subcenter of residence and various categories of nutritional status were done using Student's *t* test or analysis of variance. Association of moderate to severe anemia with underweight, stunting and wasting was done by calculating the odd's ratio with its 95% confidence interval. P <0.05 was considered statistically significant.

Results

The survey was undertaken between December 2001 and January 2002. The randomly selected sub-centers were Shahpur-Baxaulia (Sub-center A), Sipa Hidayatpur (Subcenter B) and Sarsawan (Subcenter C) each with 6 villages. The number of children assessed in each subcenter, the proportion of girls, the proportion having siblings included in the survey and the mean weight, height and hemoglobin are given in *Table I.* The proportion of anemic and severely anemic children in sub-centers A, B and C was 76% and 2.73%, 72% and 2.25% and 62% and 5.29%, respectively.

TABLE I

Nutritional and Hemoglobin Values of Enrolled Children (Mean ± SD)

	Number of children assessed	Females n(%)	Age (month)	Height (cm)	Weight (Kg)	Hemoglobin (g/dL)
Sub-center A	403	230	48.9 ± 1 0.4	86.7 ± 8.9	11.83 ± 2.2	9.79 ± 1.5
		(57.1)				
Sub-center B	400	214	47.9 ± 9.9	85.2 ± 8.5	11.94 ± 2.1	10.04 ± 1.66
		(53.5)				
Sub-center C	397	210	47.9 ± 9.9	88.1 ± 8.1	12.54 ± 2.1	10.25 ± 1.8
		(52.9)				
P value		0.5	0.05	0.0001	0.0001	0.0002

Children in subcenter C had statistically significantly greater weight, height and hemoglobin levels as compared to sub centers A and B. Mean age in months, weight in Kg and height in cm and hemoglobin levels in g/dL of boys versus girls was 48. 4 ± 10.2 *vs* 47.9 ± 9.9 (P = 0.5); 12.4 ± 2.1 *vs*. 11.7 ± 2.1 (P = 0.0001); 87.5 ± 8.5 *vs* 85.7 ± 8.6 (P = 0.0004) and 10.1 ± 1.66 *vs* 9.9 ± 1.67 (P = 0.06), respectively. There were similar proportion of severely anemic children among boys and girls (3.2% vs. 3. 7%; P = 0.6). There were 67.3% underweight, 87.6% stunted and 4.3% wasted children with similar proportions among girls and boys.

Mean hemoglobin levels were lower in underweight and stunted children as compared to those who were normal (*Table II*). The risk difference (RD) of moderate to severe anemia in the underweight children when compared to normal was 10.9 (95% CI: 5.7-16.2; P <0.0001); and among stunted children was 3.7 (95% CI: –0.002-7.4; P = 0.05) (*Table III*).

TABLE II

Hemoglobin Levels (g / dL) Among Stunted, Underweight and Wasted Children

	Yes		No		
	N	Mean (SD)	N	Mean (SD)	P value
Underweight	808	9.85	392	10.39	<0.0001
		(1.67)		(1.62)	
Stunted	1051	9.96	149	10.51	0.0002
		(1.66)		(1.69)	
Wasted	52	9.89	1148	10.03	0.5
		(1.99)		(1.65)	

TABLE III

Risk of Moderate to Severe (MS) Anemia (Hb <10 g/dL) Among Stunted, Underweight and Wasted Children

	MS anemia No n=644	MS anemia Yes n=556	OR (95% CI)	OR (95% CI)	P Value
Underweight			1.66 (1.29-2.12)	10.9 (5.7-16.2)	<0.00001
Yes (67.3%)	401 (62.3%)	407 (73.2%)			
Stunted			1.41 (0.99-2.01)	3.7 (–0.002-7.4)	0.05
Yes (87.6%)	553 (85.9%)	498 (89.6%)			
Wasted			0.91 (0.52-1.60)	–0.4 (–2.7-1.9)	0.7
Yes (4.3%)	29 (4.5%)	23 (4.1%)			

Qualitative questionnaire could be administered to all of 1004 respondents who accompanied their child. Other guardians accompanied the rest of the children. In sub-centers A (n = 235), B (n = 233) and C (n = 265) 66.9%, 72.4% and 80.1%, respectively had awareness about anemia as an entity. The main perceived ill effects of anemia were physical weakness (54.9%) and tiredness (15.5%). Only 2.5% respondents said anemia was due to lack of iron in the diet. According to them the main intervention to prevent anemia would be to consult a doctor (86.7%), consume green leafy vegetable (7.1%) or take iron tablets (3.7%).

Of the 582 mothers interviewed for intake of IFA during pregnancy with the enrolled or youngest child, only 21.1% responded in affirmative. Of the 21.1% who could remember the number of tablets consumed, 90.2% had taken <50. Majority of the mothers reported that the reason for non-intake of iron was its non-availability. Only 1.4% of 1200 children had ever received IFA tablet.

Discussion

The prevalence of anemia was 70% in the current study. This is higher than the prevalence of 51%(2) reported for the developing countries. An ICMR multi-centric study conducted in 1977 on children between ages of 3-5 years, defined anemia as hemoglobin <10.8 g/dL(6). This ICMR study reported that prevalence of anemia was 34% in Vellore, 50% in Mumbai and 74% in Delhi. In another study the prevalence from Varanasi was reported to be 63%(7).

The prevalence of severe anemia (Hb <7g/dL) was 3.4% in the current study. This is lower than reported prevalence of 6% from Baroda(8), 18% from Calcutta and 6% from Hyderabad(9). This reflects that recently there has been a reduction in the prevalence of severe anemia whereas the prevalence of anemia as such has remained almost unchanged.

Studies from India have consistently shown an association between anemia and under-nutrition(10). This is plausible, as calorie deficient children are also very likely to be deficient in other micronutrients, notably iron. A large percentage of children also come from poor background with poor sanitation and environment and are prone to infections. Studies have found that increasing the calorie intake by 20-30% by itself has resulted in improved hemoglobin status in India(11,12) despite the known low bioavailability of iron in a cereal predominant vegetarian diet. However to increase iron absorption, increase in caloric intake should be accompanied by an increase in consumption of vitamin C and folic acid rich foods and

decrease in consumption of tea. There is a need of iron supplementation through some effective strategy, since there is a high prevalence of anemia in this age group, which adversely affects cognitive and physical work performance.

The level of underweight (67.3%), stunting (87.6) and wasting (4.3%) found in the current study is higher than that found in rural Punjab and also rest of India(13). While the mean hemoglobin levels are similar to those reported in Zanzibar, Africa(14) the prevalence of underweight reported in the African region was only 34.4%.

Contact with caretakers while assessing nutrition was utilized to assess the awareness of anemia among them. More than two-thirds of respondents knew that term anemia, literally means "deficiency of blood". While about half of the respondents reported that physical tiredness was a symptom of anemia, only 2.5% felt anemia was due to lack of iron in the diet. Interestingly, most respon-dents felt that for the prevention of anemia one needed to consult a doctor. This response indicates anemia prevention is currently out of the realms of prophylactic treatment by para-medical/non-medical social workers. Intensive and focused community awareness programs have to be launched emphasizing on its cause and strategy for prevention while launching preventive measures through health and non-health sector. These findings are collaborated by the fact that despite the national anemia control program only one-fifth mothers took IFA tablets. Out of these 90% took less than half the recommended doses.

It is, therefore, concluded that anemia in association with malnutrition is widely pre-valent in preschool children in rural India. There is a need of urgent community communication strategies for ensuring the acceptability and adherence to IFA distri-bution. These communication strategies must be accompanied with counseling on appro-priate young child feeding practices, immu-nization and sickness recognition from the first year of life. Preventive measures for anemia control in children must be accom-panied by measures to prevent underweight and stunting by focusing on integrated child feeding, health and environmental care measures.

Contributors: SA designed the study, supervised data collection, analyzed and interpreted the data and wrote the manuscript. RD reviewed the literature and wrote the manuscript. TV conducted fieldwork and assisted in report writing. SV designed the study and assisted in manuscript writing. She is the technical adviser to this project.

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Key Messages

• There is a very high prevalence of iron deficiency anemia (70%) in children aged 3-5 years in rural Uttar Pradesh.

• There is an association between anemia and malnutrition with lower mean hemoglobin levels in the underweight and stunted children.

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