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Hematology Section Original Article

MAGNITUDE AND CORRELATES OF ANEMIA AMONG ADOLESCENTS IN A BORDER AREA OF WEST BENGAL

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ABSTRACT

BACKGROUND: *People of border areas are socio-economically underdeveloped and medically underserved. Anemia in the growing phase of life impairs the physical and cognitive functions and in turn, hampers the overall development of the country.* ***OBJECTIVE(S):*** *To find out the prevalence, socio-demographic correlates, and risk factors of anemia among adolescents residing in a border area.* ***MATERIALS AND METHODS:*** *A community-based descriptive cross-sectional study was carried out among 370 adolescents selected randomly by multistage and 30-clusters random sampling method. Data pertaining to the socio-demographic factors, life style and diet pattern, relevant health problems, and care-seeking were collected by a pre-designed schedule. Venous blood was examined by cyanmethemoglobin method to assess the Hemoglobin level.* ***RESULTS:*** *The overall prevalence of anemia was revealed to be 83.78% with a significant female predilection (92.59% vs. 76.92%, χ^2 = 16.46 at degree of freedom = 1, P < 0.05; odds ratio (OR) = 3. 75, 95% confidence interval (CI) = 1.84-7.77). The prevalence was higher among early adolescents compared with mid- and late-adolescents (χ^2 (overall) = 9.14, at df=2, P = 0.0103) but significant female preponderance was found in the last group with χ^2 = 12.5, df = 1, P < 0.05; OR(CI) = 4.29 (1.73-11.02). Anemia was revealed to be associated with lower literacy and socio-economic status (P < 0.05), bare-foot walking (P < 0.05), open-field defecation (P < 0.05), worm-infestation (P < 0.05), and care-seeking from unauthorized medical practitioners (P < 0.05) .* ***CONCLUSION:*** *Strict implementation of the National Anemia Control Programme as a component of school health and other health services through sub-centers and Anganwadi Centers is the need of the moment to chain the anemia.*

Key words: *Adolescents, anemia, cognitive development, physical*

INTRODUCTION

Anemia, mostly due to iron deficiency, afflicts an estimated two billion people worldwide[1] with a disproportionately high prevalence in developing countries due to poverty, inadequate diet, certain diseases, repeated pregnancy and lactation, and poor access to health services.[2] It is one of the major public health problems in India affecting 90% poor children, adolescent girls and women.[3] The prevalence is higher among the rural children. There is convincing evidence that iron deficiency and anemia cause impaired growth, developmental delay, decreased physical activity, behavioral abnormalities, and impair cognitive function (poorer attention span, memory, concentration and concept acquisition) and school performance.[2-9] Anemia is an important cause of school dropouts in India.[3] As a legacy, anemia affects the adolescence, an important phase of life for acquisition of different empowering knowledge and skills through socialization. Efforts like National Anemia Control Programme and others are already in vogue to address this gigantic problem by reaching the victims or at-risk groups with integrated comprehensive care through the existing infrastructures such as schools and routine health facilities. Due to administrative problems, inter-state conflicts among the program managers, the health and other services in border areas are mostly unsatisfactory compared to that of the mainland people.[10] People of different cultures living in difficult-to-reach border areas with inadequate socio-economic development face a lot of hardship including the extra disease burden. Residents of these areas face a dismal overall health status. They are poor and medically underserved.[10] Sensitized to the fact that border areas are less developed as compared to the mainland, the Government of India launched the Border Area Development Programme (BADP) during the Seventh Five Year Plan (1985-1990) for the comprehensive development of the border areas. Anemia is a silent modifier of the socio-economic status by affecting virtually all the present and future citizens. Information on the magnitude and determinants of anemia among adolescents in border area can reflect the impact of special input in the form of BADP.

Objectives

- To find out the prevalence of anemia among the adolescents residing in a border area

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- To describe the socio-demographic correlates of anemia
- To assess the risk factors, if any, of anemia.

MATERIALS AND METHODS

A community-based descriptive cross-sectional study was carried out from June 2007 to May 2008 involving the adolescents residing in Phasidewa block in the district of Darjeeling, which is a border area of the state West Bengal of India and Bangladesh. Multistage sampling was adopted. Initially out of three Gram Panchayat (GP) of Phasidewa block, two were selected by simple random sampling. Thus, Phasidewa GP containing 47 villages and Chathatjot GP containing 44 villages were selected. In the next stage, the study subjects were selected from these 91 villages by 30-cluster random sampling. The sample size was calculated by the formula, $N = Zpq/L^2$, where N = sample size, P = expected prevalence, q = 100-p, z = standard normal deviate = $1.96 \approx 2$, L = allowable error. Assuming 67.5% (as per a pilot study conducted to assess the feasibility of the study including pretesting of interview schedule) prevalence of anemia among adolescents and considering a design effect of 2, 370 adolescents were to be involved in the study. To round off the number, alternatively 12 and 13 adolescents from alternate clusters were selected. The list of the house-holds containing adolescents was prepared by the help of health workers. Then, starting in an unbiased manner, consecutive houses were approached in search of study subjects until the required number of adolescents was included. Thus, 209 boys and 166 girls, i.e., a total of 375 adolescents were involved in the study after obtaining an informed consent. Data regarding socio-demographic characteristics, life styles, food habits, medical history, and care-seeking behavior, etc., were collected through interview and record analysis using a pre-designed and pre-tested schedule. A total volume of 20 µl of venous blood from each subject was taken in a hemoglobinometer pipette and transferred to a pre-numbered glass bottle containing 5 ml Drabkins reagent. Blood samples could be collected successfully from 370 adolescents, i.e. 208 boys and 162 girls and were carried to laboratory of the North Bengal Medical College and Hospital for Hemoglobin estimation by cyanmethemoglobin method. WHO/United Nations International Children's Emergency Fund/United Nations University (2001)-recommended cut-off value[11] of Hb (12 g per dl in venous blood) was adopted for the diagnosis and classification of anemia. The results of the blood test were conveyed to the study subjects on the next day and those who were found to be anemic were provided with treatment as per guideline. Ethical clearance from institutional review board was obtained before the study.

Analysis was done using simple proportion, Chi-square (χ^2), '*t*-test', OR with 95% CI, and the help of SPSS 17 along with Epi-info 3.4.3 version were sought for the purpose.

RESULTS

The analysis showed that the average age of participants was 14.36 ± 3.82 with median of 14.5 and a range 10-19 years. Age distribution revealed that 35.4%, 17.0%, and 47.6% were belonged to early, mid- and late-adolescents, respectively. Males were 56.22%; 40.5%, 53.0% and 6.5% were Hindus, Muslims, and Christians respectively. About 1/10th (10.8%) of the participants were married and they were predominantly (90%) female. Majority (67%) of the participants belonged to a joint family. As regards the socio-economic status (adopting modified BG Prasad's scale); 3.24%, 2.16%, 11.08%, 42.16%, and 41.35% respondents belonged to I, II, III, IV, and V social class respectively. Regarding literacy; 8.64%, 43.24%, 27.56%, 17.29%, and 3.29% of participants were illiterate, educated up to primary, middle school, high school, and intermediate standard, respectively. Menarche was attained by 79.0% of adolescent girls with a mean age of 13.0 ± 1.0 for menarche. Anemia was prevalent among 83.78% of study subjects with average Hb level of 10.41 ± 0.38 (mean ± SD) and male and female distribution of 76.92% and 92.60% with a statistically significant difference in between [Table 1]. It was found that on the whole, 65.16% and 34.84% participants had mild and moderate anemia. Although the mean Hb level was revealed to be low among the girls of early and late-adolescence and the boys of mid-adolescence, there was no significant difference in the prevalence of anemia across the gender in early- and mid-adolescences, but it was conspicuous in late-adolescence [Table 1]. It was also observed that moderate anemia was more prevalent among the early- and late-adolescent girls, but in the mid-adolescence, it was not statistically evident [Table 1]. It was revealed from the analysis that the prevalence of anemia was significantly low among highly literate and richer sections of the people [Table 2]. The anemia was found to have a positive association with different life-style factors like bare-foot walking, open-field defecation, and some morbidity like worm-expulsion [Table 3]. The present study also showed that the prevalence of anemia was significantly low among the people seeking health care from the government health facility [Table 3].

DISCUSSION

The overall prevalence of anemia seemed to be alarming (84.85%). Raina *et al.*[12] documented a prevalence of 85.3% (Hb < 11 g/dl) anemia in rural Haryana. The present study showed that 92.60% of the girls were anemic compared to a study conducted by Chaturvedi *et al.*[13] in 1994 in rural Rajasthan among 941 adolescent girls (10-18 years old) which revealed a prevalence of 73.7%. In spite of alarming prevalence, one welcome observation was that severe anemia was absent. This finding has similarity with that found by Kaur *et al.*[14] among adolescent girls of rural Wardah, where the prevalence of

Table 1: Distribution of anemia as per age and gender (*N*=370)

Adolescent groups and gender	*Anemic*				*Non-anemic No. (%)*	*χ^2, P@; OR (95% CI)*	*Hb level (mean±SD)*	*Unpaired t and P values*
	Mild, No. (%)	*Moderate, No. (%)*	*χ^2, P; OR (95% CI)*	*Total, No. (%)*				
Early (*n*=131)								
Male (*n*=67)	48 (71.64)	12 (17.91)	6.60, <0.05; 2.86 (1.18-7.01)	60 (89.55)	7 (10.45)	0.75, >0.05; 1.75 (0.43-7.57)	10.30±0.70	t_{129}=2.33, <0.05
Female (*n*=64)	35 (54.69)	25 (39.06)		60 (93.75)	4 (6.25)		10.18±0.57	
Mid (*n*=60)								
Male (*n*=47)	13 (27.66)	22 (46.81)	3.93, <0.05; 0.26 (0.05-1.21)	35 (74.47)	12 (25.53)	>0.05*	9.91±1.10	t_{58}=2.39, *P*<0.05
Female (*n*=13)	09 (69.23)	04 (30.77)		13 (100.0)	-		10.41±0.46	
Late (*n*=179)								
Male (*n*=94)	55 (58.51)	10 (10.64)	14.72, <0.05; 4.58 (1.91-11.20)	65 (69.15)	29 (30.85)	12.51, <0.05; 4.29 (1.73-11.02)	10.69±0.58	t_{177}=5.05, *P*<0.001
Female (*n*=85)	42 (49.41)	35 (41.17)		77 (90.59)	08 (9.41)		10.16±0.84	
Total (*N*=370)								
Male (*n*=208)	116 (55.77)	44 (21.15)	7.84, <0.05; 1.96 (1.19-3.24)	160 (76.92)	48 (23.08)	16.46, <0.05; 3.75 (1.84-7.77)	10.41±0.38	t_{368}=5.37, *P*<0.001
Female (*n*=162)	86 (53.09)	64 (39.51)		150 (92.59)	12 (7.41)		10.19±0.41	

@df=1,*Fisher's exact test; CI=Confidence interval, OR=Odds ratio, Hb=Hemoglobin, df=Degree of freedom

Table 2: Distribution of anemia status according to different socio-demographic variables (*N*=370)

Parameter	*Anemia*		*Statistical tests*	
	Present, No. (%)	*Absent no. (%)*	*χ2, P@*	*OR (95% CI)*
Literacy				
Illiterate	31 (96.87)	1 (3.13)	9.60, <0.05	13.45 (1.78-280.38)
Primary	142 (88.75)	18 (11.25)	12.98, <0.05	3.42 (1.62-7.25)
Middle and high	84 (82.35)	18 (17.65)	3.91, <0.05	2.03 (0.94-4.36)
Intermediate	53 (69.74)	23 (30.26)	*	*
Religion				
Hindu	126 (84.0)	24 (16.0)	0.21, >0.05	1.14 (0.62-2.10)
Muslim	161 (82.14)	35 (17.86)	*	*
Christian	23 (95.83)	1 (4.17)	2.93, >0.05	5.00 (0.68-102.68)
Socio-economic status				
Class-I	7 (58.33)	5 (41.67)	*	*
Class-II	6 (75.0)	2 (25.0)		
Class-III	25 (60.98)	16 (39.02)		
Class-IV	120 (76.92)	36 (23.08)	24.82, <0.05	0.22 (0.12-0.44)
Class-V	152 (99.35)	01 (0.65)		
Type of family				
Joint	211 (85.08)	37 (14.92)	0.93, >0.05	1.32 (0.72-2.44)
Nuclear	99 (81.15)	23 (18.85)		
Family size				
<5	70 (78.65)	19 (21.35)	2.27, >0.05	0.63 (0.33-1.21)
≥5	240 (85.41)	41 (14.59)		

*Reference group @df=1; OR=Odds ratio, CI=Confidence interval

Table 3: Distribution of study subjects according to anemia status, related morbidities, and life styles (*N*=370)

Parameters	*Anemia*		*Statistics*	
	Present, no. (%)	*Absent, no. (%)*	*χ2, P@*	*OR (95% CI)*
Bare-foot walking				
Present	271 (87.99)	37 (12.01)	23.90, <0.05	4.32 (2.22-8.39)
Absent	39 (62.90)	23 (37.10)		
Open-field defecation				
Present	267 (92.71)	21 (7.29)	76.18, <0.05	11.53 (5.94-2.54)
Absent	43 (52.44)	39 (47.56)		
Worm-expulsion				
Present	216 (91.14)	21 (8.86)	26.25, <0.05	4.27 (2.30-7.98)
Absent	94 (70.68)	39 (29.32)		
Malaria (in the last 6 months)				
Present	39 (90.69)	4 (9.31)	1.71, >0.05	2.01 (0.65-6.93)
Absent	271 (82.87)	56 (17.13)		
Care-seeking				
RMP	33 (71.74)	13 (28.26)	1.27,> 0.05	1.51 (0.69-3.26)
Government health facility	180 (64.98)	47 (35.02)		*
Quack and others	46 (97.87)	1 (2.13)	9.30, <0.05	12.01 (1.71-240.28)
Diet				
Vegetarian	65 (85.52)	11 (14.48)	0.21, >0.05	1.18 (0.56-2.56)
Non-vegetarian	245 (83.33)	49 (16.67)		

*Reference group, @df=1 OR=Odds ratio, CI=Confidence interval, RMP=Registered medical practitioner

mild, moderate, and severe anemia was 38.4%, 20.8%, and 0.6% respectively. Low prevalence of severe anemia was also revealed by the study conducted by Rajaratnam *et al*.[15] in a rural area of Tamil Nadu with an overall prevalence of 44.8% and severe anemia only in 2.1%. The overall anemia situation was seen to be improved with advancing age from 91.60% through 80.0% to 79.32% being highest in the lower age group ($\chi^2 = 9.14$ at df = 2, $P < 0.05$). It was also true for the boys ($\chi^2 = 9.38$ at df = 2, $P < 0.05$), but not in the case of girls among whom the prevalence remained unchanged in the mid- and late-adolescence compared to their early phase (P [Fisher exact] >0.05). It might be the sequel of nutritional inadequacy in early life which led to higher prevalence of anemia among the Indian girls even before their menarche. During the pubertal growth spurt, more iron is required by the boys for the development of their comparatively heavy musculature which might overt the poor iron status among the boys also. Finally, after the onset of menstruation, the iron status of adolescent girls remained persistently compromised unless it was taken care of. In a study done by Rajaratnam *et al*.,[15] it was found that the prevalence of anemia decreased as the age of the study population increased. However, there was reduction in mean Hb as the age increased. The present study revealed that anemia had an inverse relation with the literacy status of the participants. Rajaratnam *et al*.[15] found that a significant association was present between the Hb concentration and girl's education. Like the present study, Kaur *et al*. (2006)[14] in their study found that in a univariate analysis, girls with socio-economic status grade V were associated with increased likelihood of anemia compared to girls with grade I. Anemia was shown to be positively associated with bare-foot walking and worm-expulsion. Seema Choudhury *et al*.[16] in their study in rural Varanasi observed that adolescent girls using foot-wear during defecation had significantly less (20.0%) anemia than those who were not using foot wear (42.0%). Rao *et al*. (2000) [17] in their study commented that prevalence of anemia was higher among those who had the habit of open-field defecation. Worm-infestation was found to be a strong predictor of anemia in the study done by Kaur *et al*. (2006)[14] among adolescent girls of rural Wardah. Higher prevalence of hook worm among adolescents, reported by Rao *et al*.[17] in their study among tribal adolescents of Madhya Pradesh, seemed to be an important factor for the high prevalence of anemia among that tribal adolescent population. Kaur *et al*. (2006)[14] observed that a vegetarian diet was one of the strongest predictors of anemia. Verma *et al*.[18] also quoted that compared to non-vegetarians (38.0%), more vegetarians were anemic (65.9%). But the present study had a paradox finding with no difference in the prevalence of anemia among the non-vegetarians and vegetarians [Table 3]. It might be due to the fact that these poor people usually consume infrequent and inadequate non-veg diet. Fewer anemics among those who had care-seeking from a government facility might be a guide that only the free primary health care is the intervention of choice for this silent gigantic problem.

CONCLUSIONS

Alarming magnitude of anemia among the future citizens in their formative age warrants a multipoint approach. The target group can be reached via the school health and other routine health services like Iron Folic Acid prophylaxis, periodic de-worming, detection and treatment of anemia, and health-nutrition education. This may necessitate the strengthening of formal health and other infrastructures via inter-sector, inter-state, and bilateral co-operation among the program managers and policy makers for real overall socio-economic development in the border areas.

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