

## **Burden, Severity And Determinants Of Anaemia Among Adolescents In West Bengal, India: Findings From A Large Scale Sample Survey**

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### **Abstract:**

**Background:** Adolescence is a critical period of growth which includes reproductive maturation and developmental transition. They are not only the future workforce but also the bearers of the next generation. If they are not properly fed then the country will not only able to reap the gain of demographic dividend but also suffer from vicious cycle of malnourishment. The Comprehensive National Nutrition Survey (CNNS, 2016-18) reveals that 28% of Indian adolescents are anaemic. West Bengal has the highest proportion of anaemic adolescents (45.6%) in the country.

**Materials and Methods:** Unit level data from the CNNS was used to find out the factors of anaemia among adolescents in West Bengal. Observations were interpreted as per the WHO criteria. The data was analysed by stata version 16.

**Results:** Findings shows that 46.5% of adolescents were suffering from anaemia, higher proportion of girls (65.3%) were anaemic compared to boys (25.6%). Girls were 5.7 times more likely to be anaemic compared boys (Adjusted Odds Ratio (AOR): 5.70, 95% CI = 4.04-8.04, p-value = 0.000). Other determinants were wealth quintile and knowledge of hand wash.

**Conclusion:** Findings showed a sex and poverty are two important factors of anaemia among adolescents in West Bengal. Therefore, it requires a well thought poverty reduction and gender

equality action to improve the anaemia status among the target group. Investing in adolescents not only ensures that they are healthy today, but that they grow into healthy adults in the future, who will in turn have families of good health.

**Keywords:** Adolescent anaemia, CNNS Study, Hemoglobin, Gender disparity, West Bengal

## **INTRODUCTION**

Adolescence is a special period in the lifecycle when they undergo reproductive maturation and various developmental changes, this requires proper nutritional intake during this period, failing of which adolescents may suffer from various problems due to nutritional deficiencies (1). Adolescent Anaemia is a problem in most developing countries and girls are more vulnerable than boys (2,3,4,5). The CNNS study jointly conducted by the Ministry of Health and Family Welfare, Government of India and UNICEF reveals that 28% of Indian adolescents are anaemic and among the Indian states and union territories, West Bengal has the highest proportion (45.6%) of anaemic adolescents (6). This was India's first national level study for adolescent which have provided representative estimates prevalence of anaemia both for the national and state level. Anaemia can have a number of effects across the life course of adolescents, including reduced immunity, decreased physical performance and neurodevelopment and also poor educational outcome (2,7). Anaemia in pregnant adolescents leads to congenital complications and low birth weight baby (8). Hence, Anaemia in adolescents is not just a problem today, it is also very worrying for the future (9). Many studies are conducted around the world that have measured the prevalence of Anaemia among adolescent girls and its associated factors (10), these studies show that the prevalence of Anaemia varies across countries and regions (11,12,13,14). In South-East Asia region the prevalence range is from 27% to 55% (14). Early adolescence is a critical period transition from childhood to adolescence

(15,16) and proper dietary intake is required during that period (17) else adolescents may suffer from iron deficiency which may lead to Anaemia (18). However, in some other studies Anaemia has been found to be inconsistent with various iron-rich foods (19,20,21,22). Other causes of Anaemia include traditional carbohydrate based diet (23), irregular eating habits (17), parental education (24), father's occupation are reported in other studies (25). This study will shed light not only on the prevalence of Anaemia among adolescents in West Bengal, India but also on its causes.

## **MATERIALS AND METHODS**

### **Study design and participants**

Unit level data from CNNS was used for this study. The Population Council and UNICEF led by the Ministry of Health and Family Welfare, conducted this study. This survey was conducted in 29 states of India and in the capital Delhi from 2016 to 2018. It used multistage probability proportional to size cluster sampling design to select representative sample at national and state level.<sup>[6]</sup> A sub sample of 35830 adolescents aged 10-19 years were collected at national level and haemoglobin measurement was provided for 14669. For West Bengal the sample size were 1468 and 700 respectively. This survey took anthropometry measurements and blood samples of all children (0-10 years) and adolescents (10-19 years). In the CNNS, anaemia was assessed based on haemoglobin concentration obtained from venous whole blood, using the cyanmethemoglobin method. The haemoglobin levels were adjusted for altitude in enumeration areas above 1000 metres of altitude.

### **Ethical approval**

Population Council's Institutional Review Board (IRB) in New York made ethical clearance at international level, whereas, national level ethical approval was taken from the Ethics

Committee of the Postgraduate Institute for Medical Education and Research (PGIMER Chandigarh, India). Written informed consent from the caregivers and assent from individuals was obtained for the adolescents aged 11–17 years. Adolescents aged 18–19 years provided their own consent.

### **Statistical analysis**

As per the WHO guideline anaemia among adolescents was defined and adjusted for age (26). Descriptive statistics were used to present anaemia status among adolescents. Bivariate tabulation was prepared to understand how anaemia status varied across different background characteristics. We assessed association between anaemia status of adolescent with different background characteristics like socio economic status, hygiene and adolescent-level factors such as dietary practices with multivariate logistic regression models. A 'P' value < 0.05 was considered statistically significant. Data analysis was carried out using STATA 16.0.

### **RESULTS**

The socio-economic characteristics and anaemia status of adolescents is presented in Table 1. The mean age of the adolescents girls and boys were  $14.22 \pm 2.73$  and  $14.19 \pm 2.80$  respectively. In terms of sex, adolescents were almost uniformly distributed. Majority (76.7%) were Hindu and 58.9% were from urban areas.

About one third (30.1%) of mothers of adolescents were illiterate and 47.4% studied class 5-10. In terms of standard of living index quintile 36.3% were in 'richest' quintile and 11.9% were in poorest quintile. Regarding consumption of iron rich food, it was observed that 57.4% had consumed at least one iron rich food regularly. More than two third (69.7%) of adolescents were knowledgeable about proper hand wash before food and after defecation.

**Table 1 Socio-demographic characteristics and anaemia status among adolescents**

Socio-demographic characteristics	Anaemic		Not anaemic		Total		P Value
	n (319)	%	n (381)	%	n (700)	%	
<b>Sex</b>							
Male	89	25.6	259	74.4	348	49.7	0.000
Female	230	65.3	122	34.7	352	50.3	
<b>Religion</b>							
Hindu	247	46.0	290	54.0	537	76.7	0.072
Muslim	66	42.3	90	57.7	156	22.3	
Other	6	85.7	1	14.3	7	1.0	
<b>Caste</b>							
SC	84	45.4	101	54.6	185	26.4	0.033
ST	23	65.7	12	34.3	35	5.0	
OBC	41	52.6	37	47.4	78	11.1	
None of these	171	42.5	231	57.5	402	57.4	
<b>Place of Residence</b>							
Rural	147	51	141	49	288	41.1	0.015
Urban	172	41.7	240	58.3	412	58.9	
<b>Standard of Living Index</b>							
Poorest	52	62.7	31	37.3	83	11.9	0.000
Poor	45	59.2	31	40.8	76	10.9	
Middle	51	46.4	59	53.6	110	15.7	
Rich	77	43.5	100	56.5	177	25.3	
Richest	94	37	160	63	254	36.3	
<b>Consumption of Deworming tablet in last 6 months</b>							
Yes	66	51.6	62	48.4	128	18.3	0.132
No	253	44.2	319	55.8	572	81.7	
<b>Education</b>							
Non-literate	114	54.0	97	46.0	211	30.1	0.012
1-4 Years	39	47.6	43	52.4	82	11.7	
5-10 Years	142	42.8	190	57.2	332	47.4	
11-12 Years	13	32.5	27	67.5	40	5.7	
Higher	11	31.4	24	68.6	35	5.0	
<b>Consumption of at least one iron rich food daily</b>							
No	148	49.7	150	50.3	298	42.6	0.061
Yes	171	42.5	231	57.5	402	57.4	
<b>Knowledge of hand wash after defecation and before food</b>							
No	110	51.9	102	48.1	212	30.3	0.027
Yes	209	42.8	279	57.2	488	69.7	
<b>Total</b>	319	45.6	381	54.4	700	49.7	

For total, column % for total is taken and for Anaemic and non-anaemic row % are taken.

**Factors associated with adolescent Anaemia**

The average haemoglobin concentration was  $12.23 \pm 1.42$  d/L. In total, 45.6% of the adolescents were found Anaemic, among them 25.6% were boys and 65.3% were girls. Of these anaemic adolescents, 286 (89.7%) were mild, 33 (10.3%) were moderate, no severely anaemic adolescents were found in this study.

**Table 2: Association of socio-demographic variables with anaemia status**

Characteristics	Odds Ratio	95% CI	P Value
<b>Sex</b>			
Male	1		
Female	5.70	(4.04, 8.04)	0.000
<b>Religion</b>			
Hindu	1		
Muslim	0.62	(0.39, 0.98)	0.040
Other	2.76	(0.28, 27.08)	0.383
<b>Caste</b>			
SC	1		
ST	1.87	(0.78, 4.50)	0.159
OBC	1.74	(0.93, 3.24)	0.082
Non of these	1.30	(0.84, 2.00)	0.234
<b>Place of Residence</b>			
Rural	1		
Urban	0.94	(0.62, 1.43)	0.772
<b>Standard of Living Index</b>			
Poorest	1		
Poor	0.89	(0.43, 1.81)	0.739
Middle	0.65	(0.33, 1.26)	0.200
Rich	0.52	(0.26, 1.01)	0.055
Richest	0.38	(0.18, 0.79)	0.009
<b>Consumption of Deworming tablet in last 6 months</b>			
Yes	1		
No	0.78	(0.51, 1.21)	0.275
<b>Education</b>			
Non-literate	1		
1-4 Years	1.06	(0.58, 1.90)	0.859
5-10 Years	1.00	(0.64, 1.57)	0.991
11-12 Years	0.64	(0.28, 1.46)	0.288
Higher	0.65	(0.26, 1.64)	0.367
<b>Consumption of at least one iron rich food daily</b>			
No	1		
Yes	0.90	(0.63, 1.28)	0.545

**Knowledge of hand wash after defecation and before food**

No	1		
Yes	0.78	(0.54, 1.15)	0.211

Table 1 represents the bi-variate analysis of factors associated with anaemia whereas Table 2 represents the multivariate analysis of the same. It is seen from Table 2 that girls were 5.7 (95% confidence interval [CI] 4.04, 8.04) times more likely to be Anaemic as compared to boys. In terms of religion, adolescents from Muslim households were less likely to be anaemic compared to Hindu households. Compared to Scheduled Caste, adolescents from other categories were more likely to be anaemic. Urban adolescents were likely to be less anaemic compared to rural adolescents, but this was not statistically significant. Adolescents from Rich (OR of 0.52 (95% CI 0.26, 1.01)) and Richest (OR of 0.38 (95% CI 0.18, 0.79)) SSLI quintile were less likely to be anaemic compared to those from poor and poorest quintile. It was also found that the odds (OR 0.50, 95% CI 0.29, 0.87) of Anaemia were lower among adolescents whose mothers had 10+ years of formal education, compared to mothers who are less educated. In terms of intake of iron rich food, adolescents who were consuming at least one iron rich food daily had reduced odds (OR 0.90, 95% CI 0.63, 1.28) of having Anaemia as compared to those who were not taking iron rich food daily. We also observed that knowledge of hand wash before having food and after defecation are associated with the anaemic status of adolescents. Adolescents having such knowledge were less likely to be anaemic (OR 0.78, 95% CI 0.54, 1.15) compared to adolescents who did not possess such knowledge.

**DISCUSSION**

This is the first national level survey which has collected representative sample both at national and state level to investigate nutrition related indicators among adolescent boys and girls in

India. No other previous population based surveys like National Family Health Survey (NFHS) and District Level Household Survey (DLHS) tried to measure the nutrition or anaemia among adolescent boys, such survey included adolescent girls and that to from the age of 15 years and above. Moreover, representative sample of adolescent was taken in this study, which improves the precision of estimates and reduce selection bias. The findings may be helpful to prepare a benchmark to evaluation existing nutrition programs. This study describes the prevalence and severity of anaemia among adolescent boys and girls aged 10 to 19 years in West Bengal. An attempt has also been made to know the intensity of anaemia in different socio-economic categories. While the prevalence of all forms of anaemia was found 45.6%, most of them (89.7%) were mildly anaemic and few (10.33%) were moderate and no adolescents were severely anaemic. High prevalence of anaemia among adolescents indicates it's a serious public health problem in the state. The study also looked at the risk factors for anaemia, wealth quintile found to be the most significant risk factors of anaemia among adolescents in West Bengal. Despite several strength of the study there are certain limitations as well. The study is also missing some of the important predictors of anaemia such as micronutrient deficiencies, illness, other parasitic infections and diseases and hand WASH behaviour, which would contribute to a clear picture of the important predictors of anaemia among adolescents.

## CONCLUSION

Our study repeats the fact that anaemia is a major problem of adolescent girls in India, particularly in West Bengal, which needs to be given the highest priority. Malnourished girls are highly vulnerable to anaemia, most of which belong to the poor socio-economic class. Though *Sabla* and School health programs are targeting the improvement of adolescents' health in this state, still the result shows a poor state of adolescents in West Bengal in terms of anaemia.



Therefore, appropriate interventions should be taken to increase the amount of iron-containing foods in the diet of adolescents along with measures to control infections and infestations which involves unusual blood loss resulting anaemia.

### **Conflicts of interest**

The authors declare that they have no competing interest.

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