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Prevalence of Anaemia among Adolescent School Children of Manipur, India

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Abstract: Anemia is a global health problem, moreso in the adolescent population due to rapid growth spurt and relative dietary deficiency of micronutrients. Many studies in India and other developing countries have reported a high prevalence among the adolescent school children. However, prevalence among similar population in the north-east India with different race, culture, socio-demographic profile and dietary habits, is less well-studied. This cross-sectional study aims to study anemia among 379 adolescent school children (216 males and 163 females) aged 11-19 years from selected government and private schools of Imphal east (urban) and Thoubal (rural) districts of Manipur and to determine the association between anemia and selected variables of interest like age, sex, diet, BMI, hygienic practices and family income. Haemoglobin estimation was done by cynamethaemoglobin method and data related to determinants of anemia were collected in a predesigned proforma. Statistical analysis was done using percentage, mean, standard deviation, chi-square and student t-test. A p-value < 0.05 was considered significant. The overall prevalence of anemia was found to be 36.4% (50% among females and 31.2% among males) with higher prevalence among rural adolescent school children. Anemia was found to be closely associated with female gender (p=0.00), BMI status (p=0.015), middle income group (19.6%), lack of hygienic practices (p=0.00) and fear of weight gain (p=0.02). School health program should focus on prevention and treatment of anemia, targeting on individual's benefit. Education on hygienic practices, diet and importance of nutrition should be included in the curriculum. Deworming should be part of the school health programme.

Keywords: Manipur, anaemia, adolescent, body mass index.

INTRODUCTION

Anemia (from the ancient Greek ἀναιμία, meaning 'lack of blood') is defined by a decrease in the total amount of haemoglobin or the number of red blood cells. Diagnosis in men is based on a haemoglobin of less than 130 to 140 g/L, while in women it must be less than 120 to 130 g/L [1, 2]. According to WHO, haemoglobin threshold to define anaemia is 12g/dl in adolescent (<15 years) and 15 g/dl for >15 years [3]. More than 1.6 billion people, almost a quarter of the world's population, are anaemic. Despite considerable economic and scientific advancement during recent decades, there has been, at best, only marginal reduction in the global prevalence of anemia. The World Health Organization (WHO) estimates that worldwide, 42% of pregnant women, 30% of nonpregnant women (aged 15 to 50 years), 47% of preschool children (aged 0 to 5 years), and 12.7% of men older than 15 years are anaemic [3]. The prevalence of anaemia is disproportionately high in the developing countries when compared to developed countries; the reason could be poverty, inadequate diet, worm infestations, poor access to the health services and lack of awareness [4]. Adolescent children are one of the major risk groups for anemia [5]. The prevalence of anemia among adolescents is 27% in developing countries and 6% in developed countries [6].

The word adolescence is derived from the Latin word, 'adolescere' which means to grow or to mature [7]. The WHO has defined adolescence as the age period between 11-19 years of age for both the sexes (married and unmarried). There are about 1.2 billion adolescents in the world, which is equal to 1/5th of the world's population and their numbers are increasing. Out of these, 5 million adolescents are living in developing countries. India's population has reached the 1 billion mark, out of which 21% are adolescents [8].

Anaemia during adolescence not only affects the growth and development but also reduces their concentration in their routine tasks, limits their learning ability which might lead to dropping out of school. Further it also causes loss of appetite resulting in reduced food intake and irregular menstrual cycles in females, and reduces physical fitness and their work productivity.

Studies in India on anaemia among adolescent population have shown high prevalence. However, there is a lack of similar studies in north eastern region of India with different dietary habit, practices and living conditions and, therefore, this study was undertaken to study and compare prevalence and contributing variables with similar studies in India.

EXPERIMENTAL SECTIONS/ MATERIALS AND METHODS

The study was a cross-sectional study carried out in the Department of Physiology and Department of Bio-chemistry, RIMS, Imphal in collaboration with selected government and private schools of Imphal East and Thoubal districts of Manipur from January 2016 – October 2017. The study consisted of 379 participants (216 males and 163 females) in the age-group 11-19 years from one government and one private school from each district.

Inclusion criteria

1. School children in the age group 11-19 years of selected urban and rural Secondary and Senior Secondary schools of Imphal West and Thoubal districts of Manipur
2. Subjects willing to participate

Exclusion criteria

1. Subjects with any history of recent or on-going acute infection
2. Subjects with history of any blood disorders
3. Subjects with history of chronic diseases
4. Subjects with hypothyroidism, vitamin C deficiency or celiac disease
5. Subjects with liver diseases
6. Malignancy
7. Students absent on the day of visit

After taking written informed consent, data regarding socio-demographic variables like age, sex, race and monthly family income, anthropometric measurements and personal history regarding hygiene (hand washing before meals), menstrual history (for female participants) and physical image (fear of gaining weight) were collected by using a proforma. Haemoglobin estimation was done by cynamethaemoglobin method using a digital colorimeter.

Table-1: Haemoglobin concentrations for diagnosis of anaemia was done based on vitamin and mineral information system (VMNIS) developed by WHO [9]:

Population	Anaemia (Hb in gm %)
Children 12-15 years	<12
Male >15 years	<13
Female > 15 years(Non-pregnant)	<12

Table-2: Body mass index (BMI) was calculated and classified according to WHO guidelines

BMI	Classification
< 17	Under-weight
17-24	Normal
25-30	Over-weight
>30	Obese

Table-3: Socio-economic status was classified based on the monthly family income

Monthly Family Income (INR)	Socio-economic classification
< 5000	Lower-class
5000-15000	Middle-class
>15000	Upper- class

The study subjects were requested to give 2ml of venous blood sample and sample was collected by venepuncture using sterile plastic disposable syringes and put in a vial containing EDTA for haemoglobin estimation. Haemoglobin value was analysed with 0.2 mL of venous blood by cynamethaemoglobin using EI Digital photo colorimeter model no.312.

Data were entered in Statistical Package for Social Sciences (SPSS) Software version 21 and analysed by using descriptive statistics i.e. mean, median, percentage and standard deviation. Inferential statistics i.e. Chi-square test and student t-test were employed to assess the association of iron deficiency anaemia with the variables of interest like sex, BMI, socio-economic status, menstrual history, hygienic hand wash practice before food, dietary habits, fear of gaining weight etc. A p value < 0.05 was considered significant. The study was conducted after obtaining approval from the Research Ethics Board, RIMS, Imphal.

RESULTS

The study was conducted among 379 adolescent school children, of which 216 were males and 163 were females.

Table-1: Distribution of study participants by gender, type and location of schools (n=379)

Characteristic		N (%)
Gender	Male	163 (43%)
	Female	216 (57%)
Urban	Govt. School	96 (25.3%)
	Pvt. School	84 (22.2%)
Rural	Govt. School	98 (25.8%)
	Pvt. School	101(26.6%)

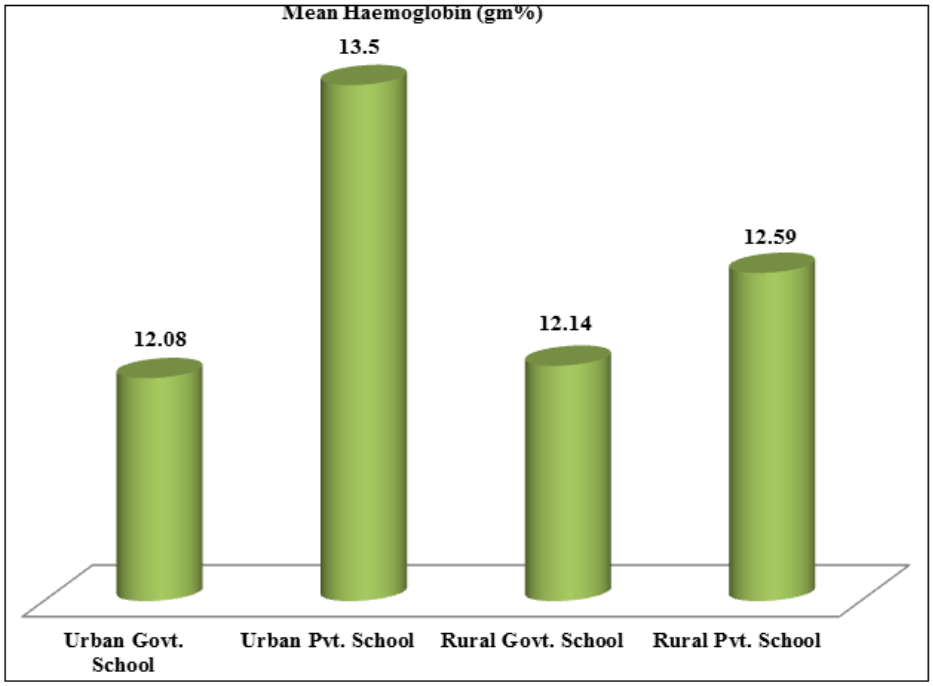

Fig-1: Mean Hb level among adolescent school children in different schools (n=379)

Table-2: Comparison of Hb level (n=379)

Type	Mean Hb (gm/dl)	S.E. of Mean	p-value (t-test)	Remark
Rural Govt.	12.14	0.20	0.11	Insignificant at 5%
Rural Private	12.59	0.19		
Urban Govt.	12.08	0.26	**0.00**	Highly Significant
Urban Private	13.5	0.21		

Inference

1. The mean difference of Hb level between Govt. and private school students in rural areas is not significant.
2. The mean difference of Hb level between Govt. and private school students in urban areas is highly significant.

Table-3: Comparision of Hb between Rural and Urban study population (n=379)

Type	Mean Hb (gm/dl)	S.E. of Mean	p-value (t-test)	Remark
Rural	12.36	0.14	0.101	Insignificant at 5%
Urban	12.74	0.18		

Inference: Hb level among rural and urban students do not differ significantly

Table-4: Comparison of Hb among Male and Female students (n=379)

Type	Mean Hb (gm/dl)	S.E. of Mean	p-value (t-test)	Remark
Male	13.64	0.15		
Female	11.72	0.13	**0.00**	Highly significant

Inference: Mean Hb. level among the male and female students are highly significant statistically (p-value < 0)

Table-5: Correlation Analysis of BMI with Hb

BMI With	Correlation	p-value	Remark
Hb	0.125	0.015	Significant

Inference: Mean hemoglobin level is significantly correlated with BMI (p-value <0.05)

Table-6: Menstrual history and Hb level (% are given out of the total)

Menstrual history		Hb Level				Total
		Severe	Moderate	Mild	Normal	
	Normal	2	25	43	66	136
		1.2%	15.2%	26.2%	40.2%	82.9%
	Moderate	1	1	12	9	23
		0.6%	0.6%	7.3%	5.5%	14.0%
	Heavy	0	0	2	3	5
		0.0%	0.0%	1.2%	1.8%	3.0%
Total		3	26	57	78	164
		1.8%	15.9%	34.8%	47.6%	100.0%

Chi-square test p-value = 0.076

Inference: There is no association between menstrual history (normal, moderate and heavy) and Hb level at 5% level of significance.

Table-7: Income and Hb Level (% are given out of the total)

Income		Hb Level				Total
		Severe	Moderate	Mild	Normal	
	Upto 5000	1	3	16	19	39
		0.3%	0.8%	4.2%	5.0%	10.3%
	5000 - 10000	4	22	48	122	196
		1.1%	5.8%	12.7%	32.2%	51.7%
	10000 above	0	7	37	100	144
		0.0%	1.8%	9.8%	26.4%	38.0%
Total		5	32	101	241	379
		1.3%	8.4%	26.6%	63.6%	100.0%

Chi-square p-value = 0.047

Inference: Income is associated with Hb level and school children belonging to the middle income group had lower haemoglobin level

Table-8: Comparison of Hb level among students who do hand wash and do not hand wash

Category	Hand Wash	Mean	Std Error	p-value (t-test)
Hb	Yes	12.65	0.11	0.00
	No	11.19	0.32	

Inference: Students who do hand wash before meals had mean higher Hb level than those who do not wash hands before meals

Table-9: Comparision of Hb. level among students with fear of weight gain and who do not have fear of weight gain

Category	Fear	Mean	Std Error	p-value (t-test)
Hb	Yes	11.96	0.26	0.02
	No	12.65	0.12	

Inference: Mean Hb level is higher but not statistically significant (p-value >0.05) among students who do not have fear of weight gain compared to those who have fear of weight gain

Table-10: Comparison of Hb levels among Students who prefer home food and junk food

Category	Food Preference	Mean	Std Error	p-value (t-test)
Hb	Home made	12.51	0.15	0.69
	Junk	12.60	0.17	

Inference: Food preferences on home-made traditional and junk food have no positive correlation with mean Hb level

DISCUSSION

Anemia is defined as a pathological process in which erythrocyte hemoglobin and concentration of red blood cells per unit volume of blood are abnormally low compared to the peripheral blood parameters of a reference population. In the present study, the overall prevalence of anaemia in the adolescent study population was found to be 36.4%.

Prevalence of anaemia among the female study population was 50% (108/216) while among the male study population, it was 31.2% (51/163). This difference may be attributed to the higher biological requirement of iron among females in adolescence, lower total food intake and due to menstrual blood loss. Similar results have been described by Rakesh *et al*., [10] in Kollam Kerala where 77.5% of female adolescents were anaemic compared to 67% in males. In a study in south west Ethiopia by Tesfaye M *et al*., [11] among school going adolescent girls, the odds of anemia was 3.04 (1.41-6.57) among females compared to males. The prevalence findings of this study is also consistent with a study done by Anna Ch *et al*., [12] in three aboriginal Canadian communities in which they found that the prevalence of anemia was 36.0%. However, prevalence was lower compared to a study done by Soman SK *et al*., [13] in Kerala, India where they found the overall prevalence to be 53.5% and female and male prevalence to be 62.0% and 46.1% respectively. This could be due to better socio-economic conditions and non-vegetarian diet which were reported by the majority of the participants in the present study. The findings of the present study, however, were not consistent with a study done by Jamali NH *et al*., [14] in Saheedabad, Pakistan in which the overall prevalence was found to be 43.1% and female and male prevalence to be 30.4% and 12.7% respectively. Although the overall prevalence of anaemia was higher in their study, the female and male prevalence were lower compared to the present study. In another study done by Bharati P *et al*., [15] on burden of anemia and its socioeconomic determinants among adolescent girls in India, they found that the lowest prevalence rates of anemia were found in the north-eastern states of India.

Mean Hb level of government and private school students did not differ significantly in the rural areas. However, it was found to be significantly lower among government than the private school students in the urban areas. This finding could be due to considerable difference in the socio-economic standard of the students in government and private schools in urban areas compared to rural areas. Private schools in urban areas are highly expensive compared to those in the rural areas. Hb level among rural and urban students do not differ significantly ($p > 0.05$).

Male study population had a mean Hb level of 13.64 ± 0.15 g/dL while the female study population had a mean Hb level of (11.72 ± 0.13 g/dL). The findings are found to be highly significant statistically (p-value < 0).

BMI status was significantly correlated with Hb level. This finding is supported by a study done by Ramzi M *et al*., [16] on anemia in adolescent school girls in Kavar urban area Southern Iran, where they concluded BMI is one of the factors influencing haemoglobin concentration. The finding is also supported by studies done by Premalatha T *et al*., [18] in Chennai and Keikhaei B *et al*., [19] However, a study done by Kaur S *et al*., [17] in rural Wardha, Maharashtra, India, found that BMI did not contribute significantly to anaemia.

In the present study, it was concluded that there is no association between menstrual history (normal flow, moderate flow and heavy flow) and Hb level (p=0.76). However, the finding was discordant with a study done in central Kerela by Siva PM *et al*., [20] where they found the prevalence to be higher among those with increased amount of blood loss during menstruation. A study by Kaur S *et al*., [17] in rural Wardha also concluded that history of excessive menstrual bleeding showed significant association with anemia.

Prevalence of anemia among adolescent students in low socio-economic group (low income, middle income) and high socio-economic group (high income) were found to be (5.3%, 19.6%) and 11.6% respectively. This finding is consistent with a study done by Shatha S *et al*., [21] in Baghdad in which they found the prevalence to be 17.6% in Low Socio Economic Area and 12.9% in high socio-economic area. Studies done by Chaudhary SM and Vasant Dhage R [22] and Vitull K *et al*., [23] in India also supported this finding.

Comparison of Hb level of the students who do and who do not hand wash before food was highly significantly (p=0) showing that there is a strong positive correlation between the lack of practice of regular hand-washing before food and anaemia. This finding is consistent with the finding of a study done by Yerpude PN *et al*., [24] in urban slum area in south India which revealed that the practice of hand washing

before eating main meals play a role in the prevalence of anaemia among adolescent boys.

Mean Hb level of students who do not fear of weight gain was significantly higher than those who fear weight gain. This finding is supported by a study done by Isik Balci Y *et al*., [25] among adolescents in Denizli, Turkey where they concluded that fear of gaining weight is associated with the development of anemia.

The present study concluded that the Hb level did not differ significantly among students who prefer home food or junk food ($p > 0.05$). This suggests that the home-made traditional food and junk food preferences have no significant contribution towards development of anaemia. This finding has not been found in any of the papers reviewed so far.

CONCLUSION

In the present study, prevalence of anaemia among the adolescent school children of Manipur was lower compared to other studies done in India. The mean haemoglobin was found to be significantly lower in female students of government schools when compared to female students of private schools. Prevalence of anaemia was higher among the female students compared to the male students. Anaemia was found to be positively correlated with BMI, monthly family income and hand washing practices before food in the present study. Menstrual history, fear of gaining weight and food preferences of the students showed no strong correlation with anaemia. Our finding, however, shows that students with fear of weight gain are more susceptible to anaemia in general.

Information, Education and Communication (IEC) activities regarding personal hygiene and promotion of healthy nutritional practices are recommended to be part of the academic curriculum. Promotion of proper utilization of iron and folic acid supplementation via Weekly Iron and Folic Acid Supplementation (WIFS) programme and biannual deworming are also recommended. Annual screening for anemia along with health education and poverty alleviation program would definitely aid in developing strategies and programs to improve adolescence health by ensuring adequate micronutrient store for prevention of anaemia.

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