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Research Paper

Assessment of micronutrient deficiencies among tribal primary school children of Meghalaya, India

■ **Namita Singh, Shipra Nagar and Ranjita Devi Takhellambam**

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■ **ABSTRACT :** The study was conducted to assess the micronutrient deficiencies among the tribal primary school children aged 8-11 years of the Meghalaya tribes. It was a Cross-sectional study. The duration of study was from 2012 to 2013. Total sample size was 1399 children. All primary children selected for the study were interviewed through school teachers or parents. Clinical examination and Hemoglobin estimation was done using Portable Haemoglobinometer (Hb Haemoglobin testing system, USA). Maximum nutritional deficiency reported by clinical examination in both tribes of primary school children was vitamin C deficiency with the symptoms of spongy and bleeding gums followed by iron deficiency anaemia. However, mean prevalence rate of anaemia in both the tribes of Meghalaya children is not significant with the mean (SD) value of 9.92 (1.71) irrespective of the gender and age with respect to blood haemoglobin concentration. There was also a significant critical difference in the distribution of different grades of anaemia *i.e.* moderate (0.031) and severe (0.127) among the age group of 8-11 years. And the highest prevalence of anemia was reported in the boys (84.65 %) than girls (83.98 %). Clinical examination should be screened periodically and appropriate measures should be taken in order to prevent from other prevailing nutritional related diseases. Further, the high prevalence of mild and moderate anemia demands due emphasis so as to bring down the total prevalence of anemia in primary school children.

■ **KEY WORDS:** Anemia, Clinical, Hemoglobin, Iron, Meghalaya, West Garo, East Khasi

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See end of the paper for authors' affiliations

Namita Singh
Department of Food Science and Nutrition, College of Home Science, Central Agricultural University, Tura (Meghalaya) India
Email : drnam2007@rediffmail.com

Despite numerous advances and improvements in health condition of tribal area, malnutrition still remains as one of the main public health challenges of the 21st century, particularly among the school age children. It undermines the survival, growth and development of children and is associated with fatal in children. Many of these conditions are associated with concomitant micronutrient deficiencies and among them vitamin A, iron, zinc and iodine deficiencies are the most prevalent in childhood Bhutta *et al*. (2012). Globally, more than 2 billion persons have micronutrient deficiencies, most of them from developing countries. More than 70 per cent of pre-school children consume less than 50 per cent of the RDAs for vitamin A, iron, folic acid and

riboflavin Sesikeran (2013). Micronutrient deficiencies impair intelligence, strength and energy, sapping individuals of much of the needed vitality, productivity and initiative for economic development (National Micronutrient Survey, 2007). Micronutrient deficiencies negatively affect child survival, growth, brain development, educational achievement and resistance to illness (Bhavesh *et al.*, 2010). Micronutrient deficiencies result from inadequate dietary intake, poor absorption of nutrients, excessive losses, increased requirement or a combination of these factors (Sarvar and Bant, 2017). Clinical examination is a method based on examination for changes, and related to inadequate nutrition, that can be seen in superficial epithelial tissues especially skin, eyes, hair or in organs near the surface of the body. Clinical examination has always been and remains an important practical method for assessing the nutritional status of a community. Iron deficiency is the most common nutritional deficiency worldwide today. (UNICEF/United Nation University/WHO, 2001). Anemia is a very common problem in pediatric age group in many developing countries with an estimated prevalence of 43 per cent of the World's children (Awate *et al.*, 1997). School children constitute 20.25 per cent of total population in India but data are even more limited on younger children (Goyal and Chavan, 1993). Therefore, it is a critical health concern because it affects growth and physical performance (Grantham-McGregor and Ani, 2001). Scheduled Tribes (ST) are the Indian communities that are explicitly recognized by the Constitution of India as previously 'depressed classes'. After independence, several educational and welfare attempts have been made to improve the educational attainments of their children. Educational inequality among tribal children is the resultant of the socio-economic backwardness of their home environment and the illiteracy of their parents (Bhise *et al.*, 2013). Inadequate data available on the clinical assessment of micronutrient deficiencies among tribal primary school children of Meghalaya. This study was aimed with the objective to assess the micronutrient deficiencies among the tribal primary school children aged 8-11 years of the Meghalaya tribes.

■ RESEARCH METHODS

The present study was done in two districts of Meghalaya in North East India in the year 2012 to 2013. Two tribes such as East Khasi and West Garo were selected for the present study. Children (age 8-11 y) of both gender were included in this cross- sectional study. Consent was obtained both from school authorities as well as parents and guardians of the selected primary children. Socio-economic data were as certained and each subject was examined clinically by the field investigator for the presence of signs of nutritional deficiency disease *viz.*, vit-A, B, C, D, iodine deficiency disorder. For this purpose, a 'check list' had been used Jellife (1966). Each subject was also clinically examined the haemoglobin level in order to assess the prevalence of anaemia. An ethical clearance was taken by Institutional Ethical Committee (IEC) as blood samples were taken from the subjects. Portable haemoglobinometer (Hb Haemoglobin testing system, USA) was used to determine haemoglobin level from a capillary blood sample collected from the fingertip of each child aseptically, using sterile single-use disposable lancet. It was done by trained and experienced laboratory technicians. The necessary safety measures were taken during blood collection. Seventy per cent ethanol alcohol was used as disinfectant. Mild anaemia was defined as haemoglobin level of 10-11.4g/dl, moderate anaemia was defined as haemoglobin of less than 7-9.9g/dl and severe anaemia as haemoglobin level less than 7g/dl (WHO, 2001).

Statistical analysis was carried out using Microsoft Excel and SPSS (Statistical packages) software programmes. Independent two variables (gender) were tested by Chi square. One way analysis of variance (ANOVA) was used to classify the different grades of anaemia.

■ RESEARCH FINDINGS AND DISCUSSION

In the present study, there exists a difference in the level of family income (Table 1). Preponderance of the East Khasi tribe (31.33%) had a monthly family income between Rs. 5001/- to 10000/- whereas West Garo tribe (30.84%) had a monthly income between Rs.1000/- to 5000/- (Table 1).

Table 2 depicts the nutritional deficiency of the respondents by clinical examination. Maximum percentage of Vitamin C deficiency (1.99%) occurred in East Khasi tribe with the symptoms of spongy and bleeding gums followed by iron deficiency (giddiness) with 1.28 per cent. However the least nutrient deficiency

was riboflavin (0.14%) being angular stomatitis the symptom. Whereas in the West Garo tribe, most nutritional deficiency prevailing was Vitamin C (0.71%) with symptoms of bleeding and spongy gums, followed by thiamine (skin rashes), Vitamin D (muscle weakness) and iron (weakness) deficiency. In addition there was no single case of folic acid and iodine deficiency observed in the present study.

The results of the study indicated that among the different grades of anaemia, the prevalence of moderate anemia recorded the maximum (46.6%) followed by mild anaemia (33.52%) in both tribal children of Meghalaya. Further different grades of anaemia were distributed disproportionately among the two tribal primary children *i.e*. 33.04 per cent of East Khasi tribe and 33.14 per cent of West Garo tribe were mildly anemic, 46.83 per cent of East Khasi tribe and 46.6 per cent of West Garo tribe were moderately anemic and 4.31 per cent of East Khasi tribe and 4.32 per cent of West Garo tribe were severed anemic. Further, children who had participated in the study reported that they had symptoms like easy fatigue or dizziness. However, the mean prevalence rate of anaemia in both the tribes of Meghalaya children is not significant with the mean (SD) value of 9.92 (1.71) irrespective of the gender and age with respect to blood haemoglobin concentration (Table 3).

Table 4 depicts the mean prevalence of different grades of anaemia with respect to age in Meghalaya primary school children according to WHO classification. The highest prevalence of anemia was present in the age group of 10 years. There was a significant critical difference in the distribution of different grades of

Table 1 : Distribution of households according to income **(n=1399)**

Per capita monthly income (in Rs.)	East Khasi tribe (n=702)		West Garo tribe (n=697)	
	No.	%	No.	%
1000-5000	198	28.21	215	30.84
5001-10000	220	31.33	98	14.06
10001-15000	19	2.71	25	3.6
15001-20000	21	3.0	17	2.44
20001-25000	140	19.94	151	21.7
25001-50000	104	14.81	191	27.40
Total	702	100.0	697	100.0

Table 2 : Nutritional deficiency of the respondents by clinical examination **(n=1399)**

Nutrient deficiency	East Khasi tribe (n=702)		West Garo tribe (n= 697)	
	Number	Percentage	Number	Percentage
Riboflavin	1	0.14	-	-
Thiamine	-	-	2	0.28
Vitamin C	14	1.99	5	0.71
Vitamin D	-	-	2	0.28
Iron	9	1.28	2	0.28

Table 3 : Prevalence of different grades of anaemia in two tribes of Meghalaya primary school children according to WHO classification **(N=1399$)**

Districts	Normal (≥11.5)	Mild (10-11.4)	Moderate (7-9.9)	Severe (<7)	Total	Mean (SD)	Chi-square
East Khasi tribe	110 (15.80)	230 (33.04)	326 (46.83)	30 (4.31)	696 (100)	9.92 (1.71)	1.000 (NS)
West Garo tribe	109 (15.70)	230 (33.14)	325 (46.82)	30 (4.32)	694 (100)	9.92 (1.71)	
Total	215 (15.50)	466 (33.52)	648 (46.6)	61 (4.4)	1390 (100)		

Note: $-Indicates 9 respondents were dropped in the middle of the study hence heamoglobin was not checked
Figures in parenthesis indicate percentage
The values are considered statistically significant if the p value is less than or equal to 0.05 ($p \leq 0.05$), NS=Non-significant

anaemia *i.e.* moderate (0.031) and severe (0.127) among the age group of 8-11 years.

Present study showed that overall prevalence of anemia among children in the age group of 8 to 11 years was 84.24 % (1171/1390). And the highest prevalence of anemia was present in the boys (84.65 %) than girls (83.98 %) with mean (SD) is 9.91 (1.62) for boys and 9.93 (1.77) for girls which showed no significant difference in the mean (SD) distribution among the gender (Table 5).

Income is a major yardstick for judging the socio-economic status of family or community. Most of the deprivation can be traced to inadequacy of income and wealth; adequate level of income and wealth would indicate feasibility of leading a decent life and therefore, a higher level of well-being. Lower level of these could off course lead to non-fulfillment of many of the aspirations and thus correspond to a lower level of well-being. Income earned by households would thus, apart from being an important indicator of well-being, be a proxy as well for many other aspects of well-being. A comparative analysis of the level of income earned and distribution of this among the members of the community would reveal some major aspects of the quality of life. Children from poor households are usually found to have higher malnutrition prevalence.

Clinical examination is an important indicator which reveals nutritional deficiency signs for assessment of nutritional status of communities. Spectrum of deficiency disorders was reported by differently in various literatures. Sonkar and Pandey (2011) reported clinical features of different nutritional deficiency disorders of 150 school going children (9-12 years) of Ramabai Nagar, Kanpur. On the basis of eye symptom, 32 per cent were having itcy eye, water discharge (32%), and weak eye-sight (5%). Cracked, cheilosis lips, pale and red tongue were observed in 44, 19, 20 and 5 per cent of children, respectively. In teeth assessment, 42 per cent were having dirty teeth and 8 per cent were having caries and dental cavity. Further, Khan *et al.* (2010) also stated the prevalence of nutritional deficiency such as bitot spots (5.15%), night blindness (8.24%), angular stomatitis and

Table 4 : Prevalence of different grades of anaemia with respect to age in Meghalaya primary school children according to WHO classification (n=1399$)

Age	Mean (SD)			
	Normal (≥11.5)	Mild (10-11.4)	Moderate (7-9.9)	Severe (<7)
8	12.29 (1.34)	10.72 (0.40)	8.80 (0.79)	6.33 (0.49)
9	12.68 (1.76)	10.67 (0.45)	8.75 (0.68)	6.32 (0.25)
10	12.03 (0.59)	10.79 (0.45)	8.98 (0.65)	6.80 (0.10)
11	12.72 (0.81)	10.72 (0.37)	8.85 (0.75)	5.90 (0.72)
Mean	12.43	10.72	8.84	6.33
'F' value	2.784	1.374	3.153	7.838
S.E.±	-	-	0.011	0.033
C.D. (P=0.05)	NS	NS	0.031*	0.127**

Note: $-Indicates 9 respondents were dropped in the middle of the study hence haemoglobin was not checked
* and ** indicate significance of values at P≤0.05 and ≤0.01, respectively NS=Non-significant

Table 5 : Prevalence of different grades of anaemia with respect to gender in Meghalaya primary school children according to WHO classification (n=1399#)

Gender	Normal (≥11.5)	Mild (10-11.4)	Moderate (7-9.9)	Severe (<7)	Total	Mean (SD)	Chi-square
Boys	83	164	276	18	541	9.91 (1.62)	0.058 (NS)
	(15.3)	(30.31)	(51.01)	(3.32)	(100)		
Girls	136	296	375	42	849	9.93 (1.77)	
	(16.01)	(34.90)	(44.20)	(4.94)	(100)		
Total	219	460	651	60	1390		
	(15.80)	(33.10)	(46.83)	(4.31)	(100)		

Note: # 9 respondents were dropped in the middle of the study hence haemoglobin was not checked
Figures in parenthesis indicate percentage
The values are considered statistically significant if the p value is less than or equal to 0.05 (p≤0.05), NS=Non-significant

cheilosis (3.09% each), tongue red and raw (13.4%), tongue papillae (2.06%), gums spongy bleeding (6.18%), teeth caries (15.46%) and teeth mottled enamel (6.18%) among school going children (7-12 years) of Parbhani district. One of the commonly seen clinical characteristic in both tribes of Meghalaya primary children is Vitamin C deficiency with symptoms of bleeding and spongy gums. However there was no Vitamin A deficiency among the respondents even though the Vitamin A intake in terms of carotene is very low when compared to RDA. The reason might be due to the food pattern in which meat becomes a staple food for the tribal in the study area which was being consumed regularly by all individuals. Further there was no single case of folic acid and iodine deficiency observed in the present study.

According to WHO if the prevalence of anemia at community level is more than 40 per cent, it is considered as an problem of high magnitude. The prevalence of various parasitic infestations and other chronic illnesses were not studied in this survey so it is difficult to comment on the actual causes of high prevalence among primary school children. However, poor socio-economic status (SES) is known to be associated with a number of factors, such as high parity, short birth interval, poor diet both in quantity and quality, lack of health and nutrition awareness, and a high rate of infectious diseases and parasitic infestations. Since the SES is an important determinant of access to health care, poor people have often limited access to medical attention and preventive measures, increasing their risk of becoming anemic. The study findings revealed that East Khasi tribe children were more anemic when compared to West Garo tribe children in spite of better SES.

In the social set-up, East Khasi tribes are better than West Garo tribe. However the prevalence of anaemia among women of Meghalaya is higher in urban areas when compared to rural set-up. It is due to the indulgence in bad habit of consuming pan/bidi/cigarette/ gutka etc. which in turn increase the risk of getting anemic in their offspring too (Sanku *et al.,* 2010).

Bhise *et al*. (2013) reported that the highest prevalence of anemia was present in the girls (87.8 %) than boys (65.1%) of tribal ashram schools (8-16 y) in Ahmednagar district of Maharashtra. Further it was reported that there was high statistical significant difference of anemia between girls and boys. Jai Prabhakar and Gangadhar (2009) also observed that prevalence of anemia was significantly higher in tribal girls (83.33%) when compared to boys (70.89%) of Mysore district, Karnataka. Jain and Jain (2012) also stated that prevalence of anemia was higher in girls than boys. However, the literature regarding the high prevalence of anemia among the gender is controversial. Tribal primary boys of Meghalaya were more prevalent in anaemia when compared to girls. The rising trend of consuming snack and junk food which supply empty calories might be one of the responsible factors among the boys children when compared to girls.

Rynjah *et al.* (2009) reported that the typical Khasi meal had a balance with rice in semi and unpolished form, fermented soybean, vegetables, such as cauliflower leaves, potatoes non-conventional seasonal fruits such as peaches, passion fruit, plums and wild berries. Non-vegetarian foods include such as meat, fish and oils such as mustard and refined oils had a protective role. However, in the present study the availability of food and nutrients among the respondents in a study area is conditioned largely due to negligence and lack of awareness of the respondent's parents especially mother who is responsible in the food preparation in terms of variety in the diet, adequacy with proper meal pattern. Sometimes ignorance on the part of parents to know the requirement of children, quantitatively or qualitatively may also lead to reduce iron intake as well as other important vitamins of children which in turn increases the prevalence rate of deficiency.

A study in primary school children documented the prevalence of nutritional deficiency disorders such as vitamin and iron in Meghalaya tribes is due to poverty, inadequate diet, certain diseases, pregnancy/lactation and poor access to health services. This further emphasizes the need for corrective measures for nutritional deficiency in primary school children before they enter adolescence so as to compensate the additional requirement for growth and development during puberty and combat the extra losses during certain critical stages.

Conclusion :

In conclusion, clinical examination should be screened periodically and appropriate measures should be taken in order to prevent from other prevailing nutritional related diseases. Further, the high prevalence of mild and moderate anemia demands due emphasis so as to bring down the total prevalence of anemia in

primary school children.

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Authors' affiliations:

Shipra Nagar, Department of Human Development and Family Studies, College of Home Science, Central Agricultural University, Tura (Meghalaya) India

Ranjita Devi Takhellambam, Department of Food Science and Nutrition, College of Home Science, Central Agricultural University, Tura (Meghalaya) India

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