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Assessment of Dietary Diversity and Nutritional Status of School Children of Ranchi District of Jharkhand

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ABSTRACT

Background: Malnutrition among school children is still a major public health problem, particularly in the state like Jharkhand. A diverse diet is important for ensuring adequate intake of all essential nutrients for physical and mental development. Information on the dietary diversity and nutritional status of the children is scanty concerning the tribal belt of Jharkhand. Therefore, a study was undertaken to assess the dietary diversity score and prevalence of malnutrition among school children.

Methods: The study was a cross-sectional survey involving 179 mothers and their 6 to 10 years old children covering 2 blocks and four villages of Ranchi district of Jharkhand. A pretested questionnaire was used to obtain information on socio-demographics. The 24-hour dietary recall method was used to calculate individual dietary diversity score (DDS based on a scale of 12 food groups) and the scores were divided into low = ≤ 4, medium = 5-8 and high = 9-12. Anthropometric measurements were taken following the standard techniques. The degree of malnutrition was calculated according to BMI in comparison with age/gender-specific centile values recommended by WHO.

Result: Cereals (0.91±0.38) and Roots and Tubers (0.60±0.29) had higher mean DDS values, while fish (0.09±0.17) and milk and milk products (0.21±0.18) had the lowest value. While assessing the prevalence of malnutrition, 36.32% and 10.6% were found to be suffering from under nutrition and overweight, respectively.

Key words: Anthropometric measurements, Diet diversity, Malnutrition, School-children.

INTRODUCTION

Malnutrition, especially among growing children, is one of the major public health problems in developing countries like India. Condition is even worse in a state like Jharkhand, where the bulk of scheduled tribes and scheduled castes reside, consisting of 40% of the total population. The majority of the tribal population of Jharkhand lives in the forest ecosystem and has its own socio-cultural pattern, traditions and typical food practices. The tribes happened to be primarily rural and rainfed agriculture is their main source of livelihood. Subsistence farming does not provide them sufficient food and income due to indifferent land situation, less use of manure, dependency on monsoons, backward technology and unproductive use of debt as most of them are farmers belonging to the deficient category. As a result of poverty, the intake of various essential constitutes of food is inadequate among tribes and the nutritional profile is low as compared to the national average [National Family Health Survey (NFHS-5), 2019-21].

School age is a crucial period of physical growth as well as mental development of the child (Anurag *et al*., 2012). Children belonging to the age group of 5-14 years mostly suffer from a lack of adequate nutrition because of their rapid growth (Twara *et al*., 2015). Inadequate nutrition if confronted during childhood can lead to deficit in mental and physical development with endless suffering. Among all age groups, the school-age period is nutritionally important because this is the fundamental time to build up body stores of nutrients in preparation for the rapid growth of adolescence (Sati *et al*., 2012). These children are the main contributors to the manpower of the future and will play a critical role in improving the Indian economy. Dietary diversity is defined as the number of different food groups or foods consumed over a given period (Hoddinot and Yohannes, 2002). Diverse foods are a good source for various macro and micronutrients and best ensure nutrient adequacy. A diverse diet that includes eating a variety of foods from each group is important in meeting the requirements for all the essential nutrients that the body needs, especially for those who are nutritionally vulnerable, as this may lead to malnutrition. Malnutrition during this critical period of growth leads not only to stunting but also to impaired intellectual development. It contributes directly or indirectly to high morbidity and mortality (Sinha and Kumari, 2018).

Nutritional status is an important indicator for measuring quality of life especially, in children. Anthropometry is a practical tool for evaluating the nutritional

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status of populations, particularly of children. It is a sensitive indicator of health, growth and development in children and inexpensive means of determining short and long term nutritional status. Tracking the nutritional status of children has far-reaching implications for promoting the health of future generations (Anurag *et al.*, 2012)

The prevalence of malnutrition among school-age children in the poor communities of rural areas of the country has been well documented (Awasthi *et al.*, 2000; Boora and Kheterpaul, 2003; Dey and Nath, 2017; Murugkar *et al.*, 2013). The condition becomes worse among the tribal communities because of their isolation from mainstream and typical lifestyle (Parimalavalli, 2012). Data on the anthropometric and nutritional status of tribal children is insufficient, particularly concerning the tribal belt of Jharkhand. Keeping all these perspectives into consideration, the present study was carried out to assess the dietary diversity and nutritional status of school children.

MATERIALS AND METHODS

The present study was conducted in the year 2023 in the Ranchi district of Jharkhand covering two tribal dominant blocks, namely Kanke and Bero. A list of tribal-dominated villages was obtained,and two tribal-dominated villages from each block were randomly selected.

A cross-sectional survey conducted during July to August in the year 2023 involving 179 mothers/fathers and their 6-10 year-old children. A pre-tested questionnaire was used to obtain information on socio-economic conditions.

Height and weight were determined according to standard anthropometric methods. Height was measured up to the nearest millimeter using an anthropometric rod with participants standing upright in bare feet. The weight of participants was measured to the nearest 100 g with minimum cloths using a portable digital scale. BMI was computed as weight/height^2 (kg m^{-2})

Dietary diversity score (DDS) was based on 24-hour recall of child's consumption of 12 food groups, namely Cereals, legumes and nuts/seeds, vegetables, fruits, meat, egg, fish and other seafoods, milk and milk products, Oil and fats, sweets, spices/condiments and beverages and tubers and roots, within the past 24 hours using FAO (2007) guidelines as suggested by Ogechi and Chilezie (2017). Commonly consumed foods in the area were incorporated into each food group.

The response categories were "yes" and "No". One point was given in the response category of "yes" whenat least two food items in a group were consumed. Half point was awarded for food items less than two. Zero (0) point were given representing "No" when no food item was consumed. By summing the number of food and food items consumed in each group separately,dietary diversity was calculated. The total score was calculated and this ranged from 0-12. The children were classified into low (≤ 4), medium (5-8) and high (9-12) as per the methods of Ogechi and Chilezie (2017).

Degree of malnutrition was calculated according to BMI in comparison with age/gender-specific centile values as recommended by WHO.

The data were subjected to statistical analysis using Statistical package for social Sciences (SPSS). A probability level of ≤ 0.05 was considered to be statistically significant.

RESULTS AND DISCUSSION

Respondent's characteristics

Socioeconomic conditions of selected respondents are presented in Table 1. The majority of respondents (48.6%) were in the age group of 30-39 years and 40.8% had no formal education. In the study area, 52 per cent of respondents were male and 48 per cent were female. Farming was the primary occupation for the majority of the

Table 1: Socio-economic profile of selected respondents (n-179).

Particulars	Number	Percent
Age		
< 20	1	0.55
20 – 29	58	32.5
30 – 39	87	48.6
40 – 49	30	16.8
≥ 50	3	1.6
Sex		
Male	93	52
Female	86	48
Education		
Illiterate	73	40.8
Non-matriculate	66	36.9
Matriculate	32	17.9
Intermediate	5	2.8
Graduation	3	1.6
Occupation		
Farming	109	60.9
Farming + Labour	61	34
Labour alone	2	1.2
Business/service	7	3.9
Food habit		
Vegetarian	8	4.4
Non-vegetarian	171	95.6
Type of family		
Nuclear	139	77.7
Joint	40	22.3
Size of the family		
Small (upto 4 members)	40	22.4
Medium (5-7)	88	49
Large (>7)	51	28.6
Average annual income (Rs)		
<50000	28	15.65
50000 - 100000	97	54.2
100000 - 200000	48	26.8
≥ 200000	6	3.4

respondents. Out of 95 per cent, 34 per cent were also engaged in labour work. About 15.6 percent of the respondents analyzed had an annual income below 50,000/- and major population (54%) earned upto 50,000 - 1 lakh per annum. The majority of respondents were non-vegetarian and belonged to a nuclear family with medium family size.

Diet diversity score

The mean dietary diversity scores ranged from 0.09±0.17 to 0.91±0.38 over 12 possible range groups with a mean DDS of 4.9±2.99 (Table 2). Fish and other Seafoods, dairy products, meat, legumes, nuts and oil seeds, sweets and fruits were the least consumed food groups by the children, while cereals, vegetables, roots and tubers, spices and condiments were commonly consumed food groups. Table 3 depicts the classification of selected children according to dietary DDS. The majority of children (49.7%) fell under the low DDS group, while 46.4% and 3.9% were in the medium and high DDS group, respectively. Children who fell in the low diversity group in this study were 49.7%, with only 3.6% having high dietary diversity. This indicates that in the previous 24 hours, only about 50.3% met the minimum dietary diversity score (5 to 8 food group) and would most likely meet their adequate nutrient requirement for growth. The prevalence of low DDS observed in this study is similar to previous studies (Herrador *et al*., 2015; Ogechi and Chilezie, 2017). The low DDS observed among the majority of the school-age children in this study could be attributed to food insecurity. Previous studies conducted in the Ranchi district of Jharkhand (Sinha and Lakra, 2006; Sinha *et al*. 2007) showed that food insecurity was common in the area, with 52-74% of rural households being food insecure. A study conducted in Ranchi, West Singbhum and Latehar districts of Jharkhand by Sinha and Lakara, 2006 revealed that 52% of the households had food grain shortage throughout the year during last five years and 66% of them had inadequate grain production in the previous year. Except for cereal, the diet of tribals was inadequate and far below the recommended amount. Another study conducted on the parameters of food security in the Ranchi district of Jharkhand revealed that 74% of the households had food grain shortages throughout the year during the last five years and 48% had food shortages for a period of 5-8 months (Sinha *et al*., 2007).

The food frequency questionnaire (Table 4) depicted the consumption patterns of different food groups. It is evident that cereals and fats/oils were consumed on everyday basis. Protein-rich foods like pulses were consumed every day by 23.7% of the respondents whereas fish and meat were consumed by only 7.9% of the respondents. Milk and its products were consumed every day by only 17.3% of the respondents, whereas 53.2% of respondents reported that they had never consumed milk and milk products. The finding of this study is in agreement with earlier work (Murugkar *et al*., 2013), which also reported

Table 2: Diet diversity score.

Food group	Diversity score (Mean±SD)
Cereal	0.91±0.38
Vegetables	0.55±0.32
Fruits	0.42±0.29
Meat	0.23±0.22
Egg	0.40±0.25
Fish and other sea food	0.09±0.17
legumes, nuts and seeds	0.28±0.16
Milk and milk products	0.21±0.18
Oils and fats	0.31±0.25
Sweets	0.32±0.29
Spices and condiments	0.58±0.19
Tubers and roots	0.60±0.29
Total	4.9±2.99

Table 3: Classification of children according to dietary diversity score.

Category	n	%
Low (≤ 4)	89	49.7
Medium (5-8)	83	46.4
High (9-12)	7	3.9

Table 4: Food frequency consumption pattern.

Food groups	Every day (%)	Once a week (%)	Fortnightly (%)	Monthly (%)	Never (%)
Cereals	100	-	-	-	-
Pulses	23.7	54.7	13.7	7.9	-
GLVs	12.2	69.8	19.8	7	-
Roots and tubers	57.6	29.5	12.9	-	-
Other vegetables	95.7	4.3	-	-	-
Fruits	-	65.4	8.6	25.9	-
Milk and milk products	17.3	10.8	10.1	8.6	53.2
Flesh food	7.9	51.1	16.5	20.9	3.6
Sugar and jaggery	86.8	13.2	-	-	-
Fats and oil	100	-	-	-	-

that protein-rich foods like pulses and flesh foods are consumed maximally only once a week. Similarly, a study conducted on tribal school children in Odisha reported that milk and pulse consumption was meagre in all age groups. Meat and meat products were eaten once a week in the form of dry fish (Joshi *et al*., 2021).

Anthropometric profile

The mean weight of girls and boys was 21.8±6.77 and 20.56±6.40, respectively (Table 6). The mean height of the girls was 119.45±15,48cm, whereas that of boys was 115.78 ± 12.86 cm. In the present study, the BMI was found to be 15.31±4.08 and14.65±2.73, respectively in the age groups of 6 -10 years. Although there was no significant sex differences were noted in the mean values of height, weight and BMI. The finding of this study is in agreement with an earlier study (Sinha and Kumari,2018) which also reported non-significant sex differences in the mean value of weight, height and BMI of tribal school children. Age-wise anthropometric characteristics of the children are given in Table 5. Mean weight, height and BMI were lower than WHO 2007 studied in all age groups. No significant difference in weight at ages 6, 7, 8 and 10 years (P >0.05) were observed. However, mean difference was significant at age 9 years. Girls exhibited significantly (P≤ 0.05) higher height compared to boys at age 9 and 10 years. The study by Medhi *et al*. (2007) and Twara *et al*. (2015) showed that the mean heights of girls are higher at the age 10,11 and12 than boys which is similar to the results of this study. No significant difference was observed in the mean values of BMI at all age groups.

The extent of malnutrition in children analyzed based on BMI for age percentile cut-offs as per WHO is given in Table 7. The prevalence of overweight was observed more in boys (13.8%) than girls (8.7%). About 37.9% boys and 37% girls were reported as underweight. A higher prevalence of malnutrition (45.2%) was reported in a study (Prabharkar and Gangadhar, 2009) done on Jenukuruka tribal children in the Mysore district of Karnataka. Similarly, 61.20% of the children were reported underweight in a study conducted on 73 tribal children in the Gajapatidistrict of Odisha (Joshi *et al*., 2021). Overall prevalence of underweight of 56.2% among tribal children aged 3-11 years of Paschimanchal area in West Bengal was reported

Table 5: Anthropometric characteristics of selected children (n-179).

Age	Number		Weight (kg)		p-Value	Height (cm)		p-value	BMI		p-value
	Boys	Girls	Boys	Girls		Boys	Girls		Boys	Girls	
6	20	23	17.08 ± 4.43	15.26 ± 2.58	0.3513	108.50± 6.60	109.54 ± 8.43	0.7848	14.37 ± 2.60	12.79 ± 2.36	0.2331
7	18	17	17.88 ± 1.64	17.06 ± 2.42	0.4148	112.53± 9.12	112.06 ± 1.10	0.8677	14.23 ± 1.67	13.88 ± 3.48	0.7907
8	17	10	21.14 ± 5.34	21.10 ± 3.63	0.9845	116.19± 13.90	118.0 ± 9.33	0.7509	16.58 ± 7.28	15.34 ± 3.16	0.6359
9	14	16	17.70 ± 2.15	25.33 ± 6.15	0.0469*	108.13 ± 8.50	127.67 ± 9.14	0.0094*	15.20 ± 1.86	15.62 ± 2.50	0.8888
10	18	26	27.00 ± 6.25	27.73 ± 6.38	0.7085	128± 9.96	135.26 ± 11.06	0.0332*	16.74 ± 4. 93	15.04 ± 2.42	0.1347

*Statistically significant (P≤0.05).

Values are Mean±SD.

Table 6: Mean weight, height and BMI of selected children.

	Male (n-87)	Female (n-92)	Pooled (n-179)	p- value
Height (cm)	115.78±12.86	119.45±15.48	117.95±14.53	NS
Weight (kg)	20. 56±6.40	21.18±6.77	20.93±6.61	NS
BMI	15.31±4.08	14.65±2.73	14.92±3.35	NS

Values are Mean±SD.

Table: 7 Classification of selected children according to BMI Percentiles.

BMI for age percentile	Grade	Boys (n-87) N%		Girls (n-92) N%		Total (n-179) N%	
< 5th Percentile	Under Nutrition	33	37.9	34	37	65	36.32
5th To 85th Percentile	Normal	42	48.3	50	54.3	95	53.07
85th To 95th Percentile	Overweight	12	13.8	8	8.7	19	10.61
≥ 95th Percentile	Obesity	-	-	-	-	-	-

by Mollah *et al*.(2021). Another study (Chandra *et al*., 2006) in the villages of Dharwad and Haliyet Talukas reported 44.4% of children as underweight. About 51.10% of school-going tribal children of Uttar Pradesh showed evidence of undernutrition in a study conducted by Twara *et al*. (2015). Similarly the prevalence of underweight ranging from 34- 62% has been reported in one large-scale study done on rural school children in five countries including India (Partnership for Child Development, 1998). The prevalence of undernutrition among selected school children in the present study was found lower as compared to other studies, but it is still unacceptably high and appropriate intervention is required to improve the nutritional status of school children as it impedes their normal physical and intellectual development.

CONCLUSION

Malnutrition is one of the major causes of illness and mortality among children in the country. Children living in tribal belts like Jharkhand are highly susceptible to malnutrition, Physical and mental well-being of school-going children is an important concern that can be achieved by good nutrition. The study showed that only about 50.3% of the school children met the minimum dietary diversity score in the previous 24 hours. About 49.75% of children fell in the low diversity group with only 3.6% having high dietary diversity. Cereals, other vegetables, roots and tubers were the predominant food groups consumed over 24 hours. Protein-rich foods like pulses, milk and flesh foods are consumed maximally only once a week. Anthropometric assessment and nutritional status analysis indicated that 36.32% and 10.6% of children (6-10 years) inthe Ranchi district were found to be suffering from undernutrition and overweight respectively. No significant sex differences were noted in the mean value of height, weight and BMI of selected children in the age group of 6-11 years, However on age and sex-wise analysis, girls exhibited significantly higher height compared to boys at age 9 and 10 years. The low diversity of children's diets shows a need to increase the consumption of nutrient-dense foods to improve the nutritional status of children. Nutrition education along with appropriate location-specific nutrition-sensitive agricultural intervention needs to be promoted for the mitigation of problems on a sustainable basis.

Conflict of interest

All authors declare that they have no conflict of interest.

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