

# Evaluating the Dietary Gaps and Anthropometric Parameters of the Government School Children Aged 11-14 Years in Accordance with ICMR Standards

K SILAMBU SELVI<sup>1</sup>, J SAI LAAVANYA<sup>2</sup>, G NANDHINI<sup>3</sup>, P SHANTHINI PRIYA<sup>4</sup>, I VANTHI EKAL<sup>5</sup>



## ABSTRACT

**Introduction:** Malnutrition is a major global health crisis that needs immediate attention. Adolescence is a crucial stage where nutrition plays a major role on account of their growth and development. There is a need to assess the nutritional status of Government school children in Tamil nadu to take appropriate policy decisions and implement nutritional interventions.

**Aim:** To assess the dietary gaps of Government school children and compare their anthropometric parameters with Indian Council of Medical Research (ICMR) standards. Also, to associate their daily intake of five food groups with their weight status.

**Materials and Methods:** This cross-sectional study was conducted by the Department of Clinical Nutrition and Dietetics, SRM Medical College Hospital and Research Centre (SRMIST), Kattankulathur, Chengalpattu District, Chennai, Tamil Nadu, India as a part of a nutritional awareness camp in month of March 2022 to examine the eating pattern of school-going children aged 11-14 years, in a Government school of Kalivanthapattu village, Chengalpattu, Tamil Nadu. Data was collected randomly among 73 school children during a nutritional awareness camp conducted by study Institute. A validated tool was used to identify the dietary gaps in food group intake and the anthropometric

parameters were assessed using standard measures and were compared with ICMR and World Health Organisation (WHO) standards to analyse their nutritional status. The acquired data was analysed using Statistical Package for Social Sciences (SPSS) software.

**Results:** Out of the 73 children, there were 52 girls and 21 boys and the mean age of the children was 12.09±0.80 years. The dietary gap assessment tool indicated the gross deficiency in the intake of different food groups by the children. The majority of the samples 52 (71.2%) had an average dietary pattern, 9 (12.3%) students were found to have poor dietary habits and only 12 (16.4%) students had a good dietary pattern. Body Mass Index (BMI) assessment indicated that 39 students (53.4%) were normal (-2SD to +1SD) and others were found to be malnourished. A substantial variation in the mean weight of 12-year-old-male students (p-value=0.025) as well as female students (p-value=0.003) was observed when compared to ICMR standards. There was high significant difference between mean height of 13-year-old female students and the mean height as per ICMR standards (p-value=0.004).

**Conclusion:** The dietary intake of Government school children was average and the anthropometric assessment indicated that many of them were malnourished.

**Keywords:** Dietary intake, Food groups, Height, Indian council of medical research, Nutritional status, Weight

## INTRODUCTION

Tackling the crisis of malnutrition has always been a pressing challenge for India and has become more challenging after the Coronavirus Disease 2019 (COVID-19) pandemic [1-3]. The comprehensive National Nutrition Survey of children and adolescents in India (2016-2018) executed by the Ministry of Health and Family Welfare along with United Nations Children's Fund (UNICEF), which collected data from 35,830 students aged 10-19 years indicated that 24% of children aged 10-19 years were thin for their age. In Tamil Nadu, 6.3% of children were severely undernourished and 19.4% were moderately undernourished [4].

A recent study measured both under and overnutrition among adolescents in India and looked at the causes of this double burden of malnutrition [5]. Adolescence is a critical age group where growth spurt occurs and sufficient nutrient intake through balanced meals is critical [6]. Proper diet is the predominant factor which determines children's overall physical development, growth, health, and academic performance [7,8]. Diet is a significant element that cannot be ignored, even though a number of other factors affect growth [9]. A nutritious diet refers to one that provides appropriate and adequate macronutrients (carbohydrates, protein, fat) and water to fulfil the body's physiological needs without overindulging for the daily cellular

process [10]. For optimal growth and development micronutrients (vitamins and minerals) are required in lesser quantities [11].

One in three of the world's malnourished children reside in India despite numerous large-scale supplementary feeding programs being implemented by the Indian government during the past 71 years [12]. Due to the synergic effect of malnutrition and infections, undernourished children are more prone to have indigent health [13]. The National Nutrition Mission-Poshan Abhiyan started with the goal of eradicating different forms of malnutrition by the year 2022 but was not achieved since its services were disrupted during the pandemic [14]. Though mid-day meal schemes and services like Integrated Child Development Services (ICDS) have significantly contributed to the reduction in hunger and malnutrition in children, with the prolonged closure of Government schools throughout the COVID-19 pandemic, the current nutritional status of the children is questionable [15].

It is highly challenging to assess the daily food intake of school children when compared to adolescents and adults. The dietary assessment method and nutrient consumption pattern is the most globally used method of identifying malnutrition status [16]. The identification of the broad dietary gaps and classification of undernourished, normal, and over nourished students in Government schools can help in planning

appropriate strategies and nutritional counseling to correct malnutrition in this most crucial stage.

Various studies had assessed the nutritional status of Government school children in different states in India [17-20]. But there is a paucity of studies examining the nutritional status of Government school children based on anthropometric measurements and dietary gap in Tamil Nadu, specifically in Chengalpattu district. Besides, there are no studies that deal with differences in boys and girls in terms of malnutrition in school children of Chengalpattu district.

Hence, present study was conducted with the following objectives  
a) To identify the gaps in the consumption of different food groups;  
b) To assess the dietary pattern of children attending Government school;  
c) To compare the anthropometric measurements of the school children with ICMR standards;  
d) To associate their daily intake of five food groups with their weight status.

## MATERIALS AND METHODS

This cross-sectional study was carried out during the month of March 2022 in Kalivanthapattu Government school, Chengalpattu, Tamil Nadu as a part of a nutritional awareness camp conducted by the Department of Clinical Nutrition and Dietetics, SRMIST, Chennai, Tamil Nadu. Parents were informed about the objectives of the study and their informed consent was obtained.

**Inclusion criteria:** Seventy school children, aged between 11 to 14 years, who attended the nutritional awareness camp at the Government school were included in the study.

**Exclusion criteria:** The students who were not interested in participating in the study and were absent on the days of data collection, were excluded.

### Study Procedure

**Assessment of anthropometric parameters:** Prevalence of overweight, underweight, wasting, and stunting, were assessed by anthropometric variables. Anthropometric measurements such as weight and height were measured by dietitians. Each student wearing a school uniform without footwear was made to stand with their back against a wall, heels together and their height was measured using a stadiometer. A portable weighing scale was used to check the weight of the students. Children were asked to stand on the weighing machine with light clothing with feet apart and looking straight and without footwear. Height for age and weight for age for each child was compared with the ICMR standards [21].

The WHO reference values for school boys and school girls were then used to calculate Z-scores of Body Mass Index (BMI) for age. BMI is calculated by using the equation height in square meters divided by weight in kilograms. BMI-for-age z-score (BAZ) is a popular indicator for determining obesity, overweight, and leanness in kids aged 10 to 19. BAZ <-2SD refers to wasting [22].

**Dietary gap assessment:** The government school children received their lunch through the mid-day meal program. Though their intake in one meal can be balanced, their overall diet needs to be assessed for possible gaps. A predesignated prevalidated dietary assessment tool including ten questions was used to observe the gaps in their dietary pattern [23]. The questions were based on ICMR and National Institute of Nutrition (NIN) recommendations for balanced dietary

intake for adolescents [24]. The questions focused on the best way to consume the recommended intake of each food groups which was direct, short, clear, and pre-defined. The dietary tool included four questions for detecting faulty food practices and six questions for dietary gaps. It took the researcher approximately 5-6 minutes to finish the questionnaire for every sample. The answers were in terms of "Yes" or "No". Scores range from one for "Yes" to 0 for "No" or "Faulty Diet," with a possible overall score of 10. A score less than 10 indicate a gap in the dietary pattern and a "0 score" requires remedial dietary counselling.

Authors categorised the scores as poor, average and good based on the scores as given in their study by Scavedi ML et al., which indicates adherence to suggested dietary guidelines [25]. Hence, in present study too, poor level of dietary pattern indicates far from dietary guidelines, average indicates partially meeting dietary guidelines and high indicates better adherence to dietary guidelines [Table/Fig-1].

Score	Level of dietary pattern
1-4	Poor
5-7	Average
8-10	Good

[Table/Fig-1]: Scoring criteria for dietary pattern.

## STATISTICAL ANALYSIS

The acquired data was analysed statistically using SPSS software. T-test was used to compare the height and weight of boys and girls with ICMR standards. A Chi-square test was used to study the relationship between the intake of food groups and weight status of the children. p-value <0.05 was considered as statistically significant at a 95% confidence interval. Descriptive values were presented as percentages of study population.

S. No.	BMI level	SD score	No. of students n (%)	Male n (%)	Female n (%)
1	Severe thinness	<-2SD	10 (13.69%)	4 (5.4%)	6 (8.2%)
2	Thinness	<-1SD	11 (15.06%)	4 (5.4%)	7 (9.5%)
3	Normal	-2SD to +1 SD	39 (53.40%)	10 (13.6%)	29 (39.7%)
4	Overweight	>+1SD	10 (13.70%)	3 (4.1%)	7 (9.5%)
5	Obesity	>+2SD	3 (4.1%)	0 (0%)	3 (4.1%)

[Table/Fig-2]: Percentage of BMI levels among (malnourished subjects) (N=73).  
BMI: Body mass index

## RESULTS

In present study, out of the 73 children, there were 52 girls and 21 boys with the mean age of 12.09±0.80 years. In present study, 39 (53.4%) children had normal (-2 SD to +1 SD) BMI and others were found to be malnourished. Among the malnourished subjects, 10 (13.69%) were severely thin (BMI <-2 SD), 11 (15.06%) were thin (BMI <-1 SD), 10 samples (13.69%) were overweight (BMI >+1 SD) and three of them (4.1%) were obese (BMI >+2 SD) [Table/Fig-2].

There was a deficit in the mean weight and mean height of selected male students when compared to the ICMR standards. Though there was a deficit in weight among all age groups, there was a significant difference between the mean weight of male students in 12-year age group when compared to ICMR standards [Table/Fig-3].

S. No.	Age	No. of children	Mean Ht (cm)	ICMR Ht (cm)	Deficit	t-value	p-value	Mean Wt (kg)	ICMR Wt (kg)	Deficit	t value	p-value
1	11	3	141	142.7	-1.7	-0.39	0.734	33.3	34.6	-1.266	-0.211	0.853
2	12	11	145	148.4	-3.4	-1.728	0.115	32.5	38.9	-6.445	-2.634	0.025*
3	13	5	153	154.3	-1.3	-1.14	0.318	37.8	44.3	-6.5	-2.399	0.074
4	14	2	146	159.9	-13.9	-2.78	0.22	35.5	50.6	-15.1	-2.745	0.222

[Table/Fig-3]: Comparison of height (cm) and weight (kg) of the male students with ICMR standards.

\*Significant at 5% level; Height (ht), Weight (wt)

The mean height of 11-year-old girls was greater (0.63) than the ICMR standards. Similarly, their weight was also greater (1.73). The deficit in weight (-5.910) of 12-year-old girls, was higher than the deficit in height (-1.638) when compared to ICMR standards. Both height and weight of 13-year-old girls were found to be lesser than the ICMR standards. The difference in mean weight of 12-year-old girls and ICMR standards was found significant ( $p=0.003$ ). Similarly, the 13-year-old female students mean height difference as compared to ICMR standards was also found to be significant with ICMR standards [Table/Fig-4].

S. No.	Age	No. of children	Mean Ht (cm)	ICMR Ht (cm)	Deficit	t value	p-value	Mean Wt (Kg)	ICMR Wt (Kg)	Deficit	t value	p-value
1	11	15	143.9	143.3	0.633	0.33	0.746	37.9	36.2	1.733	0.62	0.545
2	12	21	146.8	148.4	-1.638	-1.134	0.270	35.2	41.1	-5.910	-3.429	0.003**
3	13	16	149.1	152.2	-3.075	-3.458	0.004**	42.4	46.0	-3.563	-1.595	0.135

[Table/Fig-4]: Comparison of height (cm) and weight (kg) of the female students with ICMR standards.

\*\*Significant at 1% level

The majority of the school samples 66 (90.4%) had three meals daily. Sixty five (89%) children included protein-rich sources in their daily meals. Only 10 (13.7%) consumed two to three cups of milk and milk products daily. 40 (54.8%) children had green leafy vegetables daily and 63 (86.3%) consumed other vegetables along with their meals daily. Daily fruit consumption was observed in 49 (67.1%) and 24 (32.9%) children were not consuming fruits daily [Table/Fig-5].

S. No.	Questions regarding food groups	Response	
		Yes n (%)	No n (%)
1	Do you consume cereals in all your 3 main meals daily?	66 (90.4%)	7 (9.6%)
2	Do you take at least one of these items? (pulses/dhal/non-veg/egg) along with your meals daily?	65 (89.0%)	8 (11.0%)
3	Do you take 3 cups of milk/coffee/tea/2 cups of curd daily?	10 (13.7%)	63 (86.3%)
4	Do you take green leafy vegetables daily?	40 (54.8%)	33 (45.2%)
5	Do you take any other vegetables along with your meals daily?	63 (86.3%)	10 (13.7%)
6	Do you take fruit daily?	49 (67.1%)	24 (32.9%)

[Table/Fig-5]: Dietary gap assessment of the samples.

In present study, 38 (52.1%) children were found to have mid-morning and evening snacks, regularly. Only 13 (17.8%) were found to skip their meals and the majority of the children had their regular meals without skipping. Though 53 (72.6%) did not buy and eat processed foods daily. Around 57.5% of students consumed millets as part of their daily diet and 47.5% of students did not consume millets [Table/Fig-6].

S. No.	Questions	Response	
		Yes n (%)	No n (%)
1	Do you have mid-morning and evening snacks daily?	38 (52.1%)	35 (47.9%)
2	Do you consume 3 main meals daily without skipping?	13 (17.8%)	60 (82.19%)
3	Do you avoid buying ready-to-eat processed foods daily?	53 (72.6%)	20 (27.4%)
4	Do you consume any one of the millets daily?	42 (57.5%)	31 (47.5%)

[Table/Fig-6]: Faulty dietary habits of the samples.

[Table/Fig-7] indicates that the majority of the children 52 (71.2%) had an average dietary pattern, 9 (12.3%) were found to have poor dietary habits and only 12 (16.4%) had good dietary patterns.

Score	Mean scores $\pm$ Std. Dev	n (%)
Average	6.13 $\pm$ 0.84	52 (71.2%)
Poor	3.66 $\pm$ 0.5	9 (12.3%)
Good	8.16 $\pm$ 0.38	12 (16.4%)

[Table/Fig-7]: Dietary pattern of the samples.

In present study, among the samples with normal BMI, overall intake of food groups was better except for milk and milk products.

The samples belonging to severely thin and obese category did not consume sufficient milk, green leafy vegetables and other vegetables. The samples belonging to the thin and overweight category did not consume sufficient milk and milk products but their vegetable and fruit consumption was better [Table/Fig-8].

## DISCUSSION

The cereal intake of the samples was sufficient and they also had at least one portion of pulses, egg, and meat which are regarded

as good protein sources along with their main meal. The sufficient cereal and protein intake might have been contributed through the mid-day meal program. Children aged 10 to 18 years were advised to consume three servings of vegetables daily including one portion of green leafy vegetables and two portions of other vegetables (1 portion equals 100 g) [24].

The present study participants were found to take vegetables below the current national guidelines during meals than what is now recommended by the ICMR. Though they have included any one of the vegetables or green leafy vegetables along with their meal, the quantity of intake may not be sufficient to meet the micronutrient requirements for their age. The majority of the students did not consume the recommended amounts of milk and milk products. Many students consumed tea or coffee instead of whole milk which could be attributed to their lower socioeconomic status. The poor dietary score and the faulty dietary habits of the children may be due to a lack of nutritional awareness and the negative influence of media. A systematic review of dietary consumption patterns of 5-15 years old students in certain developing countries also found that the amount of intake was not meeting the Recommended Dietary Allowance (RDA) for their age group [26].

Anthropometric measurements of boys and girls are an important aspect to identify the individual body composition. Among the samples, 53.4% were in the normal range of BMI, and others were found to be either overweight, obese, thin, or severely thin. The prevalence rate of malnourished may be due to an imbalance of nutrients in the diet of the children regardless of gender, and a lack of nutritional awareness of parents. The intake of five food groups by the samples which was assessed through the first six questions in the questionnaire alone was associated to their BMI levels and there was no significant association. But the students who belonged to the normal BMI had better food group intake as per recommendations when compared to those who were malnourished. Though few students had taken three main meals, they were still thin for their age which indicates the lack of intake of a nutrient-dense diet. A slight obesity prevalence among students in government schools suggests increasing physical exercise while also educating them about the need of eating a balanced diet.

This may be due to the difference in income level of parents and family, lack of nutritional knowledge and awareness, and poor dietary habits. Apart from these causes of malnutrition, the consumption of junk foods, snacks, and baked goods also contribute significantly because the majority of them are primary sources of energy and are deficient in macro-and micronutrients [27]. Malnutrition (undernutrition and overweight/obesity) is prevalent in rural adolescents and is connected with prenatal, genetic, and economic factors, according to a double-blind, randomised, controlled experiment involving a total of 2115 individuals done in China [28]. The present study shows the comparison of the results with similar studies done on Government school children belonging to other states and districts [Table/Fig-9] [17-20].



S. No.	Questions	Follow	Severe thinness	Thinness	Normal	Overweight	Obesity	Chi-square value	DF (Degrees of freedom)	p-value
			n (%)	n (%)	n (%)	n (%)	n (%)			
1	Do you consume cereals in all your 3 main meals daily?	No	0	2 (18.2%)	3 (7.7%)	1 (10.0%)	1 (333.3%)	4.112	4	0.391
		Yes	10 (100%)	9 (81.8%)	36 (92.3%)	9 (90%)	2 (66.7%)			
2	Do you take at least one of these items (pulses/dhal/non-veg/egg) along with your meals daily?	No	1 (10%)	1 (9.1%)	4 (10.3%)	1 (10%)	1 (33.3%)	1.617	4	0.806
		Yes	9 (90%)	10 (90.9%)	35 (89.7%)	9 (90%)	2 (66.7%)			
3	Do you take 3 cups of milk/coffee/tea/2 cups of curd daily?	No	10 (100%)	9 (81.8%)	32 (82.1%)	10 (100%)	2 (66.7%)	4.936	4	0.294
		Yes	0	2 (18.2%)	7 (17.9%)	0	1 (33.3%)			
4	Do you take green leafy vegetables daily?	No	5 (50%)	6 (54.5%)	18 (46.2%)	4 (40%)	0	3.079	4	0.545
		Yes	5 (50%)	5 (45.5%)	21 (53.8%)	6 (60%)	3 (100%)			
5	Do you take any other vegetables along with your meals daily?	No	2 (20%)	2 (18.2%)	5 (12.8%)	1 (10%)	0	1.140	4	0.888
		Yes	8 (80%)	9 (81.8%)	34 (87.2%)	9 (90%)	3 (100%)			
6	Do you take fruit daily?	No	5 (50%)	1 (9.1%)	14 (35.9%)	3 (30%)	1 (33.3%)	4.348	4	0.361
		Yes	5 (50%)	10 (90.9%)	25 (64.1%)	7 (70%)	2 (66.7%)			

**[Table/Fig-8]:** Relation between the food groups and weight status of the samples.

\*\*-Significant at 1% level \*-Significant at 5% level

Name of author	Place and year of the study	Sample size	Objective	Findings
Hasan I and Zulkifli M [17]	Azad Nagar, Bangaluru, India. 2010	500	The study was aimed at identifying the prevalence of malnutrition among 500 children of Government schools of Azad Nagar, Bangaluru, south Asia.	Mean height and weight of girls are better than boys of same age. Prevalence of malnutrition of Government school children in Azad Nagar, Bangaluru was found to be 68%.
Karthika P, Thirumani devi A [18]	Sankarankovil, Tirunelveli district, India. 2019	200	The study was conducted in Government aided middle schools in rural area of Sankarankovil, Tirunelveli district.	75% of the subjects did not have fruits in their routine diet.
Kandagal J et al., [19]	Bangaluru, India. 2023	1128	The study aimed to assess the prevalence and aetiological profile of short stature in urban school children of Bangaluru.	Prevalence of short stature was 5.5% and chronic malnutrition with iron deficiency anaemia was the most common cause for short stature.
Patel N et al., [20]	Ahmedabad, India. 2015	28,256	The study conducted on detailed physical health assessment of children studying in class 1-8 (age-5-13 years) of 31 schools of Ahmedabad city, India.	Height and weight of school children (5-13 years age) was much lesser when compared to ICMR standards.
Present study	Government school in Tamil Nadu, India.	73		1. Both mean height and weight of girls are better than boys and prevalence of malnutrition of Government school children in Kalivanthapattu was found to be 46.6% 2. Daily fruit consumption was observed in 67.1% and only 32.9% did not consume it daily. 3. The mean height of 11-year-old children was deficit when compared to ICMR standards, which could be due to lack of sufficient micronutrient intake. 4. Deficit in height and weight when compared to ICMR standards was observed in age group 12 to 14 years.

**[Table/Fig-9]:** Comparison of findings of the study with other similar studies [17-20].

Given that dietary habits are likely to follow people into adulthood, it is vital to change these habits while adolescents are still in the pubertal stage so that they can form good eating habits for maturity.

### Limitation(s)

The current research studied the dietary gaps of students belonging to one particular school, whereas a follow-up research with a larger sample size and more Government schools of this region can give more valid conclusions and can help in making better decisions and policies, to improve the nutritional status of Government school children.

### CONCLUSION(S)

The dietary intake of Government school children was average and there were gross deficiencies in the intake of five food groups though many students belonged to the normal BMI range. Direct association between intake of five food groups and weight status were not observed, but the malnourishment observed in the children could be attributed to inadequate micronutrient intake and faulty dietary habits. Educating the children on inclusion of all five food groups and appropriate nutritional interventions can help in improving their nutritional status.

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**PARTICULARS OF CONTRIBUTORS:**

1. Associate Professor, Department of Clinical Nutrition and Dietetics, The SRM Medical College and Hospital and Research Centre, Chengalpattu District, Chennai, Tamil Nadu, India.
2. Research Scholar, Department of Clinical Nutrition and Dietetics, The SRM Medical College and Hospital and Research Centre, Chengalpattu District, Chennai, Tamil Nadu, India.
3. Lecturer, Department of Clinical Nutrition and Dietetics, The SRM Medical College and Hospital and Research Centre, Chengalpattu District, Chennai, Tamil Nadu, India.
4. Research Scholar, Department of Clinical Nutrition and Dietetics, The SRM Medical College and Hospital and Research Centre, Chengalpattu District, Chennai, Tamil Nadu, India.
5. Research Scholar, Department of Clinical Nutrition and Dietetics, The SRM Medical College and Hospital and Research Centre, Chengalpattu District, Chennai, Tamil Nadu, India.

**NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:**

J Sai Laavanya,  
No. 11, Palaniandavar Street, Radhanagar, Chromepet,  
Chennai-600044, Tamil Nadu, India.  
E-mail: [sailaavanyanutrition@gmail.com](mailto:sailaavanyanutrition@gmail.com)

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