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Research Article

A Study on Assessment of Nutritional Status of Primary School Going Children of Border Security Force in Jalandhar, Punjab

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Abstract

Introduction: *The Border Security Force (BSF), under the Ministry of Home Affairs, is committed to safeguarding India's borders and ensuring the well-being of its personnel and their families residing in dedicated establishments. Ensuring optimal child nutrition is vital for physical and cognitive growth, yet malnutrition remains a significant challenge, characterized by the "triple burden" of undernutrition, micronutrient deficiencies, and overnutrition. Poor diets and misinformation exacerbate these risks, prompting government initiatives like POSHAN Abhiyaan. Despite the importance of this, there is a lack of data concerning the nutritional status of primary school children (7–12 years).*

Methods: *A Cross-sectional observational study was conducted among Primary school children from class I to V were assessed over 06 months for nutritional status, determine the prevalence of malnutrition and to assess the clinical signs of micronutrient deficiencies in this population.*

Results: *Study showed that the prevalence of underweight, overweight & obese of the study are 5.0%, 24.0%, and 6.0% respectively. The prevalence of anaemia (pallor) in the study is 30.0%. Surplus calorie and protein intake is found among the 66.0% and 61.0% respectively of the study population. Rest were consuming diet deficit in calorie and protein.*

Conclusion: *Optimizing child nutrition and health requires a multi-pronged approach involving parents and educators to combat malnutrition, micronutrient deficiencies, and obesity.*

Keywords: *Nutrition, Micronutrients, Overweight, Pallor, malnutrition, Primary school students.*

Introduction

The Border Security Force (BSF), under the Ministry of Home Affairs, safeguards India’s borders and maintain internal security. Since troops and their families reside in BSF establishments, providing child education and nutritional awareness is vital for their well-being and nation’s socio-economic development. Child nutrition is essential for physical and cognitive growth, yet malnutrition remains a global challenge.[1] This includes the “Triple Burden” of undernutrition, micronutrient deficiencies (Hidden Hunger), and overnutrition, which cause severe morbidity in children.[2,3] Poor diets, inadequate knowledge, and social media misinformation further exacerbate these risks. To mitigate these issues, the Government of India has launched initiatives like POSHAN Abhiyan.[4] Moreover, there is no standard Indian data which is centralized and nation-wide report suggesting the nutritional assessment of primary school children between 7 and 12 years of age.

Hence assessing nutritional status accurately of the Primary school going children of BSF is crucial to addressing these deficiencies. This is traditionally evaluated using the "ABCDs" approach:

- Anthropometry: Gold standard measurements of physical growth.
- Biochemical Assessment: Laboratory tests of blood (e.g., Hemoglobin, Vitamin-D levels).
- Clinical Assessment: Physical observations for outward symptoms of malnutrition.
- Dietary Data: Detailed evaluations of food intake and feeding practices.[5]

Ultimately, preventing the ill-effects of malnutrition requires a holistic approach. By monitoring children's health, analyzing dietary patterns, and imparting correct nutritional education to mothers, organizations like the BSF can combat deficiencies. This ensures the healthy development of children, building a stronger foundation for India's future. Thus, we have conducted this study to assess the nutritional status of primary school students at the Border Security Force in Jalandhar Punjab. The Specific objectives were to find out the prevalence of Malnutrition and to assess the clinical signs of Micronutrients deficiency in primary school students in Border Security Force, Jalandhar Punjab.

Materials and Methods

We conducted the cross-sectional observational study over 06 months from April 2024 to Oct 2024. 10 boys and 10 girls each from 5 classes of I-V standards (Class I to Class V) in the Border Security Force, Jalandhar, Western India, after obtaining the written informed consent from one of the parents of all the participants, with no additional clinical or demographic criteria applied and the approval to conduct this study was taken from the Competent Authority. The study sample consisted of 100 primary school children, equally distributed across five groups (n=20 per class). To eliminate sex-based bias, a stratified random sampling approach was used to ensure an equal representation of 10 boys and 10 girls within each group.

The socioeconomic status of the study participants was determined using the Modified Kuppuswamy scale 2023, which is commonly used for urban populations in India. The income categories were adjusted to reflect the 2023 CPI-IW inflationary trends, with a 2016 base year.[6] The primary investigator ensured that the nursing staff (02 Paediatric ward nurses) get standardized, intensive training on equipment and measurement protocols, so that the staff could achieve high reliability. The primary investigator and nursing staff examined the students for anthropometry and clinical assessment for the study in pre-approved methodology. Based on clinical findings, biochemical tests were done to ascertained the symptoms and signs in the students. Dietary assessment was done by pre-approved, objective, semi-quantitative Food Frequency Questionnaire which was

explained to one of the parents in their easily understandable language to avoid confusion, reduce the discrepancy and maintain standardized measurement of the diet. Once good inter-observer reliability was established, all primary school children with the prior consent taken from parents, underwent nutritional assessment by the traditional ABCD approach. The proforma for this study is shown in Figure 1.

Baseline demographic and examination details of the primary school children were collected prospectively in a predesigned study proforma. Based on the data analyzed with the help of IAP Growth Reference charts 2015 for Weight for age, Height for age and BMI for age to know the malnutrition in the study.[7] All the laboratory findings were collected and entered as per the proforma. IAP classification of Weight for age, Height for age and BMI were used to assess the grades of underweight, stunting or tall stature, and under or overweight/Obesity respectively.

The variables recorded were entered in an excel sheet and analyzed using IBM SPSS Statistics software version 20.0. A P-value less than 0.05 was considered statistically significant.

Figure 1: Nutritional Assessment by ABCD approach

1. **Anthropometrical measurement**

S.No.	**Anthropometry**	**Values**	**Percentile as per age & gender on IAP chart**
1	Weight in Kgs		
2	Height in Cms		
3	BMI		

2. **Biochemical methods**

S.No	**Parameter**	**Values**	**Interpretation as per WHO**
1	Hemoglobin in Gms		

3. **Clinical methods**

S.No.	**Clinical signs**	**Nutrient**	**Deficiency or Excess**	**Yes or No**
1	Pallor	**Fe**	Deficiency	
2	Bitot's Spots	Vitamin A	Deficiency	
3	Rickets	Vit D	Deficiency	
4	Osteomalacia	Calcium	Deficiency	
5	Dental caries	Fluoride	Deficiency	
6	Goiter	Iodine	Deficiency	
7	Glossitis/knuckle pigmentation	Vit B12	Deficiency	

4. Dietary method- Semi-quantitative Food Frequency Questionnaire -Select (✓)

Sl No	Food item	0	½	1	1 ½	2	3	4	5	6	8	10+
1	Milk-No. of Glasses											
2	Eggs											
3	Water-No. of Glasses											
4	Biscuits											
5	Fruits											
6	Dry fruits											
7	No.of Roti											
8	Rice –No. of cups 200 Gm											
9	Vegetable curry- No. of cups											
10	Dal- No of cups											
11	Fish pieces											
12	Mutton pieces											
13	Chicken pieces											
14	Sweets											
15	Fruit Juices											
16	JUNCS in Pcs											

Results

Basic demographic characteristics of the study sample shown 59 out of 100 mothers are graduates and above, rest of them are educated up to intermediate and below. The median number of children in each family was 02, 99% of the sample were nuclear families with 96 families belongs to Upper middle class and 4 are of upper class as per the Modified Kuppuswamy Socio-economic Status Scale, 2023 as shown in Table 1.

88.0% of the study are falling into normal range as per IAP 2015 Weight-for-age charts which is corresponding to the socio-economic status of the families of school students, as majority of them belong to Upper middle as Modified Kuppuswamy SES 2023.

Study has shown 98.0% are normal as per IAP 2015 Height-for-age charts, corresponding to the socio-economic status of the school, as majority of the families belong to Upper middle (Modified Kuppuswamy SES 2023) and genetic potential of the parents. As shown in Graph 1, only 2.0% of this group were of tall stature and further evaluation is suggested to find the exact cause.

The study reveals 65.0% of the study are normal as per IAP 2015 BMI-for-age charts. It also shown the prevalence of underweight, overweight and Obese of the primary school going students are 5.0%, 24.0%, and 6.0% respectively **(Graph 2)** corresponding to the socio-economic status of the parents, access to JUNCS and high calorie food. Pandurangi et al. (2022) The burden of stunting and thinness among Indian adolescents shown 27.4% were stunted, 24.4% were thin, 4.8 and 1.1% were overweight and obese, respectively.[8]

Suman et al.(2016) reported the prevalence of underweight, overweight and obesity was found to be 30.0%, 18.33 % and 1.33% respectively and overall prevalence of malnutrition was 49.66%.[9] In another study, shown 19.9% of children were undernourished, 8% were grade I short/stunted whereas 10.2% were overweight and 5.7% obese.[10] Gender-wise comparison of the nutritional status among the primary school-going children revealed a statistically significant difference between boys and girls with respect to their Body Mass Index (BMI) ($P<0.05$). Conversely, no significant differences were observed between the gender groups for Weight-for-Age ($P = 0.569$) and Height-for-Age ($P = 1.000$). **(Table 2)**

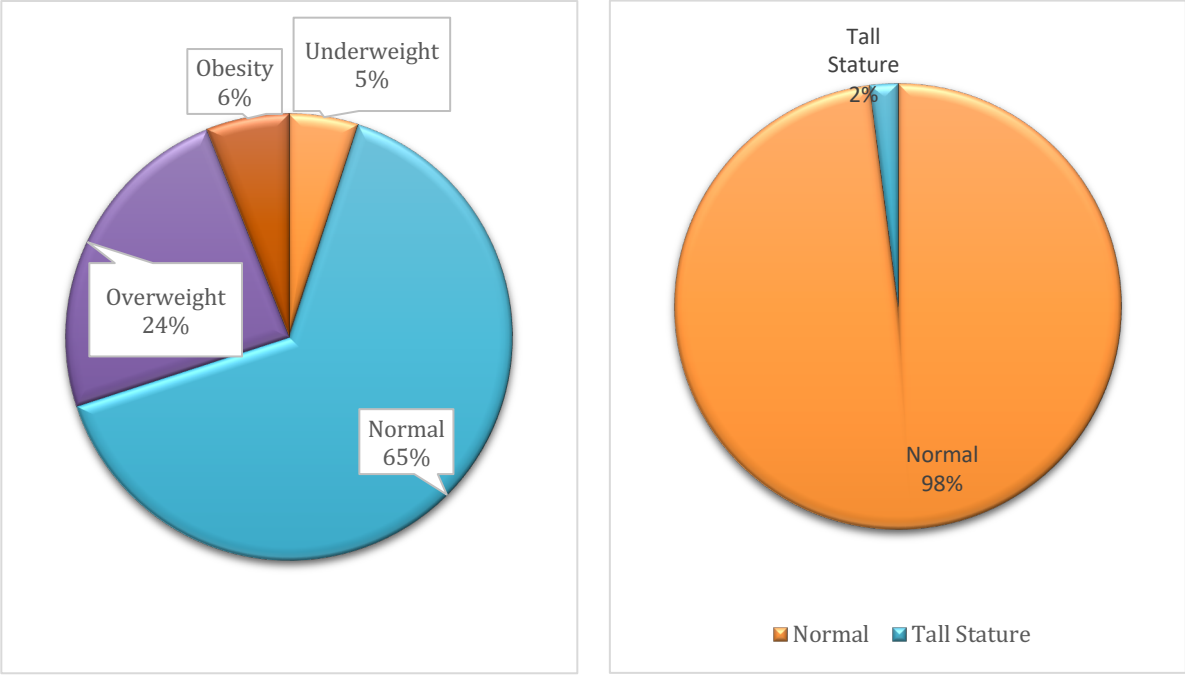
The prevalence of anemia in the study was 30.0%, 22.0% are mild pallor, 8.0% are moderately pale and boys are more anemic than girls **(Graph 3)** as per WHO classification[11]. While we found pallor, no other overt clinical signs of micronutrient deficiency—including angular stomatitis, follicular hyperkeratosis, or bleeding gums were observed.

Analysis of dietary intake reveals that girls are more likely to meet daily calorie (36.0%) and protein (33.0%) requirements compared to boys (30.0% and 28.0%, respectively), with a higher prevalence of deficiency observed among the latter **(Graph 4)**. Despite a general trend towards excess calorie (66.0%) and protein (61.0%) consumption in the study, higher maternal education emerged as a key factor in mitigating dietary inadequacies, underscoring the influence of socioeconomic status on familial nutrition.

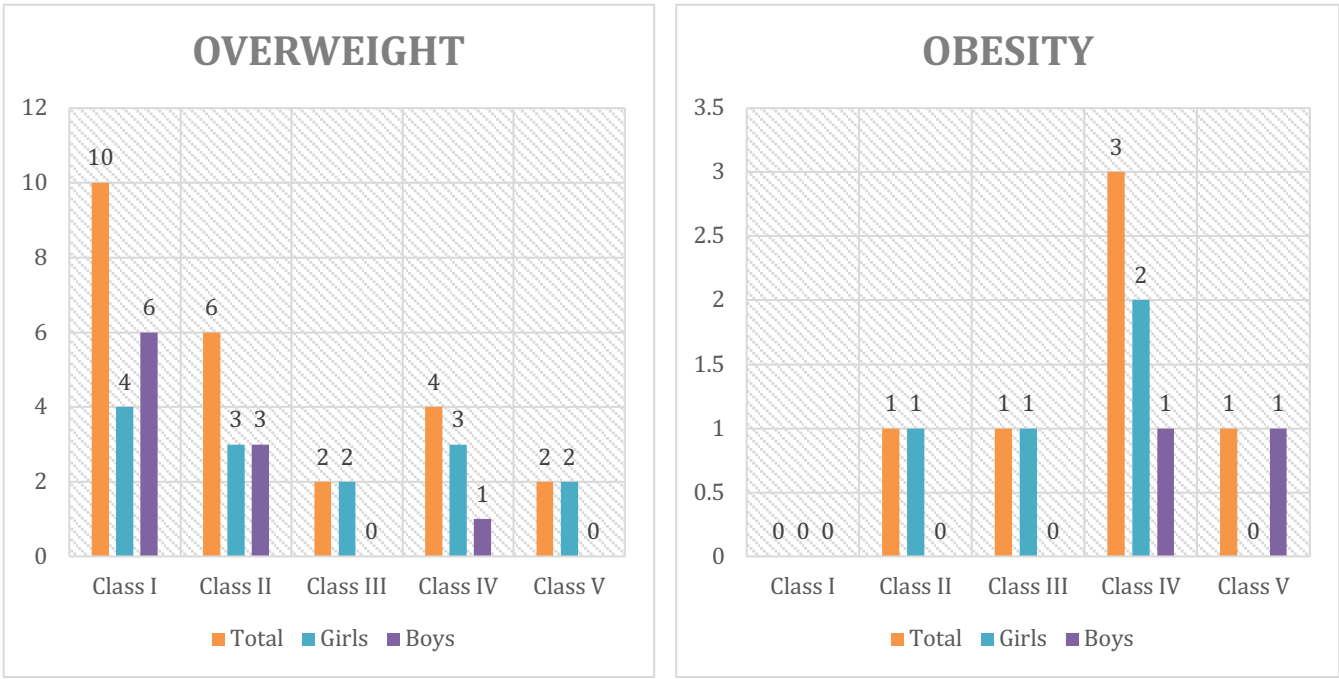
Sl No.	Parameter	Characteristics	N	Percentage
1	Gender	Female	50	50.0 %
		Male	50	50.0 %
2	Religion	Hinduism	84	84.0 %
		Islam	8	8.0 %
		Sikhism	4	4.0 %
		Christianity	3	3.0 %
		Not to reveal	1	1.0 %
		Sikhism	4	4.0 %
3	Caste	General	62	62.0 %
		Other Backward Classes	23	23.0 %
		Scheduled Caste	11	11.0 %
		Scheduled Tribe	4	4.0 %
4	Family type	Nuclear	99	99.0 %
		Joint	1	1.0 %
5	Maternal education	Graduation and above	59	59.0 %
		Intermediate	30	30.0 %
		Up to high school	7	7.0 %
		Primary school	4	4.0 %
6	Maternal occupation	Professional	7	7.0 %
		Semi-professional	4	4.0 %

		Skilled	7	7.0 %
		Semi-skilled	2	2.0 %
		Unemployed	80	80.0 %
7.	Occupation of Head of Family	Professionals	4	4.0%
		Clerk	13	13.0%
		Skilled workers and Shop	1	1.0%
		Plant and Machine operator	5	5.0%
		Craft & related trade workers	10	10.0%
		Technicians and associate	3	3.0%
		Elementary Occupation	64	64.0%
8.	Education of Head of Family	Professionals	1	1.0%
		Graduate	39	39.0%
		Intermediate	47	47.0%
		High school	13	13.0%
7	Modified Kuppuswamy Socioeconomic Status Scale, 2023	Upper class	4	4.0 %
		Upper middle class	96	96.0 %

Table 1: Socio Demographic profile



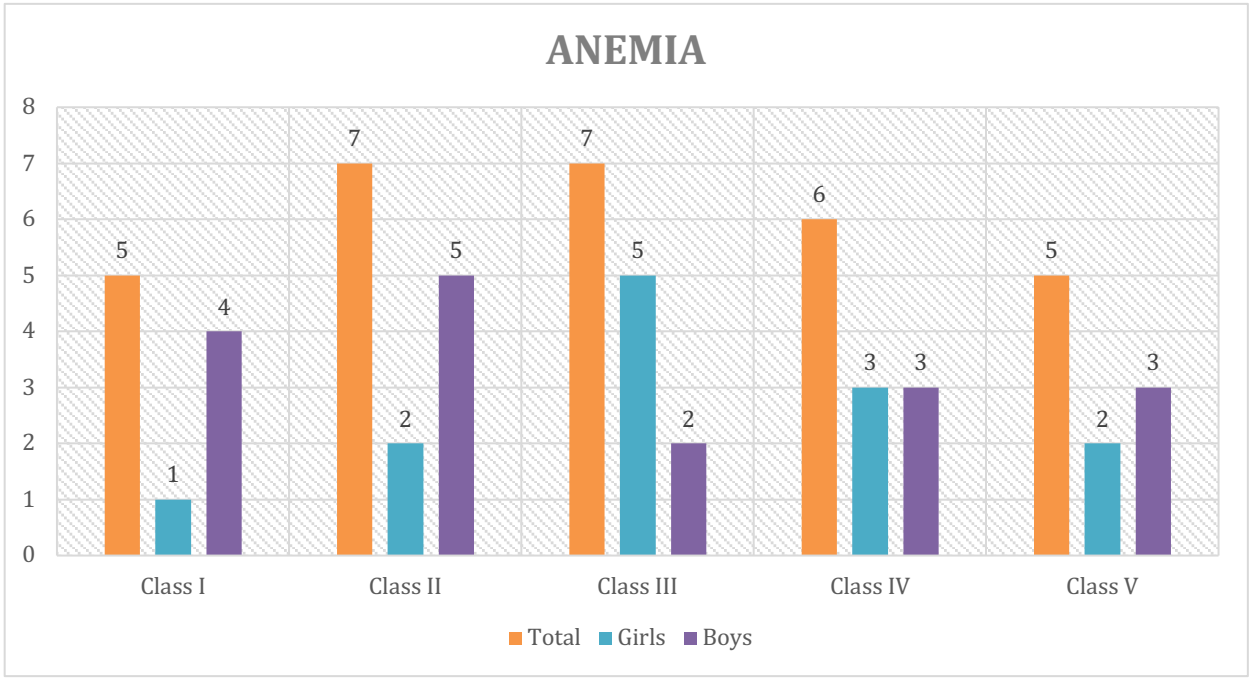
Graph 1: Category of Children as per BMI for Age and Height for Age.



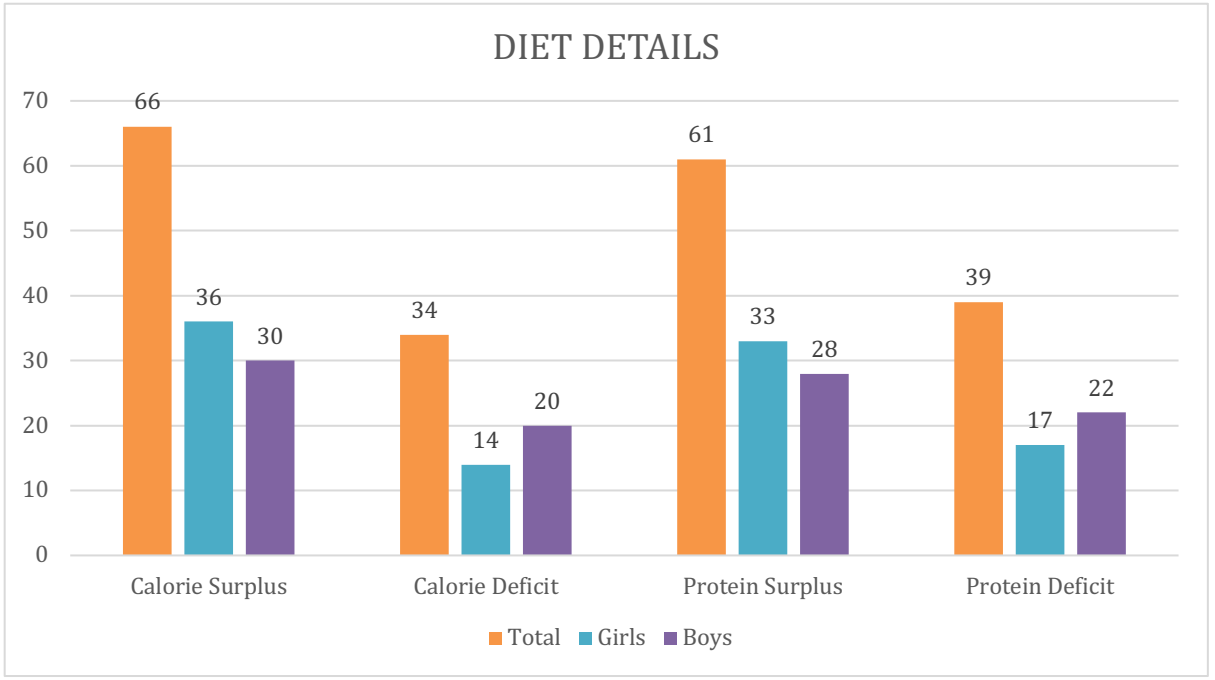
Graph 2 : Class wise comparison of overweight and Obesity in the primary school

Sl No.	Variable	Categories	Girls	Boys	dF	P-value
1.	Weight for age	<3rd Percentile	0	1	3	0.569
		Normal Weight	46	42		
		90-97th percentile	3	5		
		>97th Percentile	1	2		
2.	Height for age	Short stature	0	0	1	1.000
		Normal height	49	49		
		Tall stature	1	1		
3.	Body Mass Index for age	Underweight	5	0	2	0.019
		Normal	27	38		
		Overweight	14	10		
		Obesity	4	2		

Table 2: Gender-wise comparison of Nutritional status of children



Graph 3: Class wise comparison of anemia in the primary school



Graph 4: Gender wise nutritional details in the primary school

Discussion

This 6-month cross-sectional observational study evaluated the nutritional status of 100 primary school children (aged 7–12, classes I-V) at the Border Security Force in Jalandhar, Punjab. The nutritional assessment was done by using the traditional ABCD approach—Anthropometry, Biochemical, Clinical, and Dietary—to provide a comprehensive, holistic evaluation of nutritional status, bridging subjective dietary habits with objective physical and metabolic markers. Our study found a total malnutrition prevalence of 35.0%, with specific rates of 5.0% for underweight, 24.0% for overweight, and 6.0% for obesity. Additionally, 30.0% of children were anemic, with a higher prevalence in boys. Bhoir et al., (2021) shown the prevalence of underweight, overweight and obesity was disproportionately higher in females than that of males.[12] Pandurangi et al. (2022) reveals stunting was higher in girls and the late adolescent age group (15–19 years), thinness and overweight were higher in boys and early adolescence (10–14 years).[8]

The IAP 2015 growth charts are revised growth charts for Indian children, are recommended by Indian Academy of Pediatrics for use in children from 5 to 18 years to replace the old IAP growth charts. The charts with Height-for-Age percentiles are best in detecting pathological short stature and tall stature and Weight-for-Age percentiles are offering a more accurate reference for a healthy weight. The IAP 2015 charts with BMI-for-Age percentiles specifically incorporate BMI cut-offs of 23 and 27, which correspond to the Asian Indian definition of adult overweight and obesity respectively.

Despite the study population primarily belonging to upper-middle/upper-class nuclear families with highly educated, homemakers, a significant nutritional transition was observed. In a study reported that moderate and severe malnutrition was more prevalent in children of homemaker mothers and children of working mothers respectively[13]. There is statistically significant relationship between mother's education and undernutrition (wasting).[14]

The study found a total malnutrition prevalence of 35.0%, with specific rates of 5.0% for underweight, 24.0% for overweight, and 6.0% for obesity. Additionally, 30.0% of children were anemic/pale, with a higher prevalence in boys without any observation of severe paleness and other micronutrient deficiency. Anemia was linked to excessive milk consumption (>400-600 mL/day), poor dietary diversity, and lack of periodic deworming.

Study revealed that more than 60.0% of the children are consuming the calorie and protein in surplus. Dietary assessments indicated that while girls had better calorie and protein adequacy, many boys suffered from deficiencies. In a study shown the adequacy of food intake was ranging from (53.9-98.2 percent) and the adequacy of nutrient intake ranged from 77.31-132.51 percent.[8] Key factors causing malnutrition, particularly the high prevalence of overweight/obesity, included high-calorie intake, lack of dietary diversity,

and easy access to JUNCS (Junk foods, Ultra-processed foods, Nutritionally inappropriate foods, Caffeinated/coloured/carbonated beverages, and Sugar-sweetened beverages) foods.

The strengths of the study are that we evaluated under-researched, objective, and biochemical data, providing fresh insights into paediatric health and nutrition of primary school children. We have applied updated IAP 2015 growth charts, which are better suited for assessing malnutrition and cardiometabolic risk in Indian children compared to older or international standards. We also conducted a comprehensive, pan-India analysis on children of BSF troops from various states and Union Territories.

Though the study was conducted in strict concurrence with the structured protocol and well-defined standards for reference, it still had limitations like small sample size, so further studies with larger sample size are needed. The study was a single center study and required multicentred study to include the rural or urban population to know the nutritional inadequacies. Staff from primary school should also be interviewed to know the awareness of nutrition. Etiology of tall stature, pallor or anemia could not be identified due to resource constraints.

Conclusion

The study highlights a paradoxical nutritional scenario where high-calorie, low-diversity diets lead to elevated overweight and anemia rates despite a high socio-economic background. The study fills a gap in literature by applying updated national standards to a distinct national sample. Strengthening school health programs and promoting awareness regarding nutritional diversity and hygiene are essential to improve the overall physical and cognitive growth of primary school children.

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