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Nutritional Health Evaluation among Tribal Preschool Children of Tamil Nadu, India Based on Anthropometry

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Abstract

Anthropometric measurements have recently become popular for assessing childhood health and nutritional status. Anthropometry is a low-cost, simple, and non-invasive approach to determining a child's nutritional health. There is a scarcity or lack of information on the nutritional status of Aboriginal preschoolers. As a result, research was done to measure the nutritional health of tribal preschool children based on anthropometry. During November and December 2018, a community-based cross-sectional study was done in a village region in Villupuram, Tamil Nadu, India. The present study aims to study the nutritional profile among tribal preschool children of Tamil Nadu, India, based on anthropometry. Weight-for-age, height-for-age, weight-for-height, and mid-upper-arm-circumference-for-age z-scores were used to measure nutritional status. According to the revised WHO reference standards, undernutrition was defined as a Z-score of -2.0 SD. The current study comprised 87 Irula (PVTG) and Malayali (ST) children aged 13 to 60 months. Underweight, Stunting and wasting were prevalent in 61.8%, 38.0 %, and 54.2% of children, respectively. According to MUAC, 57.2% of children were undernourished, with 45.4% and 11.8% being moderately and seriously underweight, respectively. The MUAC demonstrated a strong agreement (Kappa=0.82) with underweight, followed by a moderate agreement (Kappa=0.54) with wasting. On the other hand, Stunting had a poor agreement (Kappa=0.26). The overall prevalence of Stunting was high, while underweight and wasting were very high, indicating a severe situation, according to WHO criteria for severity of malnutrition.

Keywords: Irulas; Malyali; Malnutrition; Tribal; MUAC; Anthropometry

Introduction

Anthropometric assessments have recently become a common way to examine children's health and nutritional status [1,2]. Anthropometry is a low-cost, simple, and non-invasive approach to determining a child's nutritional health [3]. On the other hand, the criterion for determining the nutritional status of the sample population has proven problematic [4]. The World Health Organization [5] recently developed a childhood growth database for international reference or standard, incorporating data from developing countries, including India, for nutritional status assessment, and the results can be presented as nutritional indices in the form of z-scores, percentiles, or percentages of the median. It is commonly known that an appropriate diet is a critical factor in mental and physical development.

On the other hand, malnutrition is becoming more recognised as a widespread and severe health issue in many nations. This problem has significant long-term ramifications for the child and harms a country's development. Protein-energy malnutrition is the most prevalent nutritional issue. In developing nations, malnutrition or undernutrition is a leading cause of illness and premature death among children. Furthermore, residents in India's rural areas have a higher rate of undernutrition than their urban counterparts.

India, i.e. Bharat, has been reported to have the world's most significant number of tribal communities [6]. The vast majority of tribal peoples live in rural areas around the country; the majority are illiterate and work for meagre wages as unskilled labour. India's tribal populations are socially and economically weak [7]. The Irulas (Especially Vulnerable Tribal Groups) and Malayali are two tribes that live in Tamil Nadu's Villupuram district. Malayali made up 45.05 per cent of Tamil Nadu's total tribal population, according to the most recent census. Irulas are the state's second-largest tribal community, accounting for 23.87 % of the state's overall tribal population.

Malayalis are predominantly hill farmers who grow thinai and samai (types of millet). They migrated from Kanchipuram to the hills of southwest Tamil Nadu a few decades ago, originally belonging to the vellala caste of cultivators. The origins of the Malayali tribe are a matter of debate. During the palaver period, evidence of the Malayali tribe's migration to the Jawadhu hills was discovered in Kanchipuram. The Malayali tribes are small-nosed and have a modest stature. They have silky black hair on their heads. Malayalis marry in various ways, and most of the population speaks Tamil. Ragi, rice, samai, millet, and festival occasions are the Malayali tribe's primary foods. The Malayali tribes are non-vegetarians who eat beef, mutton, pig, and rabbit meat. Men are the only ones that consume alcohol, and they used to drink the local variety of alcoholic drinks, just like they do now.

On the other side, after the Malayali tribe, the Irular (a Dravidian ethnic group) is the second-largest Scheduled Tribe. Except in Andhra Pradesh, they are primarily found in India's southern states. According to the 2011 Indian census, most Irular live in Tamil Nadu, particularly in the northern districts. Both men and women have irular, black, curly hair, a broad nose and face, and are short. Irular can be divided into several subgroups based on where they live. Adivasi, malaiyar, kattukaaran, villiyan, atchers, and shikari are some subgroups; more than seven-ninths of Irular inhabitants live in Tamil Nadu's north-eastern state. Thiruvallur, Kancheepuram, and Tiruvannamalai districts in Tamil Nadu have four-ninths of the Irular populace [8]. By adopting the WHO-recommended z-scores method based on three regularly used indices: weight-for-age, height-for-age, and weight-for-height, there is a shortage of community-based data on the nutritional health of indigenous preschool children. As a result, the current study looked into the frequency of underweight, Stunting, and wasting among tribal preschool children in the Villupuram region of Tamil Nadu, so the present study aims to study the nutritional profile among tribal preschool children of Tamil Nadu, India, based on anthropometry.

Materials and Methods

A cross-sectional study was conducted in November and December 2018 in a Villupuram district village inhabited by people of the Irulas and Malayali tribes. The town is around 36 kilometres west of Pondicherry and 170 kilometres from Chennai, Tamil Nadu's capital. In Tamilnadu's Tindivam, Vanur, and Marakkanam blocks, there are 201 families. The average number of family members in the investigated household was 4.8 2.4, and each family's middle child was 2.421.8. Following a house-to-house visit, it was discovered that these three blocks housed 98 children ages 13 to 60 months. To establish the nutritional status of 87 children, 41 males and 46 girls were measured. During the study period, eleven children were excluded due to illness. A pre-tested questionnaire was used to collect age, gender, and anthropometry (height and weight) information. The children's ages were recorded as given by the moms and double-checked with other senior household members. Parents were told about the study's goals, and each parent's agreement was obtained orally and in writing before data was collected.

Several anthropometric measurements were taken, such as height (Ht), weight(Wt), and mid-upper arm circumference (MUAC), and were followed for each individual [9,10]. The weight, height, and MUAC were measured nearest 0.1 kg and 0.1cm, respectively, using a conventional anthropometric apparatus, weighing scale, anthropometer rod, and fibre tape. The scale was calibrated every day before data collection with a known weight. Weight-for-age (WAZ), height-for-age (HAZ), weight-for-height (WHZ), and MUAC-for-age z-scores < -2.0 SD of the WHO (2006) reference criteria were used to determine the prevalence of underweight (UW), Stunting (S), wasting (W), and undernutrition (UN). Prevalence of severe and moderate undernutrition was defined as Z- score ≤-3.0 and ≥3.0 - < -2.0, respectively. Further, the nutritional status was assessed based on cutoff points for MUAC [11] as documented by earlier studies [7,12,13,]. A MUAC of 13.5 cm was used to identify undernourished children, with a MUAC of 12.5 cm to 13.5 cm indicating moderate undernutrition and less than 12.5 cm indicating severe undernutrition [11]. As a result, MUAC has been regarded as a reliable and straightforward screening tool for protein-energy deficiency in preschoolers [14]. The researcher used the WHO [3] criteria for determining the severity of malnutrition in children based on the percentage prevalence ranges of these three indicators. A student's t-test examined gender differences in Ht, Wt, and MUAC. Proportion tests were used to see gender variations in the prevalence of UW, S, and W. The odds ratio (OR) and correlation coefficient (r) was calculated. The SPSS statistics software was used to conduct the statistical analysis. Statistical significance is defined as a p-value of less than 0.05.

Results

A nutritional health evaluation among tribal preschool children typically involves assessing their overall nutritional status, growth patterns, dietary intake, and health indicators. Here are some key components that may be considered during such an evaluation.

- Anthropometric Measurements: Anthropometric measurements provide information about the child's growth and nutritional status. These measurements may include height or length, weight, and head circumference. These measurements are usually compared to growth charts specific to the child's age and gender to determine if they are within normal ranges.
- Dietary Assessment: Assessing the children's dietary intake helps to understand their nutritional habits. This can be done using various methods, such as 24-hour dietary recall, food frequency questionnaires, or food diaries. It helps to identify any deficiencies or excesses in their diet and provides insights into their eating patterns.
- Micronutrient Assessment: Micronutrients are essential for children's growth and development. An evaluation may include assessing the intake or blood levels of essential micronutrients like iron, vitamin A, vitamin D, zinc, and iodine. Deficiencies in these nutrients can negatively impact a child's health and development.
- Clinical Examination: A physical examination is conducted to assess the child's general health. This may involve checking for signs of nutritional deficiencies, such as pale conjunctiva (indicative of anaemia), brittle hair, or poor skin condition. Other health parameters like heart rate, blood pressure, and organ function may also be evaluated.
- Haemoglobin Levels: A blood test often measures haemoglobin levels to evaluate the child's iron status. Low haemoglobin levels can indicate anaemia, a common nutritional deficiency among children.
- Immunization Status: The evaluation may include checking the child's immunization records to ensure they have received the necessary vaccinations, which are crucial for protecting against infectious diseases.
- Health and Hygiene Practices: Assessing the child's overall health and hygiene practices can help identify any factors that may affect their nutritional well-being. This may include evaluating access to clean water, sanitation facilities, and hygiene practices like handwashing.
- Socioeconomic and Environmental Factors: Factors such as family income, parental education, access to healthcare services, and the child's living conditions can significantly impact their nutritional health. Evaluating these aspects provides a broader understanding of the child's environment and potential influences on their nutrition.
- Health Education and Intervention: Based on the evaluation findings, appropriate health education and interventions can be planned. This may involve providing nutritional counselling, promoting healthy eating practices, addressing deficiencies through supplementation or dietary modifications, and improving overall access to healthcare services.

It's important to note that conducting a nutritional health evaluation requires a multidisciplinary approach involving healthcare professionals, nutritionists, and social workers who have experience working with tribal communities. The review should be culturally sensitive and consider the unique dietary and lifestyle practices of the tribal population.

Age (months)	**12 (N=9)**	**2 (N=10)**	**3 (N=21)**	**4 (N=22)**	**5 (N=25)**	**Total (N=87)**
Mean±SD	8.4±2.5	16.6±3.8	29.2±2.8	45.6±2.6	50.4±1.8	32.4±10.7
AC	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Height (cm)	71.5±2.4	80.6±4.6	91.2±2.6	94.6±3.2	101.4±4.8	93.4±8.6
Weight (kg)	7.6±1.5	8.6±2.1	11.5±2.2	12.9±1.8	13.9±2.6	12.0±2.6
MUAC (cm)	12.2±1.5	12.8±1.2	13.9±1.4	14.0±1.4	14.1±1.8	13.8±1.4
Z-scores						
Weight-for-Age	-2.0±1.0	-2.7±0.8	-2.1±1.0	-2.0±0.8	-2.1±1.1	-2.1±1.0
Height-for-Age	-2.1±1.0	-2.1±1.2	-1.4±1.1	-1.8±1.2	-1.7±1.2	-1.7±1.2
Weight-for-Height	-1.5±1.0	-2.4±0.9	-2.1±1.1	-1.8±1.2	-2.0±1.2	-1.9±1.3
MUAC-for-Age	-1.1±0.8	-2.0±0.6	-1.6±1.1	-1.7±1.0	-1.9±1.2	-1.8±1.2

Table 1: Distribution of Irula and Malyali Children According to Their Age, Anthropometric Characteristics (AC) and Z-Scores.

The mean age of the presently studied sample was 32.4±10.7 months. Anthropometric characteristics and z-scores for all and by age groups are presented in Table 1. It was observed that mean height for boys (93.4±8.6) Vs girls (94.6±10.8), t=0.424), mean weight for boys (11.95±2.2) Vs girls (12.0±2.8) t=0.286), Similarly MUAC for boys (13.9±1.4) Vs girls (13.9±1.5), t=0.189) and z-scores values, i.e. WAZ (-2.17±1.03 Vs -2.18±1.12), HAZ (-1.47±1.35 Vs -1.59 ±1.19), WHZ (-2.07±1.26 Vs -1.85±1.29) and MUACZ (-1.76±1.21 Vs -1.72±1.16) were similar in both sexes.

Underweight (Low weight for age)	**Both (n = 87)**	**Boys (n = 41)**	**Girls (n = 46)**	**Chi-square (p-value)**
Prevalence of underweight	61.8	60.7	62.9	0.05
(<-2 z-score)	(48.2– 71.3)	(41.2 - 74.3)	(45.2 - 74.6)	-0.812
Prevalence of moderate underweight	34	33.7	34.3	0.01
(<-2 z-score and >=-3 z-score)	(23.5 - 46.0)	(19.2 - 51.2)	(20.8 - 50.8)	-0.936
Prevalence of severe underweight	27.8	27	28.6	0.03
(<-3 z-score)	(18.3 - 39.6)	(14.2 - 44.4)	(16.3 – 45.1)	-0.864
Stunting (Low height for age)				
Prevalence of Stunting	38	36	39	0.08
(<-2 z-score)	(26.4 - 49.4)	(20.8 - 53.4)	(24.4 – 55.3)	-0.763
Prevalence of moderate Stunting	24.3	23.1	25.2	0.05
(<-2 z-score and>=-3 z-score)	(14.7 - 35.2)	(10.7 - 39.8)	(13.1 – 41.2)	-0.835
Prevalence of severe Stunting	13.2	12.9	13.8	0.06
(<-3 z-score)	(6.4 - 23.4)	(5.6 - 28.6)	(6.4 – 28.3)	-0.802
Wasting (Low weight for height)				
Prevalence of global malnutrition	54.2	58.8	51.2	0.48
(<-2 z-score)	(42.2 - 65.7)	(41.2 - 74.3)	(34.5 – 66.0)	-0.476
Prevalence of moderate malnutrition	31.7	36.1	28	0.48
(<-2 z-score and >=-3 z-score)	(21.3 - 43.2)	(20.8 - 53.4)	(15.2 – 44.1)	-0.477
Prevalence of severe malnutrition	22.5	22.7	22.3	0.01
(<-3 z-score)	(13.6– 33.5)	(11.8 - 40.9)	(11.4 – 38.0)	-0.96

Values are % and 95% Confidence Interval (CI).
Table 2: Prevalence of Underweight (UW), Stunting (S)and Wasting (W) of The 1-5 Year Children.

Table 2 presents the prevalence of UW, S and W of the studied subjects for the total and by sex of the subjects. It was observed that, overall,61.8 % of tribal children were underweight. 34.0% and 27.8% of children were moderately and severely underweight. Moreover, 60.7% were underweight, of whom 33.7% and 27.0% were moderately and severely underweight. Similarly, 62.9 % of girls were underweight; 34.3% and 28.6 % were moderately and severely underweight. The result revealed that overall, 38.0 % of tribal children were stunted. 24.3% and 13.2% of children were moderately and severely stunted, respectively. It was observed that girls (39.0 %) were more stunted than boys (36.0%). Similarly, a higher prevalence of moderate and severe Stunting was observed among girls. Moreover, the overall prevalence of wasting was 54.2%. Of these, 31.7% and 22.5% of children were moderately and severely wasted, respectively. The boys were (58.8%) more wasted than the girls (51.2%); they had 42% (OR=1.42, 95% CI: 0.47- 4.28) more risk of being wasted. Similarly, moderate and severe wasting was slightly higher among boys. The results showed no significant sex differences in underweight, Stunting and wasting, respectively.

Mid-upper arm circumference (MUAC)	Both (n = 87)	Boys (n = 41)	Girls (n = 46)		Chi-square (p-value)
Severe (<12.5 cm)	15.5	17.3	17.7		0.01
	(8.25-29.18)	(5.21-38.64)	(6.17-36.24)		-0.859
Moderate (12.5 – 13.4 cm)	36	33.9	37.7		0.1
	(20.42-52.09)	(15.38-60.31)	(19.64-62.32)		-0.749
Undernutrition (<13.5cm)	53.5	51.2	55.4		0.11
	(35.20-72.09)	(26.58-81.32)	(30.58-82.57)		-0.729
MUAC-for-age z-score					
Severe (<-3sd)	11.8	9.2	14		0.02
	(4.41-22.15)	(2.12-25.12)	(4.64-33.34)		-0.894
Moderate (-3sd - <-2 sd)	45.4	53.9	37.8		1.7
	(24.85-60.18)	(31.38-84.51)	(19.63-62.45)		-0.182
Undernutrition (<-2 sd)	57.2	63.1	51.8		0.92
	(40.15-72.24)	(37.12-96.40)	(30.45-81.24)		-0.346
Z-scores					
Weight–for–Age (WAZ)	0.80**	0.87***	0.74***		
Height-for-Age (HAZ)	0.57***	0.52*	0.63***		
Weight–for–Height (WHZ)	0.52***	0.62**	0.43*		
Nutritional Status	**Sensitivity (%)**	**Specificity (%)**	**Predictive value (%)**		**Kappa**
			Positive	**Negative**	
Underweight	91	97	98.4	86.8	0.82
Wasting	81.4	73.6	79.5	76	0.54
Stunting	77	56	52.6	79.4	0.26

Values are % and 95% Confidence Interval **(CI); (***p<0.01),(**p<0.001), (***P<0.0001)

Table 3: Children's nutritional status based on MUAC, MUAC-for-Age z-score, Correlation coefficient (r) between MUAC-for-Age with WAZ, HAZ and WHZ and Screening test of undernutrition based on MUAC and UW, S, W.

The nutritional status of children based on MUACon MUAC-for-Age z-score is presented in Table 3. The prevalence of undernutrition using Shakir's cutoff point for MUAC measurement was 53.3%, out of whom 36.0% and 15.5% of children were moderately and severely undernourished, respectively. More importantly, girls (55.4%) were more undernourished than boys (41.2%), they had nearly 16% (OR=0.82, 95% CI: 0.28-2.51) more risk of being undernourished, but results showed no statistical significance. Moreover, the prevalence of malnutrition based on the MUAC-for-age z-score was 57.2%, of whom 45.4% and 11.8% of children were moderately and severely malnourished, respectively. The overall prevalence of malnutrition was more among boys than girls (63.1 vs 51.8; p>0.05). More importantly, the MUAC-for-age z-score had a good significant positive correlation with WAZ (r=0.80, p<0.001) followed by HAZ (r=0.57, p<0.001) and WHZ (r=0.52, p<0.001), respectively.

The screening test results are also shown in Table 3. The MUAC demonstrated a strong agreement (Kappa=0.82) with underweight, followed by a moderate agreement (Kappa=0.54) with wasting. On the other hand, Stunting had a poor understanding (Kappa=0.26). Furthermore, the MUAC demonstrated significant sensitivity, specificity, and negative and positive predictive power for detecting underweight children rather than wasting and stunting in malnourished children.

Discussion

Tribal children often face specific nutritional problems that are influenced by various factors, including their socio-economic status, access to healthcare, cultural practices, and the availability of nutritious foods. Undernutrition in 1-5 year children is a significant public health issue in many developing nations, including India. It has long been known that economically and socially disadvantaged people are more likely to be malnourished than others. Tribal populations in India are considered financially and socially disadvantaged groups. 61.8%, 38.0%, and 54.2% of people of all ages and genders, respectively, were underweight, stunted, and wasting. According to the World Health Organization's (1995) definition of malnutrition severity, the overall prevalence of Stunting (30–39%) was in the high group. However, the rates of underweight and wasting were alarmingly high (30% and 15%, respectively), indicating a difficult situation.

Compared to age-specific mean weight and height with Indian affluent children, the Irula and Malyali children were lighter and shorter in all age groups [8]. Similarly, previous Indian studies Swaminathan, et al. [15] Banik, et al. [16] Vijayaraghavan, et al. [17] have reported higher mean anthropometric values among children of higher socioeconomic groups. More importantly, the present study found no significant sex difference in mean anthropometric and z-score values, as reported recent study [7,1]. The study rejects the sexbiasness of food allocation and care. However, the prevalence of malnutrition in socio-economically weaker groups is still higher [18].

It is observed that the prevalence of underweight is similar to the rates of underweight Gond Rao, et al. [19] and Koramudi [7] tribal preschool children. However, the prevalence was higher than the Kawar [20] tribal children. The underweight rates were lower than the Saharia Rao, et al. [21] and tribal children from Maharastra [22]. When compared to the prevalence of stunting with other tribal children in India, it was observed that the majority of Stunting is similar to Lodha children Bisai, et al. [23], lower than Gond Rao, et al. [19], and Sahara Rao, et al. [21] tribal children studied in different parts of India. Moreover, the prevalence of wasting was higher than in all those studies conducted among other tribal communities [7,19-23]. Because wasting is a composite sign of immediate and chronic or long-term nutritional deficits, the children in this study were under immediate and long-term nutritional stress.

When compared to the prevalence of undernutrition with scheduled tribes (Toda and Kota) children of Tamil Nadu, results indicated that most Stunting was similar in both tribal children. However, the underweight and wasting were higher in tribal children than the caste children [24]. Similarly, a higher rate of undernutrition among tribal children than among caste and other groups has also been reported in a recent Indian national survey [18]. Dietary deficiencies are extensively documented, as evidenced by the high prevalence of malnutrition in underweight, Stunting, and wasting in Indian preschool (1-5 years) children. Tribal communities in India face discrimination regarding income distribution and social status, and their malnutrition rates are higher.

Furthermore, high rates of low birth weight, inadequate treatment, and limited access to health services result in high rates of child undernutrition, endangering the development process and contributing to increased morbidity and mortality rates. As a result, indigenous,i.e. tribal communities, require considerably more access to healthcare knowledge, opportunities, and resources to enhance their children's nutritional status. Using Shakir's cutoff point for MUAC measurement, the prevalence of undernutrition in the current study was 53.5%, with 36.0 % and 15.5% of children being moderately and severely undernourished, respectively.

When MUAC-for-age z scores were utilised to assess nutritional status, a higher proportion of undernutrition (56.9%) was discovered. These rates were more significant than those seen in Punjab Kaur, et al. [25], Orissa Chakrabarty, et al. [26], Kolkata, West Bengal Chatterjee and Saha [27], and Nadia, West Bengal [27,28]. 38.5%, 35.6%, 35.1%, and 28.6% were the respective rates.Using both z-scores (Weight–for–age, height–for–age, and weight–for–height) and MUAC (MUAC-for–age and set cutoffs), our investigation revealed that the nutritional state of these1-5 year children was serious, with very high rates of undernutrition. However, it is important to note that the present study had certain limitations, including a small sample size and the lack of data on dietary intake. Due to a lack of information, determining the quantity and quality of food provided to participants is difficult.

Furthermore, the MUAC was found to have a substantial positive connection with WAZ, HAZ, and WHZ in the current investigation. MUAC should be favoured over WAZ, HAZ, and WHZ indices since large-scale studies are considerably easier to quantify. As a result, with limited resources and a qualified crew, it may be more suited to employ MUAC for human population surveys, particularly among developing country rural populations [23]. WAZ, HAZ, WHZ, and MUAC might all be used to assess nutritional status; however, the latter may be favoured due to its simplicity. There is no need for a scale, an anthropometric rod, or a calculator. MUAC to detect child malnutrition is affordable and straightforward to learn and conduct. As a result, MUAC is becoming more widely employed in developing nations for rapid and comprehensive nutrition surveillance and screening [29,30].

Conclusion

The Irula and Malyali1-5 year children of Villupuram, Tamil Nadu, are critical. Since undernutrition is intricately linked with morbidity and mortality, improving nutritional status is paramount to ensure the child's well-being. In this regard, relevant authorities must enhance the nutritional status of these children to improve their health status. One of the study's shortcomings was the lack of data on illness. Future studies on the nutritional status of tribal children should incorporate various measures of morbidity. Such investigations will provide valuable information on the relationship between undernutrition and illness.

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The Competing Interests

The author declares that there are no competing interests.

Conflict of Interest

No conflict of interest

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