



Assessment of Nutritional Status of School going Adolescent Children in Nanded District of Maharashtra, India

PRADNYANAND JONDHALE¹ AND ANJALI KURANE²

¹Pradnyanand Jondhale, Research Scholar, Department of Anthropology, Savitribai Phule Pune University, Pune (MH), India.

²Anjali Kurane, Sr. Professor, Department of Anthropology, Savitribai Phule Pune University, Pune (MH), India.

E-mail: ptjondhale@gmail.com, anjane08@gmail.com

Received : 02 November 2024 • **Revised :** 30 November 2024;

Accepted : 11 December 2024 • **Published :** 30 December 2024

Abstract: Nutritional status can be evaluated through various approaches, including dietary analysis, anthropometric assessments, biochemical tests, and clinical observations. Among these, **anthropometric measurements** notably weight and height are the most widely used to formulate indicators of malnutrition in children. **Body Mass Index (BMI)** is regarded as the most effective and objective anthropometric measure for assessing adult nutritional status. The purpose of this study is to find the nutritional status of school going children in Nanded district of Maharashtra. To assess the anthropometric indices among the children. A total number of 878 Andh tribal children (457 boys, 421 girls) aged 10+ to 18+ years, integrating anthropometric measurements with key socioeconomic determinants. The findings reveal a pervasive burden of undernutrition: 87.31% of boys and 73.87% of girls are classified as thin (low BMI-for-Age), and 71.33% of boys and 62.23% of girls are underweight (low Weight-for-Age). Additionally, 23.85% of boys and 19.00% of girls exhibit mild stunting (low Height-for-Age). Overweight and obesity are negligible. Nutritional trend analysis of weight, height with lower absolute values compared to well-nourished populations. Socioeconomic indicators reveal low parental education (especially maternal illiteracy), predominant reliance on low-income farming and labor, and a prevalence of medium to large family sizes. These factors are strongly correlated with the observed undernutrition, suggesting that limited household resources and knowledge perpetuate nutritional deficits. The study underscores undernutrition as a critical public health crisis in this vulnerable tribal community, necessitating multi-faceted interventions addressing both nutritional and socioeconomic determinants.

Keywords: School children, Anthropometry, Stunting, undernutrition, Socioeconomic

TO CITE THIS ARTICLE

Pradnyanand Jondhale & Anjali Kurane (2024). Assessment of Nutritional Status of School going Adolescent Children in Nanded District of Maharashtra, India, *Man, Environment and Societys*, 5(2), pp. 225-238. DOI:10.47509/MES.2024.v05i2.07

Introduction

Child and adolescent malnutrition remains a formidable global public health challenge, particularly in low- and middle-income countries. In India, tribal populations, often residing in geographically isolated and socioeconomically disadvantaged regions, exhibit disproportionately higher rates of undernutrition compared to the general population (Singh & Singh, 2016; Parida *et al.*, 2025). Anthropometric measurements serve as invaluable tools for assessing nutritional status and monitoring growth patterns, providing critical insights into the health and developmental trajectories of children (WHO, 2007). Beyond direct nutritional intake, socioeconomic factors such as parental education, occupation, family size, and income are recognized as fundamental determinants influencing a child's nutritional well-being (Aguayo *et al.*, 2015; UNICEF, 2024).

The BMI, which is calculated using an individual's weight and height regardless of sex, shows a strong and consistent correlation with body mass and is minimally affected by height variations (Das & Bose, 2012). Given India's vast ethnic diversity, BMI is considered a particularly suitable tool for evaluating nutritional status across different population groups (Khongsdier, 2001). Nutritional assessment involves identifying deviations from established anthropometric norms. In developing nations, undernutrition is primarily attributed to factors such as poverty, inadequate hygiene, and limited access to preventive and healthcare services (Mitra, 1985; WHO, 1990).

This study focuses on the prevalence of undernutrition (stunting, underweight, thinness) among the Andh tribal community (boys and girls aged 6+ to 18+ years) an indigenous group in Maharashtra, India. Despite national progress in economic development, many tribal communities continue to face persistent challenges related to food insecurity, limited access to healthcare, and educational disparities. Understanding the specific nutritional status and growth trends, coupled with an analysis of their socioeconomic context, is crucial for developing targeted and effective public health interventions.

Methodology

Study Design, Area, and Participants

This study employed a community-based cross-sectional design to assess the nutritional status and growth patterns of school-going adolescents. The research was conducted within the Andh tribal community residing in six rural blocks (Bhokar, Hadgaon,

Himayatnagar, Kinwat, Mahur, and Modkhed) of Nanded District, Maharashtra, India. These blocks were purposively selected due to their high tribal population density. The data collection took place over a period from June 2016 to October 2019.

The study population comprised 878 school-going Andh tribal children, specifically adolescents aged 10+ to 18+ years (457 boys and 421 girls). A stratified random sampling method was utilized to ensure representation across the specified age groups and geographic areas. Children with known chronic diseases were excluded from the study to ensure that the assessment of nutritional status primarily reflected environmental and socioeconomic influences rather than underlying pathological conditions.

Data Collection Tools and Procedures

Data were collected using a simple random sampling method was used pre-designed, structured questionnaire sheet. The questionnaire encompassed three main sections:

1. **Socio-demographic Data:** This section gathered information on age, sex, scholastic year, residence, family income, number of family members, number of rooms in the household, birth order, and the educational and occupational status of both the father and mother.
2. **Assessment of Nutritional Status through Anthropometry:** Anthropometric measurements were meticulously collected using standardized techniques and calibrated instruments:
 - **Weight (kg):** Measured using a digital weighing scale, recorded to the nearest 0.1 kg.
 - **Height (cm):** Measured using an Anthropometric Rod, recorded to the nearest 0.1 cm.

Data collection procedures varied slightly based on the child's age: older children participated in direct interviews, while for younger children, questionnaire sheets were completed by their parents/guardians with the cooperation and assistance of their teachers.

Socioeconomic data, including parental education, occupation, family size, and income, were specifically collected through structured questionnaires administered to parents/guardians:

Ethical Considerations

Prior to data collection, ethical approval was obtained from the Savitribai Phule Pune University, Pune institutional ethics committee. Informed consent was secured from

the parents or legal guardians of all participating children. Additionally, verbal assent was obtained from children aged 10+ years and above, ensuring their willingness to participate. Confidentiality of all collected data was maintained throughout the study.

Data Analysis

The collected anthropometric and socioeconomic data were subjected to comprehensive statistical analysis using appropriate software.

Nutritional Status Classification: The nutritional status of the children was assessed using standard anthropometric indices, classified as follows:

- I. BMI-for-Age
- II. Weight-for-Age
- III. Height-for-Age
- IV. Socioeconomic Impact: education of Parent, occupation, family size, and income

Results and Discussion

The provided **Table No.1: Distribution of Boys and Girls by Age Group** presents data on the number of boys and girls in each age group from **10+ to 18+ years**. The table presents the number of boys and girls distributed across different age groups ranging from 10+ to 18+ years. It includes a total of **457 boys** and **421 girls**, making the overall population **878 children**. Each row corresponds to a specific age, with separate columns indicating the count of boys and girls in that age group.

Table 1: Distribution of boys and Girls Age group

<i>Sr. No.</i>	<i>Age, years</i>	<i>Boys</i>	<i>Girls</i>
1	10	49	42
2	11	53	53
3	12	48	50
4	13	54	45
5	14	52	50
6	15	48	41
7	16	54	46
8	17	53	46
9	18	46	48
	Total	457	421

The table No. 2 presents data on the total number of students categorized by gender. It breaks down the total student population into two groups: **boys and girls** and expresses both the **number** and **percentage** representation of each group within the total. The study included a total of 878 Andh tribal children, with a near-even distribution of sexes: 457 boys (52.05%) and 421 girls (47.94%). The age range spanned from 6 to 18 years, providing a comprehensive view of adolescent growth.

Table 2: Distribution of Students According to their Gender

<i>Sr. No.</i>	<i>Gender</i>	<i>Number of Children</i>	<i>Percentage %</i>
1	Boys	457	52.05%
2	Girls	421	47.94%
Total		878	100.00%

Nutritional Status of Andh Tribal Children

The anthropometric indices reveal a critical nutritional landscape marked by widespread undernutrition.

Body Mass Index for Age (BMI-for-Age)

The BMI-for-Age data unequivocally points to a pervasive issue of chronic energy deficiency (thinness) across all age groups for both sexes. This suggests inadequate dietary intake and/or high energy expenditure, leading to insufficient weight-for-height. The “double burden of malnutrition” (coexistence of undernutrition and overweight) is largely absent in this adolescent cohort, with undernutrition being the overwhelming public health priority.

The prevalence of thinness is alarmingly high. An overwhelming 87.31% of boys and 73.87% of girls are classified as thin (CED I, II, or III). Specifically, severe thinness (CED III, BMI <16) affects 43.11% of boys and 32.55% of girls. This indicates a pervasive energy deficit, reflecting insufficient weight for height. The age-wise trend shows a slight decrease in severe thinness with increasing age, but undernutrition remains prevalent even in older adolescents. Conversely, the prevalence of overweight (20.1-25 BMI) and obesity (25.1-30 BMI) is negligible (boys: 2.85% overweight, 0.21% obese; girls: 9.98% overweight, 0% obese). This suggests that the “double burden of malnutrition” (coexistence of undernutrition and overnutrition) is not a significant concern in this specific age cohort of the Andh tribal population, with undernutrition being the overwhelming public health priority. This contrasts with observations in

more urbanized or affluent populations in Maharashtra where adolescent overweight is rising (Bhosale *et al.*, 2025).

Table 3: Distribution of BMI For Age

<i>Boys</i>	<i>No</i>	<i>CED III %</i>	<i>CED II%</i>	<i>CED I%</i>	<i>Normal</i>	<i>Slightly Obese</i>	<i>Overweight</i>
<i>Age,yrs</i>		<16	16-17	17.1-18.5	18.6-20	20.1-25	25.1-30
10	49	45 (9.84)	2 (0.43)	2 (0.43)	0	0	0
11	53	29 (6.34)	15 (3.28)	9 (1.96)	0	0	0
12	48	38 (8.31)	6 (1.31)	4 (0.87)	0	0	0
13	54	31 (6.78)	13 (2.84)	9 (1.96)	1 (0.21)	0	0
14	52	16 (3.50)	13 (2.84)	14 (3.06)	7 (1.53)	2 (0.43)	0
15	48	21 (4.59)	12 (2.62)	12 (1.83)	3 (0.65)	0	0
16	54	7 (1.53)	10 (2.18)	27 (5.90)	8 (1.75)	1 (0.21)	1 (0.21)
17	53	8 (1.75)	19 (4.15)	18 (3.93)	5 (1.09)	3 (0.65)	0
18	46	2 (0.43)	3 (0.65)	14 (3.06)	20 (4.37)	7 (1.53)	0
Total	457	197	93	109	44	13	1
%		43.11%	20.35%	23.85%	9.63%	2.85%	0.21%
<i>Girls</i>	<i>No</i>	<i>CED III %</i>	<i>CED II%</i>	<i>CED I%</i>	<i>Normal</i>	<i>Slightly Obese</i>	<i>Overweight</i>
<i>Age,yrs</i>		<16	16-17	17.1-18.5	18.6-20	20.1-25	25.1-30
10	42	33 (7.83)	4 (0.95)	5 (1.18)	1 (0.23)	0	0
11	53	35 (8.31)	13 (3.08)	4 (0.95)	0	1 (0.23)	0
12	50	23 (5.46)	9 (2.13)	12 (2.85)	5 (1.18)	1 (0.23)	0
13	45	13 (3.08)	10 (2.37)	15 (3.56)	5 (1.18)	2 (0.47)	0
14	50	12 (2.85)	11 (2.61)	16 (3.80)	7 (1.66)	4 (0.95)	0
15	41	6 (1.42)	7 (1.66)	5 (1.18)	10 (2.37)	13 (3.08)	0
16	46	7 (1.66)	2 (0.47)	11 (2.61)	15 (3.56)	11 (2.61)	0
17	46	5 (1.18)	9 (2.13)	13 (3.08)	11 (2.61)	8 (1.90)	0
18	48	3 (0.71)	10 (2.37)	19 (4.15)	14 (3.32)	2 (0.47)	0
Total	421	137	75	99	68	42	0
%		32.55%	17.81%	23.51%	16.15%	9.98%	0

Weight for Age (WFA)

The WFA data reinforces the conclusion that underweight is a widespread issue among both boys and girls in the Andh tribal community. This suggests widespread chronic nutritional deficits impacting overall body mass, likely due to insufficient caloric intake and/or recurrent infections.

The WFA data corroborates the BMI findings, highlighting a severe burden of overall underweight. Only 26.71% of boys and 33.73% of girls are classified as “Normal” weight. The majority fall into underweight categories: 71.33% of boys and 62.23% of girls are underweight (Grades I-IV). Boys exhibit a higher overall prevalence of underweight compared to girls, particularly in the more severe grades. This indicates widespread chronic nutritional deficits impacting overall body mass, likely due to inadequate caloric intake or recurrent infections.

Table 4: Distribution of Weight for Age

<i>Boys</i>							
<i>Age, yrs</i>	<i>No</i>	<i>50%</i>	<i>51-60%</i>	<i>61-70%</i>	<i>71-80%</i>	<i>81-100%</i>	<i>>100%</i>
		<i>Grade IV</i>	<i>Grade III</i>	<i>Grade II</i>	<i>Grade I</i>	<i>Normal</i>	
10	49	-	1 (0.21)	14 (3.06)	25 (5.47)	8 (1.75)	1 (0.21)
11	53	-	-	11 (2.40)	24 (5.25)	16 (3.50)	2 (0.43)
12	48	-	6 (1.31)	20 (4.37)	14 (3.06)	7 (1.07)	1 (0.21)
13	54	-	6 (1.31)	17 (3.71)	16 (3.50)	13 (2.84)	2 (0.43)
14	52	-	7 (1.07)	8 (1.75)	12 (2.62)	23 (5.03)	2 (0.43)
15	48	1 (0.21)	2 (0.43)	12 (2.62)	25 (5.47)	8 (1.75)	-
16	54	-	-	13 (2.84)	24 (5.25)	16 (3.50)	1 (0.21)
17	53	-	-	11 (2.40)	33 (7.22)	9 (1.96)	-
18	46	-	-	5 (1.09)	19 (4.15)	22 (4.81)	-
Total	457	1	22	111	192	122	9
%		0.21%	4.81%	24.30%	42.01%	26.71%	1.96%
<i>Girls</i>							
<i>Age, yrs</i>	<i>No</i>	<i>50%</i>	<i>51-60%</i>	<i>61-70%</i>	<i>71-80%</i>	<i>81-100%</i>	<i>>100%</i>
		<i>Grade IV</i>	<i>Grade III</i>	<i>Grade II</i>	<i>Grade I</i>	<i>Normal</i>	
10	42	1 (0.23)	2 (0.47)	13 (3.08)	11 (2.61)	14 (3.32)	1 (0.23)
11	53	-	6 (1.42)	11 (2.61)	25 (5.93)	9 (2.13)	2 (0.47)
12	50	-	6 (1.42)	8 (1.30)	17 (4.03)	18 (4.27)	1 (0.23)
13	45	-	5 (1.18)	10 (2.37)	10 (2.37)	20 (4.75)	-
14	50	2 (0.47)	2 (0.47)	6 (1.42)	18 (4.27)	20 (4.75)	2 (0.47)
15	41	-	-	10 (2.37)	9 (2.13)	18 (4.27)	4 (0.95)
16	46	-	-	4 (0.95)	19 (4.51)	19 (4.51)	4 (0.95)
17	46	-	-	8 (1.90)	25 (5.93)	11 (2.61)	2 (0.47)
18	48	-	-	8 (1.90)	26 (6.17)	13 (3.08)	1 (0.23)
Total	421	3	21	78	160	142	17
%	%	0.71%	5.00%	18.52%	38.00%	33.73%	4.04%

Height for Age (HFA)

While stunting (chronic undernutrition) is present, particularly in its mild form, it appears less severe and widespread than thinness and underweight. This could imply that while children are experiencing energy deficits, their linear growth is somewhat less impacted than their weight-for-height, or that the chronic deprivation affecting linear growth might have occurred earlier in life.

HFA, an indicator of chronic undernutrition (stunting), reveals that while severe stunting is rare (0% boys, 0.48% girls), a notable proportion exhibits mild linear growth retardation. 23.85% of boys and 19.00% of girls show “Mild Retardation” (81-91% HFA). This suggests that chronic nutritional deprivation has impacted linear growth in a significant segment of the population, even if not to the extent of severe stunting. The slightly lower prevalence of stunting compared to thinness/underweight might imply that while children experience energy deficits, their linear growth is somewhat less impacted, or that the chronic deprivation affecting linear growth might have occurred earlier in life.

Table 5: Distribution of Height for age

<i>Boys</i>					
<i>Age, yrs</i>	<i>No</i>	<i>80% Poor</i>	<i>81-91% mild retardation</i>	<i>91-100% Normal</i>	<i>>100%</i>
10	49	-	15 (3.28)	32 (7.00)	2 (0.43)
11	53	-	20 (4.37)	29 (6.34)	4 (0.87)
12	48	-	15 (3.28)	28 (6.12)	5 (1.09)
13	54	-	23 (3.51)	25 (5.47)	6 (1.31)
14	52	-	9 (1.96)	41 (8.97)	2 (0.43)
15	48	-	11 (2.40)	36 (7.87)	1 (0.21)
16	54	-	7 (1.53)	47 (10.28)	-
17	53	-	3 (0.65)	50 (10.94)	-
18	46	-	6 (1.31)	40 (8.75)	-
Total	457		109	328	20
%		0	23.85%	71.78%	4.37%
<i>Girls</i>					
<i>Age, yrs</i>	<i>No</i>	<i>80% Poor</i>	<i>81-91% mild retardation</i>	<i>91-100% Normal</i>	<i>>100%</i>
10	42	1 (0.23)	16 (3.80)	21 (4.98)	4 (0.95)
11	53	-	17 (4.03)	34 (8.07)	2 (0.47)
12	50	-	11 (2.61)	34 (8.07)	5 (1.18)
13	45	-	9 (2.13)	33 (7.83)	3 (0.71)
14	50	1 (0.23)	8 (1.90)	39 (9.26)	2 (0.47)

15	41	-	5 (1.18)	35 (8.31)	1 (0.23)
16	46	-	8 (1.90)	37 (8.78)	1 (0.23)
17	46	-	3 (0.71)	41 (9.73)	2 (0.47)
18	48	-	3 (0.71)	39 (9.26)	6 (1.42)
Total	421	2	80	313	26
%		0.48%	19.00%	74.34%	6.18%

The pervasive undernutrition observed among Andh tribal children aligns with and often exceeds the prevalence rates reported in other tribal and vulnerable populations across India. Recent systematic reviews and studies confirm that undernutrition, including stunting and underweight, remains a significant public health challenge among Indian adolescents (Parida *et al.*, 2025; Singh & Singh, 2016). For instance, a study in tribal blocks of Maharashtra found 55% of adolescent girls to be wasted and 67% stunted (Kulkarni *et al.*, 2019), comparable to the high rates of thinness and stunting in our cohort. Similarly, a study on tribal children in Kerala reported 70% underweight (IJCRT.org, 2024). These comparisons underscore the severity of the nutritional crisis in the Andh community and its consistency with broader regional and national patterns of tribal malnutrition. The absence of significant overweight/obesity in this cohort also distinguishes its nutritional profile from the “double burden” observed in more developed regions (Bhosale *et al.*, 2025).

Socioeconomic Determinants

The socioeconomic profile of the Andh tribal community provides crucial context for the observed nutritional challenges.

Parental Education

Table 6: Education of Parents

<i>Sr. No.</i>	<i>Education of Parents</i>	<i>Father</i>	<i>Percentage %</i>	<i>Mother</i>	<i>Percentage %</i>
1	Illiterate	191	21.75%	380	43.28%
2	Primary School	190	21.64%	255	29.04%
3	Middle School	166	18.90%	154	17.53%
4	High School	220	25.05%	75	8.54%
5	Junior College	98	11.16%	14	1.59%
6	Degree	13	1.48%	0	0.00%

Table 6 details the educational attainment levels of the parents, categorized from Illiterate to Degree, providing critical insight into the socioeconomic context of the study population. A striking disparity in educational attainment is evident between fathers and mothers, alongside a general trend towards lower educational levels within the community. For fathers, 21.75% are illiterate. However, the largest proportions of fathers have attained primary (21.64%), middle (18.90%), or high school (25.05%) education, with high school representing the single largest category. A smaller percentage of fathers have pursued junior college (11.16%) or a degree (1.48%). In stark contrast, a substantial 43.28% of mothers are illiterate, nearly double the illiteracy rate observed among fathers, underscoring a significant gender gap in educational access and attainment. Among literate mothers, the majority have attained only primary (29.04%) or middle school (17.53%) education. Furthermore, higher educational attainment is notably limited among mothers, with only 8.54% reaching high school, 1.59% completing junior college, and no mothers holding a university degree (0.00%). This pronounced educational disparity, particularly the high maternal illiteracy rate, highlights a significant barrier to improving household health and nutritional outcomes within this community.

Parental Occupation

Parental occupation directly influences household income and resource availability. The overwhelming majority of parents are engaged in farming (39.06% for boys' parents, 38.72% for girls' parents) or labor (11.5% for boys' parents, 4.32% for girls' parents). Occupations in business or formal employment are exceedingly rare (less than 1.2%). These livelihoods are typically characterized by low, irregular, and seasonal incomes, making households vulnerable to food insecurity and limiting their purchasing power for diverse and nutritious foods.

Table 7: Occupation of Parents

<i>Sr. No.</i>	<i>Occupation of Parents</i>	<i>Boys</i>	<i>Percentage %</i>	<i>Girls</i>	<i>Percentage %</i>
1	Farmer	343	39.06	340	38.72
2	Labours	101	11.50	68	4.32
3	Bussiness	8	0.91	10	1.13
4	Employee	5	0.56	3	0.34

This economic vulnerability directly contributes to the observed high rates of thinness and underweight, as documented in studies linking low socioeconomic status to undernutrition (Gondikar *et al.*, 2017).

Family Size

Table 8: Family Size

Sr. No.	Family Size of Parents	Boys	Percentage %	Girls	Percentage %
1	Small Family	6	0.68	18	2.05
2	Medium Family	289	32.91	301	34.28
3	Large Family	138	15.71	87	9.90
4	Very Large Family	24	2.73	15	1.70

Family size can significantly impact per capita resource availability. A considerable proportion of children live in medium (32.91% boys, 34.28% girls) to large (15.71% boys, 9.9% girls) families. In resource-constrained settings, larger family sizes can lead to “resource dilution,” where available food and other necessities are spread thinly among more members. This can exacerbate energy and nutrient deficits, contributing to higher rates of undernutrition, particularly thinness and underweight, which are highly sensitive to daily dietary intake.

Parental Income

Parental income is a fundamental determinant of nutritional status. The income distribution in the Andh tribal community is heavily skewed towards lower brackets.

Table 9: Income of Parents

Sr. No.	Income of Parents	Boys	Percentage %	Girls	Percentage %
1	Low Income group	8	0.91	27	3.07
2	Lower income group	202	23.00	184	20.95
3	Upper medium income group	181	20.61	166	18.90
4	High income group	56	6.37	36	4.10
5	Very high income group	10	1.13	8	0.91

The largest proportions of parents fall into the “Lower income group” (23% boys’ parents, 20.95% girls’ parents) and “Upper medium income group” (20.61% boys’ parents, 18.9% girls’ parents). “High” and “Very High” income groups are minimal. This predominant low-income status directly restricts a household’s ability to purchase sufficient quantities of diverse and nutrient-rich foods, access quality healthcare, and maintain hygienic living environments. These limitations are directly correlated with the high prevalence of undernutrition observed.

Conclusion

The study unequivocally concludes that undernutrition is a critical and widespread public health crisis among Andh tribal children aged 10-18 years. The high prevalence of thinness, underweight, and mild stunting signifies substantial and chronic energy and nutrient deficits within this community. These prevalent nutritional challenges are deeply rooted in and exacerbated by the prevailing socioeconomic vulnerabilities, including low parental education (especially maternal illiteracy), reliance on unstable low-income occupations, and potential resource dilution within larger family structures.

This study comprehensively assessed the nutritional status and growth patterns of 878 Andh tribal children (457 boys, 421 girls) aged 10+ to 18+ years, integrating anthropometric measurements with key socioeconomic determinants. The findings reveal a pervasive and severe burden of undernutrition deals with 87.31% of boys and 73.87% of girls are thin (low BMI-for-Age), and 71.33% of boys and 62.23% of girls are underweight (low Weight-for-Age). Additionally, 23.85% of boys and 19.00% of girls exhibit mild stunting (low Height-for-Age). Overweight and obesity are negligible. Growth trend analysis of weight and height demonstrates distinct age- and sex-specific patterns consistent with pubertal development, yet often with lower absolute values compared to well-nourished populations. Socioeconomic indicators reveal low parental education (especially maternal illiteracy), predominant reliance on low-income farming and labor, and a prevalence of medium to large family sizes. These factors are strongly correlated with the observed undernutrition, suggesting that limited household resources and knowledge perpetuate nutritional deficits.

References

- Aguayo, V. M., Nair, R., Badgaiyan, N., & Krishna, V. (2015). Determinants of stunting and poor linear growth in children under 2 years of age in India: an in-depth analysis of Maharashtra's comprehensive nutrition survey. *Maternal & Child Nutrition*, 11(4), 732–742. <https://doi.org/10.1111/mcn.12217>
- Bhosale, T. S., Potdar, N. J., & Choudhari, S. K. (2025). Prevalence of Obesity Among Adolescents: A Study from Western Maharashtra. *Journal of Neonatal Surgery*, 14(17S).
- Bogin, B. (1999). *Patterns of Human Growth* (2nd ed.). Cambridge University Press. <https://doi.org/10.1017/CBO9780511608116>
- DS, Bose K. 2012, Nutritional deprivation among Indian tribals: A cause for concern. Anth Notebook 18:5-16.

- Gondikar, A., Sangrulkar, T. V., & Brahmanekar, T. R. (2017). Anthropometric assessment of nutritional status of children attending anganwadi in urban slums of Miraj city, Maharashtra. *International Journal Of Community Medicine And Public Health*, 4(11), 4157–4164. <https://doi.org/10.18203/2394-6040.ijcmph20174668>
- IJCRT.org (2024). Health and Malnutrition among the Tribal Children in Kerala. *International Journal of Creative Research Thoughts*, 12(7). <https://www.ijcrt.org/papers/IJCRT2407165.pdf>
- Kshirsagar, V. Y., & Bangal, R. S. (2015). Anthropometric assessment of nutritional status among tribal school children in Nashik district, Maharashtra. *International Journal of Recent Trends in Science and Technology*, 15(3), 591–594. http://statperson.com/Journal/ScienceAndTechnology/Article/Volume15Issue3/15_3_20.pdf
- Khongsdier R. 2001. Body mass index of adult males in 12 populations of Northeast India. *Ann Hum Biol* 28:374-83.
- Kulkarni, M. V., et al. (2019). Nutritional Status of Adolescent Girls in Tribal Blocks of Maharashtra. *Indian Journal of Community Medicine*, 44(3), 283-287. https://doi.org/10.4103/ijcm.IJCM_369_18
- Meshram, I. I., Kodavanti, M. R., & Chitty, G. R. (2018). Nutritional status and anthropometric measurements among tribal children in Maharashtra. *Indian Journal of Community Health*, 30(4), 358–364. <https://www.iapsmupuk.org/journal/index.php/IJCH/article/view/973>
- Mitra A. 1985. The nutrition situation in India. In: Margaret R. Biswas & Per Pinstrup-Andersen (eds.), *Nutrition and Development*. Oxford: Oxford University Press, pp. 142-62.
- Parida, J., Bagepally, B. S., Patra, P. K., Pati, S., Kaur, H., & Acharya, S. K. (2025). Prevalence and associated factors of undernutrition among adolescents in India: a systematic review. *BMC Public Health*. <https://doi.org/10.1186/s12889-024-19250-w>
- Singh, P., & Singh, R. (2016). Nutritional status of tribal adolescents in India: A review. *Journal of Clinical and Diagnostic Research*, 10(10), LE01-LE01. <https://doi.org/10.7860/JCDR/2016/21650.8679>
- Tanner, J. M. (1962). *Growth at Adolescence: With a general consideration of the effects of hereditary and environmental factors upon growth and maturation from birth to maturity* (2nd ed.). Blackwell Scientific Publications.
- Toppo, M., & Venugopal, R. (2024). Nutritional status of adolescent boys of Oraon tribe of Chhattisgarh, India. *International Journal of Physical Education, Sports and Health*, 11(5), 433-436. <https://www.kheljournal.com/archives/2024/vol11issue5/PartG/11-5-69-793.pdf>
- UNICEF. (2024). *Child Food Poverty. Nutrition Deprivation in Early Childhood*. UNICEF, New York. <https://www.unicef.org/media/157661/file/Child-food-poverty-2024.pdf>

- Vaidya, V., Gaware, S. D., Murarkar, S. K., & Mishra, A. (2015). Nutritional Status of Rural Indian School Children of Maharashtra. *International Journal of Health Sciences and Research*, 5(5), 17-21.
- WHO. 1990. Diet, nutrition and the prevention of chronic disease. WHO Technical Report Series No. 797. Geneva: World Health Organization.
- WHO 2007: Growth Reference Data for 5–19 Years: BMI-for-age,height-for-age and weight-for-age. WHO Press. <https://www.who.int/tools/growth-reference-data-for-5to19-years>.