

Assessment Of Nutritional Status Of Tribal Adolescent Girls Through Anthropometric Measurements: A Cross-Sectional Study In Mayurbhanj District Of Odisha

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Abstract

Tribal adolescent girls are among the most nutritionally vulnerable population groups in India due to poor dietary intake, socio-economic deprivation, limited access to health services and increased physiological nutritional requirements during adolescence. Anthropometric assessment is a simple and reliable method for evaluating nutritional status. The objective of the study is to assess the anthropometric measurements of tribal adolescent girls in Mayurbhanj district of Odisha to generate a baseline database of their nutritional status. A community-based cross-sectional study was conducted among 150 tribal adolescent girls aged 15-19 years in Baripada block of Mayurbhanj district, Odisha. Data on their anthropometric measurements including height, weight, Body Mass Index (BMI), waist circumference (WC), hip circumference (HC) and waist-hip-ratio (WHR) were recorded following standard WHO procedures. BMI and WHR was classified according to WHO criteria. Data was analyzed using SPSS 2.0. The results revealed that a higher proportion of the selected respondents belonged to the Santhal tribe (48.0%). The data showed a majority of the tribal girls were continuing education (86.0%) and belonged to joint families (67.3%). The mean height and weight were 149.41±4.96 cm and 46.82±2.75 kg, respectively with mean BMI value of 17.78±1.51 kg/m² indicating a significant gap with WHO reference values. More than half (61.33%) of the respondents were underweight, whereas only 38.66% had normal BMI. Among the underweight respondents, 14.0% had severe thinness, 21.33% had moderate thinness and 26.0% had mild thinness. The mean WHR was 0.754±0.16, with 73.33% of respondents classified as low risk, 24.00% as moderate risk, and 2.66% as high risk. The study revealed a high prevalence of undernutrition among tribal adolescent girls in Mayurbhanj district. Regular nutritional assessment, nutrition education, dietary diversification and strengthening of existing adolescent health programmes are essential to improve nutritional status of tribal adolescents.

Keywords: Tribal Adolescent Girls, Nutritional Status, Anthropometry, BMI, Undernutrition, Waist-Hip Ratio.

Introduction

Adolescence is a critical phase characterized by rapid physical growth, hormonal changes and increased nutritional requirements. Nearly half of adult body weight and approximately 15-20% of adult height are attained during adolescence. Nutritional deficiencies during this period may impair growth, reproductive health and cognitive development and future maternal outcomes. Tribal adolescent girls constitute one of the most nutritionally disadvantaged populations due to poverty, food insecurity, inadequate dietary diversity, poor sanitation and limited healthcare access (Bhargava et al., 2020).

A nutritious diet is essential for a healthy life and is regarded as a significant element in maintaining optimal health and promoting social wellness. Nutrition is the consumption of food that satisfies the body's dietary requirements. A nutritionally balanced diet is crucial for optimal health. Adolescents represent a nutritionally vulnerable population owing to the rapid development and physical maturation; this phase of growth marks a transitional stage as it signals the onset of puberty (Thakur & Gautam, 2017). This critical stage is closely connected to reproductive wellness and needs focused care for optimal treatment. The health and nutrition of today's adolescent girls may have a significant impact on the quality of future generations. To tackle the problem of undernutrition among indigenous populations, suitable nutritional initiatives and health policies need to be established (Bharthi et al., 2017).

India is home to more than half of the world's indigenous population, commonly referred to as tribals. "Adivasi," which means "original residents" in Hindi, accounts for 8.1% of India's overall population (Faizi & Nair, 2016). The Indian government classified 72 tribal communities as primitive tribes due to their slow growth, lack of access to modern technology, and exceptionally low literacy rates (Bairwa et al., 2017). Adolescents have a higher risk of being underweight or stunted. Stunting in teenagers is caused by the cumulative effects of inadequate nutrition, particularly in the first two years of life (Nithya & Bhavani, 2018).

Undernutrition is more common in younger age groups (particularly 15-19), rural areas, and among scheduled tribes for women (NFHS -5). It is commonly recognised that a variety of nutrient-dense meals must be taken in order to meet nutritional requirements, yet indigenous people have a limited understanding of nutrition.

According to the NFHS-5 findings, 40% of girls aged 15-19 and 24.8% of scheduled tribal females aged 15 to 49 had a BMI of less than 18.5 (Panwar et al., 2025).

Odisha has one of the highest tribal populations in India, with Mayurbhanj district predominantly inhabited by Santal, Ho, Bathudi, Munda and other tribal communities. Despite, several government nutrition programmes, undernutrition remains a major public health challenge among tribal adolescents. Anthropometric assessment provides a practical and inexpensive approach to evaluate nutritional status and identify adolescents at nutritional risk (Kulkarni et al., 2019; Chakrabarty, 2008). Therefore, the present study was undertaken to assess the anthropometric measurements of tribal adolescent girls in Mayurbhanj district of Odisha to generate a baseline database of their nutritional status.

Material & Methods

The present community-based cross-sectional study was carried out in Baripada block of Mayurbhanj district, Odisha. A total of 150 tribal adolescent girls aged 15-19 years were selected from three villages namely Rangamatia, Sankhabhanga & Chandanpur of Baripada Block of Mayurbhanj district for the present study using both purposive and simple random sampling technique. Background information as well as anthropometric measurements were included in the interview schedule. The researcher used a portable stadiometer, a digital weighing balance and a measuring tape to take anthropometric measurements (Height, Weight, Waist & Hip circumference, respectively) using standard procedure. Socio-economic profile of the respondents viz. age, tribe, family type, educational details, family income and eating habits was collected using semi structured pre-tested interview schedule.

Anthropometry is essential for conducting population nutrition surveys and determining the severity of undernutrition in individuals. Growth retardation may be the body's initial response to dietary inadequacies. Anthropometric measures, which evaluate an individual's height and weight, provide crucial information about their nutritional status and overall health (Shrilakshmi, 2018). These measures determine if a newborn, child, adolescent, or adult is developing normally for their age.

The Body Mass Index (BMI) was calculated by dividing the absolute weight (kg) by the square of the height (m). It reduces dependency on frame size by defining adiposity in terms of weight and height, accounting for variations in body composition (Jelliffe, 1966). Participants were classified based on their body mass index using WHO guidelines (2004). The waist circumference measures the region around the abdomen. Waist circumference is an easy method for estimating intra-abdominal fat mass and total body fat. Data were analysed using SPSS 2.0. Descriptive statistics including mean, standard deviation, frequency and percentage were calculated for the results.

Results

The socio-economic data of the selected respondents revealed that a higher proportion of the selected respondents were 17 years old (36.7%) and belonged to the Santal tribe (48.0%). A majority of the tribal girls were continuing education (86.0%) and were pursuing their study at intermediate level (68.2%). Most of the respondents belonged to joint families (67.3%). Slightly more than half of the population (57.3%) had a monthly income of Rs. 5,000-15,000, indicating a very low economic status. Regarding the eating habits it was found that most of the tribal adolescent girls were consuming a non-vegetarian diet (93.33%).

Table-1. Mean Anthropometric Measurements of the Selected Respondents

Matrices	Standard Range	Mean±SD (n=150)
Height (cm)	159-163	149.41±4.96
Weight (kg)	52-56	46.82±2.75
Waist Circumference (cm)	>80	62.12±4.10
Hip Circumference (cm)	>88	70.92±3.69

#WHO (2000, 2008)

The mean anthropometric measurements of tribal adolescent girls are presented in Table-1. The mean height was 149.41±4.96 cm, which was considerably lower than the WHO reference range (159-163 cm). Similarly, the mean body weight was 46.82±2.75 kg, which was below the WHO reference value (52-56 kg). The waist circumference is used to classify central obesity. The hip circumference is measured at the maximum buttock circumference, although some studies assessed the waist circumference at the thinnest waist point (Ross et al., 2008). The mean waist circumference and hip circumference were 62.12±4.10 cm and 70.92±3.69 cm,

respectively. Although the mean waist circumference was below the WHO cut-off for abdominal obesity (>80 cm), the relatively low height and body weight indicate poor overall physical growth and nutritional status among the respondents.

Body Mass Index (BMI) Classification

Table-2. BMI Classification of the respondents as per WHO (2004)

Categories of Body Mass Index (kg/m ²)	Respondents (n=150)	
	Frequency (f)	Percentage (%)
Under weight (<18.50)	92	61.33
Severe thinness (<16.00)	21	14.00
Moderate thinness (16.0-16.99)	32	21.33
Mild thinness (17.0-18.49)	39	26.00
Normal (18.5-24.99)	58	38.66
Overweight (25.0-29.99)	0	0.00
Obese (>30)	0	0.00
Mean±SD	17.78±1.51	

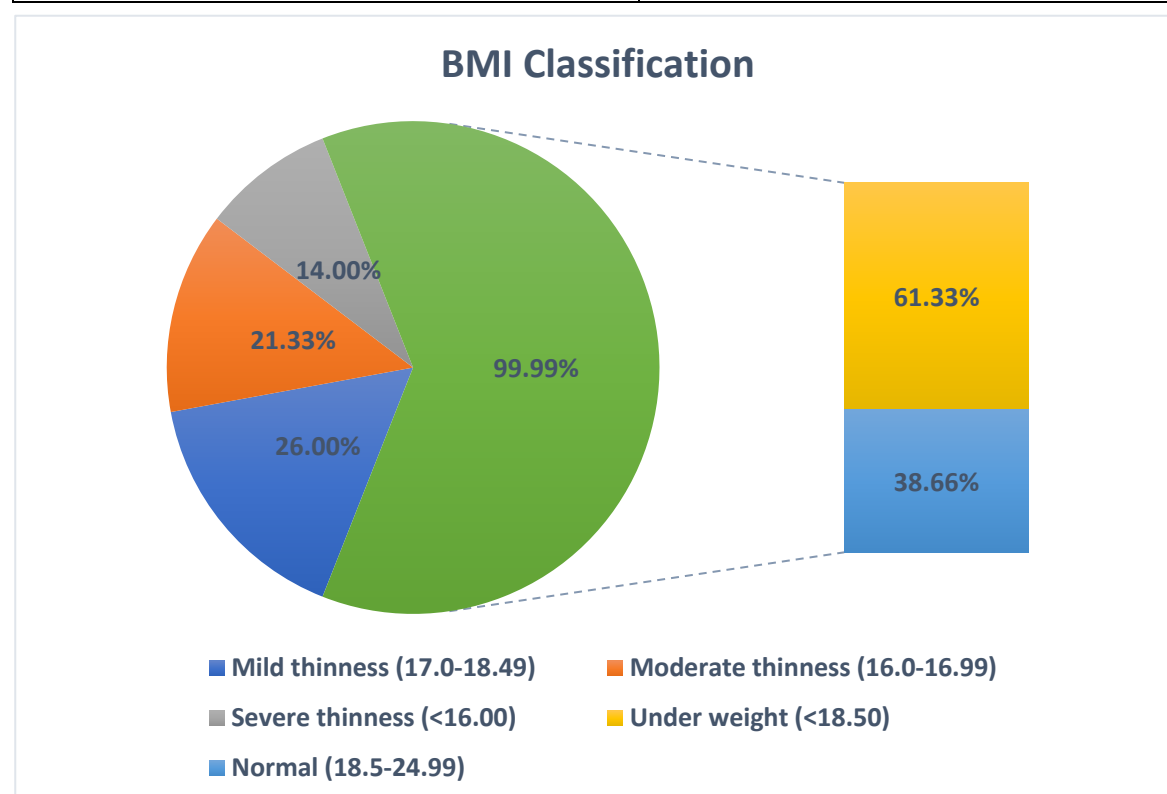


Fig. -1 Distribution of respondents according to BMI

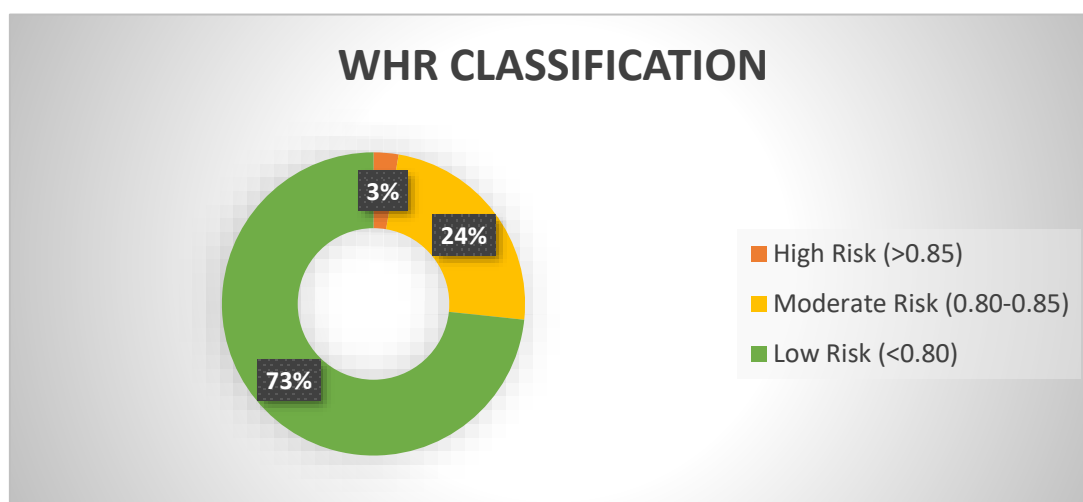
Table-2 & Figure-1 presents the BMI classification of the respondents according to WHO (2004) criteria. The mean BMI of the respondents was 17.78±1.51 kg/m², indicating an overall undernourished population. More than three-fifths (61.33%) of the respondents were underweight (BMI <18.5 kg/m²), whereas only 38.66 per cent had normal BMI. Among the underweight girls, 14.0 per cent suffered from severe thinness, 21.33 per cent from moderate thinness and 26.0 per cent from mild thinness. None of the respondents were overweight or obese.

Waist-Hip Ratio (WHR) Classification

Table-3. WHR classification of the respondents as per WHO (2000)

Health Risks	Respondents (n=150)	
	Frequency (f)	Percentage (%)
High Risk (>0.85)	04	2.66
Moderate Risk (0.80-0.85)	36	24.00
Low Risk (<0.80)	110	73.33
Mean±SD	0.754±0.16	

According to WHO (2000) classification (Table-3), the mean waist-hip ratio was 0.754 ± 0.16 . The majority of respondents (73.33%) had a low health risk (WHR<0.80), while 24.00 per cent had a moderate health risk and very negligible (2.66%) had a high health risk (WHR>0.85). These findings indicate that central obesity was uncommon among the study population despite the high prevalence of undernutrition.

**Fig. -2 Distribution of respondents according to WHR classification**

Discussion

The study assessed the nutritional status of tribal adolescent girls in Mayurbhanj district of Odisha using anthropometric measurements. The findings revealed widespread undernutrition, reflected by low mean height, body weight and BMI among the respondents. The mean height (149.41 cm) and weight (46.82 kg) observed in the present study were lower than the WHO reference values, indicating impaired physical growth among tribal adolescent girls. Poor linear growth and lower body weight during adolescence generally associated with long-term nutritional deprivation, recurrent infections, food insecurity and poor socioeconomic conditions. The predominance of low-income households in the present study further supports these findings. Similar observations have been reported by Priyadarshini & Biswal (2023) that the mean height (149.82 cm), body weight (39.13 kg) and BMI (17.43 kg/m^2) of the tribal adolescent girls in Keonjhar district of Odisha, were also considerably below the reference standards, indicating chronic undernutrition. According to Gagebo et al. (2020) the respondents' median weight was 42 kg. Stunting (low height for age) and thinness (low body mass index for age) were widespread among all adolescent girls at 29.6 per cent and 19.5 per cent, respectively. Stunting and thinness were more prevalent in late adolescent girls than in early adolescent girls (35.6% vs. 25.7% and 21.8% vs. 17.9%, respectively).

BMI assessment further demonstrated that 61.33 per cent of the respondents were underweight, while only 38.66 per cent had normal BMI. The mean BMI ($17.78 \pm 1.51 \text{ kg/m}^2$) was below the normal WHO cut-off of 18.5 kg/m^2 , indicating Chronic Energy Deficiency (CED). The presence of severe (14.0%), moderate (21.33%) and mild (26.0%) thinness highlights varying degrees of nutritional deficiency within the study population. These findings indicate that inadequate dietary intake during the rapid growth period of adolescence continues to be a major public health concern among tribal communities. The high prevalence of underweight observed in the present study is consistent with previous studies conducted among tribal adolescents in Odisha and other parts of India. Priyadarshini & Biswal (2023) reported that approximately 79.4% of tribal adolescent girls in Keonjhar district

were underweight with a mean BMI of 17.43 kg/m², emphasizing the persistent burden of undernutrition among tribal populations. Similarly, studies among Shabar tribal adolescent girls in Odisha (Chakrabarty, 2008), reported significantly lower height, weight and BMI compared with reference standards and documented a high prevalence of chronic undernutrition. Likewise, according to Santhanam & Maheswari (2022), the mean BMI (Body Mass Index) of the study participants was 15.89±1.89 kg/m². The average BMI was 18.8 kg/m². The majority of respondents (41%), had BMIs characterised as low weight normal, while 31% had Chronic Energy Deficiency (CED-grade I) mild, 17% had CED-grade II moderate, and 2% had CED-grade III severe.

The observed nutritional inadequacies may be attributed to several interrelated factors including poverty, household food insecurity, low dietary diversity, inadequate intake of calorie and micronutrients, frequent infections, limited nutrition awareness and poor access to healthcare services. Adolescence is a period of rapid growth requiring increased nutrient intake and inadequate nutrition during this stage may adversely affect adult stature, reproductive health, educational achievement and future maternal outcomes. WHO also recognizes anthropometric assessment as one of the most reliable methods for identifying nutritional problems among adolescents.

Interestingly, despite the high prevalence of underweight, 59.33 per cent of the respondents had a low waist-hip ratio, while only 2.66 per cent were classified as having a high health risk. This indicates that abdominal obesity and associated metabolic risk factors were uncommon among these tribal adolescent girls. The low waist circumference and WHR observed in the present study are consistent with the predominance of thinness rather than excess adiposity. Further, the NHLBI (National Heart, Lung, and Blood Institute) Obesity Education Initiative (2002) recommends an upper maximum of 80 cm waist circumference for girls, with 88 cm hip circumference being the cut-off point value. In the present study, the mean waist circumference and hip circumference of the respondents were below the WHO cut-off point. The present findings are in agreement with Bose and Bisai (2018), who observed that tribal adolescents had low Waist-to Hip Ratios and a high prevalence of undernutrition, reflecting poor nutritional status and limited adipose tissue accumulation. Similarly, Maiti et al., (2011) also reported that most tribal adolescent girls belonged to the normal or low-risk WHR category, indicating minimal abdominal obesity in nutritionally deprived populations. Although, central obesity was rare, the coexistence of chronic energy deficiency remains a significant public health concern requiring immediate nutritional intervention.

Overall, the findings demonstrate that undernutrition is the predominant nutritional problem among tribal adolescent girls in Mayurbhanj district. These results highlight the urgent need for nutrition education, improved dietary diversity, regular growth monitoring, iron-folic acid supplementation, school-based nutrition programmes and community-level interventions aimed at improving the nutritional status of tribal adolescents. Strengthening existing government programmes for adolescent health services may contribute significantly to reducing the burden of undernutrition in this vulnerable population of tribal community.

Conclusion

The present study revealed a high prevalence of undernutrition among tribal adolescent girls aged 15-19 years in Mayurbhanj district. The low mean height, weight and BMI indicate chronic nutritional deficiencies, while the absence of overweight and obesity reflects the predominance of undernutrition in this population. Although most respondents had a low waist-hip ratio, the widespread occurrence of thinness highlights the urgent need for targeted nutritional interventions. Regular anthropometric monitoring, nutrition education intervention, improved dietary diversity, micronutrient supplementation and strengthening adolescent health programmes are recommended to improve nutritional outcomes among tribal adolescent girls.

These findings emphasise the critical need for targeted nutritional interventions, educational initiatives, and legislative actions to enhance the dietary consumption and general well-being of tribal adolescent girls. Establishing community-oriented nutritional initiatives, facilitating access to a variety of nutrient-dense foods, and enhancing health education efforts may significantly contribute to combating malnutrition in this at-risk population.

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