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Prevalence of Stunting, wasting and underweight among Santal children of Galudih, Purbi Singbhum district, Jharkhand, India

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Abstract: The objective of this study was to assess the differences in body stature (height), body weight, and frequency of stunted, wasted, and underweight children of the Santal ethnicity in Galudih area, Purbi Singbhum, Jharkhand, India. The study included 400 children (200 girls and 200 boys) aged between 3 and 6 years old. Stunting, wasting, and underweight were evaluated using < -2 z-scores for H-A-Z (Height-for-age), W-A-Z (weight-for-age), and W-H-Z (weight-for-height) based on the reference values recommended by the NCHS (National Center for Health Statistics). The results revealed substantial age differences in mean body weight and height for both boys and girls, with boys having significantly higher weight than girls across all ages. The mean H-A-Z, W-A-Z, and W-H-Z values were lower than those reported by NCHS for all age groups and both sexes. The overall frequency of stunting, wasting, and being underweight was higher among girls compared to boys. The combined incidences of stunting, wasting, and underweight due to sex and age were 25.3%, 12.0%, and 31.8%, respectively. Using the WHO criteria for judging the austerity of malnutrition, the incidence of wasting (9-15%) was found to be high, while the overall frequency of stunting (24-27%) was medium, and underweight was very high (30%). In conclusion, the occurrence of undernourishment of Santal children in this study was concerning, and there is an urgent need for improved supplementary nutritional programs and public health awareness initiatives within this community.

Introduction

The tribal population of India comprises around 8.6% of the total population, among which the Santals are one of the most populous tribes spread throughout the country. Unfortunately, malnutrition has emerged as a significant public health concern for tribal children, both in terms of undernutrition and overnutrition, particularly in the state of Jharkhand. To measure the health and nutritional progress of children, physical growth is a crucial indicator that can be evaluated using a relatively inexpensive, non-invasive, and safe method compared to other health assessment tools, such as WHO (1995) and Mahapatra et al. (2019). The optimum nutrient intake is vital for school-going children to support their rapid growth and development, which occurs during this critical age range, as mentioned in WHO (1995) and Bishnoi et al. (2004). The high prevalence of malnutrition among preschool children, specifically undernutrition, is a significant obstacle to overall health and national development, especially in rural Indian populations, as reported in Saxena et al. (1997), Mahapatra et al. (2000), Brahmbhatt et al. (2001), Rajaram et al. (2003), Kumar and Bhawani (2005), and Ray (2005). Despite the importance of this issue, there is scant information available in the scientific and academic communities to provide a clear understanding of the frequency of undernutrition among the preschool children population

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in India, as reported in Bishnoi et al. (2004) and Kumari (2005).

To determine the nutritional condition of the study participants, this study utilized three internationally recommended nutritional measures, namely stunting (low H-A-Z), underweight (low W-A-Z), and wasting (low W-H-Z), as reported in WHO (1995). Stunting indicates a failure to achieve potential linear growth due to sub-optimal health and/or nutritional situations, while wasting indicates acute undernutrition, which may result from recent food deprivation or illness. On the other hand, underweight refers to low body weight concerning the children's age, which can be controlled by both body weight and height (stature). Thus, underweight alone cannot differentiate between a child who has less body weight concerning his/her height/stature and a child who has low height concerning his/her age but has normal body weight concerning his/her height/stature, as stated in WHO, 1995.

The concerned authority has already taken an initiative by implementing a special program called the ICDS scheme (Integrated Child Development Services), which promotes the health and development of mothers and children worldwide, and it is the largest national program in India, as reported in Kapil and Pradhan (1999). This program benefits child aged less than 6 years, pregnant women, lactating mothers, and other women belonging to the age group of 15 to 44 years, as mentioned in Kapil and Pradhan (1999). The program provides a set of supplementary food, nutrition, immunization, health check-ups, nutrition and health education, preschool education, and other referral services to its beneficiaries, as mentioned in Kapil and Pradhan (1999). The program is implemented through an "Anganwadi" center located in every village, and hence, it is crucial to know the rates of stunted, wasted, and being underweight children in a specific interval. Poor rates of stunting, wasting, and being underweight after specific intervals indicate that the measures taken by the scheme are workable in reducing the incidence of undernutrition, as mentioned in Bhasin et al. (2001). Rural and tribal children malnutrition having a different magnitude of etiology and occurrence have been reported by several recent studies from diverse regions of India (Stiller et al., 2020; Ghosh et al., 2021; Mhatre et al., 2023) which stimulates the present endeavour for further understanding.

Materials and Methods

Study area and subjects

The current field-based study was conducted in four distinct villages situated under the Kalimati Mouza of the Galudih region (22.6456° N, 86.4140° E) in the Purbi Singbhum district of Jharkhand. This specific region encompasses a hilly upland stretch, positioned at the eastern side of the Chota Nagpur plateau, which is situated approximately 35 kilometers away from Jamshedpur, the industrial capital of Jharkhand. The area in question is considered to be remote and inhabited primarily by indigenous tribal populations.

Prior to initiating this research endeavor, it was of utmost importance to obtain formal and explicit ethical approval from the local authorities with respect to the planned data collection activities (Figure1). To ensure a representative sample of the population, the research team selected participants at random from different households located within each of the villages included in the study. Anthropometric measurements were collected from a total of 408 Santal children, with 202 boys and 206 girls, all of whom were between the ages of 3 years and 6 years. A small subset of participants, consisting of 8 children (6 girls and 2 boys), were ultimately excluded from the final analysis due to the presence of missing data. Consequently, the effective sample size utilized for this study was comprised of 400 children, with an even distribution of 200 boys and 200 girls. In order to ensure the accuracy of the collected data, the age and ethnicity of all participants were verified and approved via official documentation such as birth certificates, school records, vaccination cards, and other relevant documents.

Figure 1. Photograph of Fieldwork with the local tribal children and school authorities of Galudih, Jharkhand

Anthropometric measurements and evaluation of nutritional status

Anthropometric measurements, specifically height and body weight, were procured from each and every participant (Figure 2) in adherence with the recommended standard protocol as proposed by Lohman et al. (1988) in order to ensure the accuracy and consistency of data acquisition. It is pertinent to mention that the Technical Errors of Measurements (TEM) were

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carefully estimated and scrutinized, and the results were found to be well within the range of reference values as advocated by Ulijaszek and Kerr (1999), thereby making it unnecessary to include TEM in the statistical analyses. Furthermore, the distributions of height/stature and body weight were subjected to careful examination, and it was established that they were not significantly skewed, indicating that they did not necessitate normalization. Several statistical analyses were carried out, including the determination of the mean, standard deviation, standard error, and other relevant measures, in order to effectively accomplish the aims and objectives of the study.

Figure 2. Photograph of fieldwork with the studied tribal school children at Galudih, Jharkhand

To evaluate the nutritional status of the participants, three globally recognized undernutrition indices were used, namely stunting, underweight, and wasting. In order to accurately define stunting, wasting, and underweight, the sex and age-specific (-) 2 z-scores, as recommended by the NCHS (United States National Centre for Health Statistics), were followed in accordance with the guidelines proposed by Hamill et al. (1979) and WHO, 1983. The aforementioned criteria were adopted in the current interpretation to ascertain the nutritional condition of the studied subjects, with utmost care and attention given to ensuring the accuracy and reliability of the results.

Stunting: < - 2 H-A-Z (Z-score for height-for age)
Underweight: < - 2 W-A-Z (Z-score for weight-for age)
Wasting: < - 2 W-H-Z (Z-score for weight-for-height)

Where, H-A-Z refers to z scores of height-for-age, W-A-Z stands for z scores of weight-for-age and W-H-Z refers to z scores of weight-for height, according to NCHS.

The WHO (1995) recommended classification of prevalence percentage of these three exponents among children for assessing the severity of their malnourished condition. The classification is as below:

	Low (%)	**Medium (%)**	**High (%)**	**Very High (%)**
Stunted	< 20.0	20.0 – 29.9	30.0 – 39.9	≥ 40.0
Underweight	< 10.0	10.0 –19.9	20.0 – 29.9	≥ 30.0
Wasted	< 5.0	5.0 – 9.9	10.0 – 14.9	≥ 15.0

Results and Discussion

In Table 1, mean values of basic anthropometric parameters such as height/stature and body weight, along with their standard deviations, have been presented in accordance with age and sex. It is observed that both height and weight exhibit an increase with age in both male and female groups. Moving on to Table 2, it showcases the mean z-score values for H-A-Z (height-for-age), W-A-Z (weight-for-age), and W-H-Z (weight-for-height). It is noteworthy that in all age and sex groups, the mean values of H-A-Z, W-A-Z, and W-H-Z are lower (negative values) than the NCHS values. These anthropometric measures range in maximum and minimum values from –0.698 for H-A-Z in boys' age groups of 3 years to –1.844 for W-A-Z in girls' age groups of 6 years.

Table 3 is dedicated to highlighting the prevalence percentages of stunted, underweight, and wasted children among the studied population. In general, there is observed a mild to moderate variation in terms of the prevalence of different malnutritional measures such as stunting, wasting, and undernutrition, prevailing in both sexes. Girls are found to exhibit higher prevalence percentages of stunting, wasting, and being underweight (26.3%, 14.2%, and 34.3%, respectively) in comparison to boys (24.2%, 9.8%, and 29.3%, respectively). Moreover, the overall, i.e. age and sex combined, percentages for stunted, wasted, and underweight have been found to be 25.3%, 12.0%, and 31.8%, respectively. As per the WHO recommended classification of malnutritional severity, the overall (age and sex combined) rate of stunting falls under the medium category (20-29%), whereas wasting has been categorized as high (10-14%), and underweight as very

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Table 1. Descriptive statistics of anthropometric measurements of the Santal children of Galudih, Jharkhand, India

Age (Year)	Sex	N (Sample size)	Height (in cm) Mean ± SD	Weight (in kg) Mean ± SD
3	Boys	45	90.3±5.1	11.5±1.8
	Girls	49	89.2±4.7	11.1±1.5
4	Boys	52	96.7±4.5	12.8±1.7
	Girls	43	94.8±4.9	12.3±1.7
5	Boys	55	101.6±5.4	14.4±1.9
	Girls	51	99.8±5.1	13.8±1.9
6	Boys	48	107.5±5.3	15.2±1.9
	Girls	57	105.3±5.5	14.9±1.8

Table 2. Means and standard errors H-A-Z, W-A-Z and W-H-Z of the Santal children

Age (Year)	Sex	H-A-Z Z-score (SE)	W-A-Z Z-score (SE)	W-H-Z Z-score (SE)
3	Boys	-0.698 (0.175)	-1.324 (0.109)	-0.951 (0.079)
	Girls	-0.723 (0.156)	-1.467 (0.105)	-1.058 (0.088)
4	Boys	-0.878 (0.131)	-1.415 (0.099)	-0.977 (0.091)
	Girls	-0.925 (0.144)	-1.586 (0.106)	-0.997 (0.085)
5	Boys	-1.231 (0.161)	-1.509 (0.108)	-1.030 (0.076)
	Girls	-1.321 (0.137)	-1.797 (0.089)	-1.121 (0.091)
6	Boys	-1.453 (0.156)	-1.631 (0.081)	-0.998 (0.083)
	Girls	-1.525 (0.152)	-1.844 (0.093)	-1.212 (0.085)
H-A-Z: Z-score values of Height for age; W-A-Z: Z-score values of Weight for age W-H-Z: Z-score values of Weight for height				

Table 3: Frequencies (%) of stunted, underweight and wasted children of the Santal population

Age (Year)	Sex	Stunted (%) (H-A-Z < -2.0)	Underweight (%) (W-A-Z < -2.0)	Wasted (%) (W-H-Z < -2.0)
3	Boys	21.4	30.2	10.8
	Girls	23.5	36.5	15.5
	Total	22.5	33.4	13.2
4	Boys	25.7	29.8	9.5
	Girls	22.3	35.2	13.9
	Total	24.0	32.5	11.7
5	Boys	25.6	25.7	7.8
	Girls	29.0	32.4	12.6
	Total	27.3	29.1	10.2
6	Boys	23.9	31.6	10.9
	Girls	30.2	33.1	14.7
	Total	27.1	32.4	12.8
Overall (All ages combined)	Boys	24.2	29.3	9.8
	Girls	26.3	34.3	14.2
	Total	25.3	31.8	12.0

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Table 4. Reviewing the outcomes of other relevant studies in comparison to the findings of the current research

Author(s) (year of publication)	Sample of study	Findings
Stiller et al. (2020)	307 Santal children of Birbhum.	Prevalence percentage at stunting, wasting and underweight were found to be 51.9%, 19.0% and 49.2% respectively.
Ghosh et al. (2021)	307 Santal children of Purulia.	Prevalence rates of stunting, wasting and underweight were exhibited as 27.69%, 36.81% and 44.63% respectively.
Dharmaraj et al. (2021)	128859 children from India NFHS-4.	37.93%, 34.02% and 20.70% prevalence rates were found for stunting, underweight and wasting respectively.
Li et al. (2022)	5529 children from 72 villages from rural Hunan.	Stunting, underweight and wasting children were found in 4.4%, 3.9%, and 4.0% respectively.
Luzingu et al. (2022)	3911 children.	Stunted, underweight and wasted were found at 42.7%, 21.9% and 8.2% respectively.
Mhatre et al. (2023)	8542 children from 132 Anganwadi.	Occurrence of underweight, stunted and wasted was found at 32.9%, 35.7%, and 16.4% respectively.
Present study	400 Santal children.	Rates of stunted, wasted and underweight were found to be 25.3%, 12.0% and 31.8%, respectively.

high (30%). Additionally, it is also noticeable that among both sexes, the incidence of being underweight was found to be high (20-29%) and very high (30%) for boys and girls, respectively.

It is a well-known fact that anthropometric indicators are deemed highly suitable for nutritional evaluation in population-based studies, especially since they are proxy indicators and do not require nutrient intake or biochemical examination. These indicators include indirect measures of undernutrition and are widely used because they involve a set of simple methods that are highly sensitive to the nutritional variations in a specific population as reported by Post and Victoria (2001). This makes them an appropriate choice for monitoring nutritional conditions in cohort studies, which are known to suffer from logistic support difficulties, especially in third world countries. In such cases, cross-sectional research can offer pertinent information to better understand the association between health-status and lifestyle, since they are relatively inexpensive and can be highly informative. Moreover, the basic information collected through these studies can be incredibly useful in conducting health-related surveillance programs, as well as long-term intervention approaches (Waterlow et al., 1977; Satyanarayan et al.,1989). It is also important to note that undernutrition appears to be a leading cause behind the occurrence of ill-health and early mortality among the children population of India and other such developing nations across the world. This has been highlighted in studies conducted by Nandy et al. (2005).

When it comes to evaluating the nutritional status of children, there are a number of widely-used indicators, including stunting (low H-A-Z), wasting (low W-H-Z), and underweight (low W-A-Z). Stunting is typically used to identify chronic undernutrition, which can result in a child having a low height due to factors such as prolonged illness, disease, or food scarcity. Wasting, on the other hand, is used to assess acute undernutrition, which can cause a child to have a lower weight than expected based on their age, and may be the result of recent food deficiency or ailment. Finally, underweight is considered to be a composite marker that takes into account both acute and chronic undernutrition, though it can be difficult to differentiate between the two (as noted in the World Health Organization's 1995 report on the topic).

To determine whether a child is undernourished according to these indicators, the values of their measurements (stunted, wasted, and underweight) are related to international reference values from the population of the United States, as established by the National Center for Health Statistics (NCHS) in studies conducted by Hamill et al. (1979) and the World Health Organization (1983). Specifically, if a child's measurements are found to be below the value of -2 z-scores of the reference population median value for any of these indicators, they are considered to be undernourished.

It is important to note that each of these indicators reflects distinct biological processes, and that their use is crucial for determining appropriate interventions to address malnutrition (as emphasized in the WHO's 1995 report). In the context of this particular study, the output indicated that stunting was moderately prevalent among the overall study population (at a percentage of 20-29%), while wasting was found to be highly prevalent (at 10-

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14%) and underweight was very highly prevalent (at 30%). Additionally, the study found that being underweight was more common among boys (with a prevalence of 20-29%), but highest among girls (with a prevalence of 30%).

While these findings suggest that the nutritional status of the tribal children included in this study was generally poor, it is worth noting that the prevalence rates for each of these indicators are similar to those found among children from other parts of India in various studies conducted by different researchers. Finally, it is worth highlighting that the prevalence of underweight among the study population was lower than the overall prevalence of underweight among children in India (47%) as reported by UNICEF in 2006.

The children population under study exhibited moderate chronic undernutrition due to prolonged food deprivation, as evidenced by their stunted growth. Additionally, a higher rate of acute undernutrition was observed in the same population, as indicated by the wasting condition, which may have been caused by recent food deprivation. Furthermore, a very high prevalence of both acute and chronic undernutrition was observed in children who were underweight.

Undernutrition can be caused by various factors, including prolonged food deprivation, illness, and disease, as well as demographic and socioeconomic and aspects such as poverty, education, economy, and lifestyle. Basic anthropometric measurements are used as proxy pointers to assess the nutritional profile of the children population, according to Nandy et al. (2005). These dimensions are frequently used to evaluate the nutritional profile of a population, but they only provide an approximate estimation.

Conclusion

To reduce the prevalence rate of underweight children in a given population, it is crucial to improve the overall living standards. This can be achieved through various measures, such as reducing poverty, providing clean drinking water, adequate food resources, proper sanitation, and other essential facilities. Such interventions may have a positive impact on the overall health condition of children and ensure their basic rights are met.

However, it should be noted that the present study did not cover different supplementary health and nutrition schemes for young children, nor did it address the other related factors of undernutrition. The study found that the nutritional condition of the participants was deficient, indicating the need for progress in providing supplementary nutrition and other facilities to help the population overcome poor nutritional conditions. Therefore, it is imperative that competent authorities pay special attention to enhancing the current supplementary nutrition being given to them. Of course, this initiative will require additional planning and funding to be successful.

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Conflict of Interest

None

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