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Prevalence of Nutritional Status among Bonda Children Under Five Years of Khairput Block of Malkangiri District, Odisha, India

Ranjita Nayak*, Sonia Kaushal* and Awdhesh Narayan Sharma*

Abstract: The nutritional status of children under five years of age is a critical concern for health and development, predominantly within particularly vulnerable tribal populations. The Bonda tribe is one such tribe where undernutrition among children under five years of age has not been investigated effectively in the Malkangiri district of Odisha. The present study aimed to assess the prevalence of nutritional status among children under five years of age in the Bonda tribe, Khairput block, Malkangiri district. A cross-sectional study was conducted in 28 villages within the Khairput block of Malkangiri district (Odisha), from December 2021 to July 2022. A sample of 464 children (Boys=241, Girls=223) aged 0-5 years were randomly selected from 12 Anganwadi centers, (including 416 households) for the present study. The WHO (2006) standard classification was used to calculate levels of (underweight, stunting, and wasting) for reference.

The study unveils the average height and weight among boys and girls. In the Bonda tribe, girls are taller than boys, and boys are heavier than girls. Regarding nutritional status, the prevalence of underweight, stunting, and wasting among children under five years (64.5%, 62.5%, and 33.2%, respectively) has been noticed. A greater prevalence of undernutrition was found among boys compared to girls. Statistically significant underweight was identified among girls ($p<0.05$), while no significant association was found among boys. The nutritional status of children under five of the Bonda tribe, in Malkangiri district, Odisha, is a critical situation. Therefore, this study emphasises the urgent need for targeted interventions to report the nutritional issues faced by the Bonda tribe and other marginalised groups.

Keywords: The Bonda, Malkangiri, nutritional status, under five, Odisha.

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* Research Scholar, Department of Anthropology, Dr. Harisingh Gour Vishwavidyalalya, Sagar, M.P. 470003; E-mail id-*ranjitanayak390@gmail.com*

Introduction

Child undernutrition is without any doubt one of the leading causes of morbidity and mortality in children under five (Biswas, 2022). Therefore, child malnutrition remains a major public health concern in India (Sahu et al., 2015; Dhansay et al., 2022; Kumar et al., 2021) especially among indigenous and marginalised populations. Geographical features like mountains, plateaus, plains and deserts, along with cultural differences in customs, traditions, food, and dietary taboos, all contribute to regional variations in human health. Due to these reasons, the variety of diseases in India is vast because of the complex links that exist between humans and the environment (Sonowal, 2017). Children living in such situations are particularly vulnerable to health and nutritional concerns. However, early childhood malnutrition can have a long-term negative impact on health, including stunted growth, cognitive decline, and an increased risk of acquiring infectious diseases. The problem gets worse because of a shortage of required health facilities, medicines, and healthcare workers (Srivastava et al., 2012). Similar investigations have been reported on the Indian subcontinent among numerous population groups, including tribes. Nutrition throughout the first five years of life affects not only growth and morbidity in childhood but also physical and mental development and adult health (Das et al., 2020). Naturally, poor feeding practices—rather than food availability or household food security—are the cause of malnutrition (Radhamani & Rajeev, 2017). Growth and development require a healthy diet from an early age. Nutrition is the outcome of complicated connections between food consumption, an unbalanced consumption in excess or wrong proportion intake, and general health (Kabeta et al., 2017; Radhamani & Rajeev, 2017). Inadequate nutritional intake and traditional socio-economic activities can contribute to child undernutrition (Das et al., 2020).

According to the World Health Organisation (WHO) standards, the nutritional status of under-five children is traditionally three anthropometric indices commonly used to measure nutritional status in childhood: underweight (low weight-for-age), stunting (low height-for-age), and wasting (low weight-for-height) (WHO, 2006). Children are especially vulnerable because of their high nutritional needs for physical growth and development. It is more prominent in India, where one of the world's largest number of tribal people live, and tribal cultures are more susceptible to various diseases (Padmanabhan, 2016).

The Malkangiri district in Odisha, India, was chosen as a focal area for conducting child undernutrition because of the region's alarming levels of malnutrition, as demonstrated by the data from the National Family Health Survey-5 (2019-21). The National Family Health Survey (NFHS-5) results show that India's under-five children's health and nutritional status have not improved significantly. The results in rural India were 33.8%, 37.3%, and 19.5% whereas in urban areas they were 27.3%, 30.1% and 18.5%, for underweight, stunting, and wasting, respectively (NFHS, 2022). Similarly, in odisha underweight, standing and wasting in rural areas reported rates was 31.0%, 32.0% & 18.6% while in urban areas had 21.5%, 24.9% and 14.9% (NFHS, 2022). In both regions, the figures show that the rural areas are more affected as compared to urban areas. For children under five years of age in the Malkangiri district, the nutritional status is even more concerning, with 51.8% underweight, 45.7% stunted, and 32.5% wasted (Das & Behera, 2021). The district Malkangiri has been selected for the survey partially because, no comprehensive study focusing on nutritional status concerning children under five years across all age groups belonging to the Particularly Vulnerable Tribal Group (PVTG), Bonda tribe, has yet been conducted. Malkangiri district was chosen as an excellent environment for conducting child nutrition research since it is a tribal area (58.36%) (Meher, 2007). In the Bonda tribe, only 6.35% of them are literate people (Ota, 2019). Therefore, Malkangiri district, Odisha emerged as the optimal study area for studying the prevalence of nutritional status of children among Bonda.

The Bonda tribe is found in Bonda Ghati hills in lap of nature in Odisha and it is one of the most primitive tribes belonging to the Austro-Asiatic group. They are well known for their homicidal tendencies and long-time occupation in a defined territory in relative isolation in this region. The typical Bonda villages are situated on hilltops or hill slopes surrounded by forest, suitable for shifting cultivation, and water streams are available nearby (Elwin, 1950). However, the Bonda do not receive sufficient medical care. Bonda women start working in slash cultivation and bring their newborn child into the forest after five days of pain-free childbirth. Therefore, the infant is not given enough food, attention, and medical care, which may lead to the undernutrition of children. In this, under-five children are the most vulnerable group, and their nutritional status reflects the overall health status of the Bonda population (Philip et al., 2015). Moreover, there is a lack of studies regarding the nutritional status of the Bonda population. In this context, this study aimed to assess the prevalence of the nutritional status of children under five years of age among the Bonda tribe.

Material and Methods

Study Design

A community-based cross-sectional study was conducted from December 2021 to July 2022. The study was conducted to assess the undernutrition among Bonda PVTG (Particularly Vulnerable Tribal Group) children under five years of age in the Khairput block of Malkangiri district, Odisha, India.

Sampling technique

The study was conducted in 28 villages within the Khairput block of Malkangiri district and was selected through purposive sampling. The villages and Anganwadi centres were selected using stratified random sampling. A sample of 464 children (Boys=241, Girls=223) aged 0-5 years were randomly selected from 12 Anganwadi centres, (including 416 households) for the present study. The birth dates were verified from the Anganwadi centre or *"Mamta cards"* (Maternity Cards). Additionally, anthropometric measurements of the children were taken for inclusion in the study.

Data Procurement

Secondary data sources included Anganwadi workers' records, which contained information on the children's age, gender, date of birth, and past health and nutrition status. These records were supplemented with primary data gathered from direct measurements and observations.

Anthropometric Measurements

The study required collecting anthropometric data, including the height (in cms), weight (in kgs), and mid-arm circumference (in cms) of each child (WHO, 1995). The measurements were recorded nearest to 0.1 cm and 0.1 kg. For infants, height and weight were taken using an infanometer and spring weighing machine. Other children's heights were taken using an Martin's anthropometric rod. The children were instructed to stand barefoot with the feet parallel to each other, the heels, buttocks, shoulders, and back of the head touching the measuring rod, and the hands hanging straight at their sides. The head was held comfortably erect, with the top in close contact with a horizontal piece. The children's weight was measured accurately to within 100 grams using a digital weighing machine. Children were instructed to stand on the scale in light clothing, barefoot, facing front. Then, their 'weights' were recorded.

Inclusion criteria

Children of the Bonda tribe under five years of age enrolled at the local Anganwadi centres, also, those who were available and their guardians consented to participate were included in the study.

Exclusion criteria

Children above five years of age, those not from the Bonda tribe, and those whose guardians did not agree to participate in the study were not included. Children with significant birth defects that impact nutritional measures were also not included.

Analysis

The analysis was performed using the "WHO Anthro" software (v 3.2.2), and the Z score indicators were used to determine weight-for-age (WAZ/ underweight), height-for-age (HAZ/stunting), and weight-for-height (WHZ/ wasting). The Anthropometric indices data i.e. age, sex, date of birth, height, weight, and MUAC (Mid-Upper Arm Circumference) measurements, were used to measure the prevalence rate of undernutrition among Bonda children under the age of five years. All statistical analyses, including descriptive (mean and standard deviation), and inferential statistics such as t-test to determine differences in height, weight, and MUAC between the two groups, and chi-square for significant relationships between nutritional status found, were conducted using "Statistical Package for Social Science" (SPSS) version 16.0. Graphs were prepared using Microsoft Excel (2010). A value of $p<0.05$ is considered statistically significant.

Results

Table 1: Mean and Standard Deviations of Body Weight, Height, and MUAC by Age and Sex among the Bonda Children (0-5 Years)

Age group (years)	*Sex*	*Height (cm) Mean±SD*	*Weight (kg) Mean±SD*	*MUAC (cm) Mean±SD*
1 year	Boys	64.52±12.49	7.94±8.80	12.83±1.46
	Girls	64.63±11.33	6.52±2.08	12.23±1.57
t value (Sig)		-0.052 (0.83)	1.12 (0.31)	2.12 (0.60)
2 years	Boys	76.70±8.76	8.79±1.70	12.78±1.05
	Girls	72.32±10.92	9.48±9.83	12.36±5.00
t value (Sig)		2.23 (0.61)	-0.49 (0.22)	-0.81 (0.08)

Age group (years)	*Sex*	*Height (cm) Mean±SD*	*Weight (kg) Mean±SD*	*MUAC (cm) Mean±SD*
3 years	Boys	81.96±6.76	9.91±1.92	13.28±1.16
	Girls	82.64±5.44	9.40±1.31	12.91±.96
t value (Sig)		-0.52 (0.24)	1.43 (0.07)	1.62 (0.19)
4 years	Boys	86.05±14.58	11.64±2.10	14.46±5.22
	Girls	88.43±4.91	10.87±1.94	13.72±1.01
t value (Sig)		-0.94 (0.02) *	1.73 (0.76)	0.83 (0.23)
5 years	Boys	94.25±8.29	13.05±3.15	15.30±6.58
	Girls	91.39±15.11	12.14±1.82	15.85±13.18
t value (Sig)		0.92 (0.31)	1.55 (0.66)	-0.20 (0.58)
Combined	Boys	78.36±14.69	9.86±5.24	13.53±3.52
	Girls	78.83±14.56	9.53±5.25	13.54±6.39
t value (Sig)		-0.34 (0.56)	0.68 (0.73)	-0.02 (0.45)

(*significant $p < 0.05$)

Table 1 presents age-specific mean and standard deviation data of anthropometric measurements like body weight, height, and MUAC (mid-upper arm circumference). A total of 464 children under five years of age (male-241 and female-223) were examined. The anthropometric measurements revealed that the girls were slightly taller than the boys (except for the age group of 5 years). Similarly, the boys were slightly heavier than the girls (except for the age group of 2 years). There was a significant difference between the age group of 4 years ($p<0.05$). The mean and standard deviation of the combined body height for boys and girls are 78.36±14.69 cm and 78.83±14.56 cm, respectively, with the combined body weight for boys being 9.86±5.24 kg and for girls 9.53±5.25 kg. There was no significant difference found between age-combined groups ($p > 0.05$).

Table 2: Age and Sex-wise Prevalence Rate of Nutritional Status among the Bonda (PVTGs) Children (under 0-5 years)

Age (years)	*Underweight η (%)*			*Stunted η (%)*			*Wasted η (%)*		
	Boys								
	Normal	*Moderate*	*Severe*	*Normal*	*Moderate*	*Severe*	*Normal*	*Moderate*	*Severe*
1 year	25 (37.9)	26 (39.4)	15 (22.7)	26 (39.4)	12 (18.2)	28 (42.4)	42 (63.6)	14 (21.2)	10 (15.2)
2 years	17 (32.7)	20 (38.5)	15 (28.8)	21 (40.4)	11 (21.2)	20 (38.5)	34 (65.4)	9 (17.3)	9 (17.3)
3 years	16 (35.6)	17 (37.8)	12 (26.7)	14 (31.1)	7 (15.6)	24 (53.3)	33 (73.3)	8 (17.8)	4 (8.9)

Age (years)	*Underweight η (%)*			*Stunted η (%)*			*Wasted η (%)*		
	Boys								
	Normal	*Moderate*	*Severe*	*Normal*	*Moderate*	*Severe*	*Normal*	*Moderate*	*Severe*
4 years	12 (24.5)	15 (30.6)	22 (44.9)	16 (32.7)	10 (20.4)	23 (46.9)	24 (49.0)	12 (24.5)	13 (26.5)
5 years	5 (17.2)	16 (55.2)	8 (27.6)	13 (44.8)	5 (17.2)	11 (37.9)	17 (58.6)	7 (24.1)	5 (17.2)
Total	**75 (31.1)**	**94 (39.0)**	**72 (29.9)**	**90 (37.3)**	**45 (18.7)**	**106 (44.0)**	**150 (62.2)**	**50 (20.7)**	**41 (17.0)**
p-value	**>0.16**			**>0.89**			**>0.44**		
Girls									
1 years	26 (51.0)	11 (21.6)	14 (27.5)	22 (43.1)	13 (25.5)	16 (31.4)	35 (68.6)	7 (13.7)	9 (17.6)
2 years	29 (58.0)	9 (18.0)	12 (24.0)	20 (40.0)	14 (28.0)	16 (32.0)	39 (78.0)	7 (14.0)	4 (8.0)
3 years	11 (25.6)	16 (37.2)	16 (37.2)	14 (32.6)	14 (32.6)	15 (34.9)	27 (62.8)	10 (23.3)	6 (14.0)
4 years	15 (41.7)	14 (38.9)	7 (19.4)	15 (41.7)	10 (27.8)	11 (30.6)	27 (75.0)	5 (13.9)	4 (11.1)
5 years	9 (20.9)	21 (48.8)	13 (30.2)	13 (30.2)	11 (25.6)	19 (44.2)	32 (74.4)	7 (16.3)	4 (9.3)
Total	**90 (40.4)**	**71 (31.8)**	62 (27.8)	84 (37.7)	62 (27.8)	77 (34.5)	**160 (71.7)**	**36 (16.1)**	**27 (12.1)**
p-value	**<0.00***			**>0.88**			**>0.74**		
Pooled value									
1 years	51 (43.6)	37 (31.6)	29 (24.8)	48 (41.0)	25 (21.4)	44 (37.6)	77 (65.8)	21 (17.9)	19 (16.2)
2 years	46 (45.1)	29 (28.4)	27 (26.5)	41 (40.2)	25 (24.5)	36 (35.3)	73 (71.6)	16 (15.7)	13 (12.7)
3 years	27 (30.7)	33 (37.5)	28 (31.8)	28 (31.8)	21 (23.9)	39 (44.3)	60 (68.2)	18 (20.5)	10 (11.4)
4 years	27 (31.8)	29 (34.1)	29 (34.1)	31 (36.5)	20 (23.5)	34 (40.0)	51 (60.0)	17 (20.0)	17 (20.0)
5 years	14 (19.4)	37 (51.4)	21 (29.2)	26 (36.1)	16 (22.2)	30 (41.7)	49 (68.1)	14 (19.4)	9 (12.5)
Total	**165 (35.6)**	**165 (35.6)**	**134 (28.9)**	**174 (37.5)**	**107 (23.1)**	**183 (39.4)**	**310 (66.8)**	**86 (18.5)**	**68 (14.7)**
p-value	<0.01*			>0.94			>0.78		

(*significant p<0.05)

Table 2 shows the three indicators based on the prevalence rate of underweight (Weight-for-Age), stunting (Height-for-Age), and wasting (Weight-for-Height). These data reveal gender and age-related differences in the frequency of undernutrition indicators in children aged 5 years. The prevalence of underweight, stunting and wasting is higher in boys (68.9%, 62.7%, and 37.7%, respectively) than in girls (59.6%, 62.3% and 28.1%,

respectively). Similarly, the prevalence of severe underweight, stunting, and wasting is higher in boys (29.9%, 44.0% and 17.0%, respectively) in comparison to girls (27.8%, 34.5% and 12.1%, respectively) counterpart.

It is important to note that in the 1-year age group, the prevalence of underweight and wasting is higher among girls (underweight- 22.7% in boys vs 27.5% in girls and wasting- 15.2% in boys vs 17.6% in girls); in the stunting case, prevalence is higher among boys (42.4% in boys vs 31.4% in girls).

In the 5-year age group, the prevalence of underweight (30.2% in boys vs 29.2% in girls), stunting (44.2% in boys vs 41.7% in girls), and wasting (9.3% in boys vs 12.5% in girls), it is observed that boy's prevalence is high compared with that of girls, except in wasting cases. Furthermore, the total prevalence rate among under-five children with severe underweight, stunting, and wasting is 28.9%, 39.4% and 14.7%, respectively. Hence, the overall age and sex-wise prevalence rates among Bonda under-five children in underweight (moderate + severe), stunting and wasting are 64.5%, 62.5% and 33.2%, respectively. The association between being underweight and being a girl child was found to be significant ($p<0.05$). However, no significant association was found among boys with undernutrition, stunting, or wasting ($p>0.05$) across all age groups.

Discussion

The present study highlights the prevalence of nutritional status among children under the age of five in the Bonda tribe. The findings provide valuable information about the nutritional status of the Bonda population under five years of age. Undernutrition is a type of malnutrition that occurs when the body does not receive sufficient nutrients for healthy growth, maintenance and development. Persistent undernutrition during childhood is associated with delayed cognitive development and severe health problems that diminish the quality of life and economic status (Kumar et al., 2015). Therefore, researchers, academicians and medical professionals continue to pay close attention to the nutritional status of these children (Dhansay et al., 2022). In addition, compared to Bonda's girls, Bonda's boys (under five) were more undernourished. Similar studies were conducted in the Korba Block, Chhattisgarh, India (Dhansay et al., 2022). The study argued that male children were more affected than female children. Another study on the Bharia tribe (PVTG) of Patalkot, Chhindwara (Madhya Pradesh) India (Ahirwar & Gautam, 2017) reported that the prevalence of undernutrition among 5-17-year-old children was higher among boys than among girls.

However, the prevalence of underweight, stunting, and wasting among the Bonda is 64.5%, 62.5%, and 33.2%, respectively, which is higher than that of other Indian PVTGs such as the Jenukuruba of Mysore, Karnataka (Prabhakar & Gangadhar, 2009), Sahariyas of M.P. (Ghosh et al., 2013), Kamar of Chhattisgarh (Mitra et al., 2007), Baria of Chindwada, M.P. (Ahirwar & Gautam, 2017), and Lodha of West Bengal (Bisai et al., 2008). In contrast, the prevalence of wasting among Bonda is lower than that among Kamar children of Chattisgarh (Mitra et al., 2007). This demonstrates that undernutrition is widespread among these marginalised Indian PVTG populations. (**Figure 1 indicates the prevalence of undernutrition among children of the Bonda Particularly Vulnerable Tribal Groups (PVTGs) compared with other PVTGs in India).**

Moreover, a comparison has been done on the prevalence of undernutrition among Bonda PVTGs to other Indian Tribes, viz, Kunduruba of Karnataka (Manjunath et al., 2014), Kawa, Manjhwar, Birhor, Painaka and Yadav of Chattisgarh (Dhansay et al., 2022), the tribe of Maharashtra (Meshram et al., 2012), Paniyans, Kurichiyans, Kattunayikkar and Cholanayikkar of Kerala (Philip et al., 2015), the tribes of Assam (Islam et al., 2014), the Koramundi tribe of West Bengal (Bisai & Mallick, 2011), Santal of West Bengal (Bisai, 2014), and Paniya, Betta Kurumba, Mulakurumba, and Katunayakan tribes of Nilgiri of Tamil Nadu (Sunny & Elamana, 2021); hence, these studies showed that the prevalence rate among Bonda children under five years of age, and nutritional status is higher than that among other tribes except for the Santal tribe of West

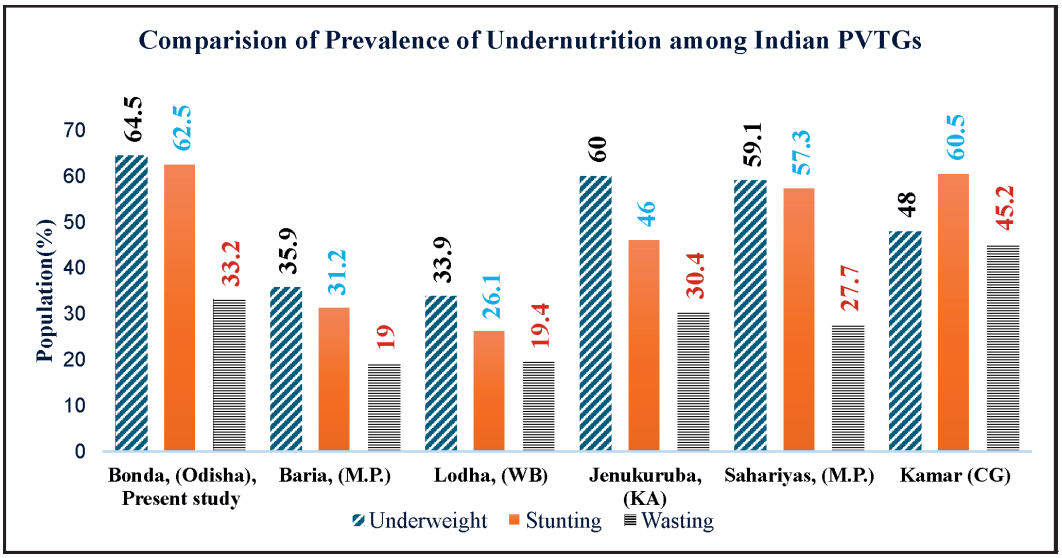

Figure 1: Comparison of Prevalence of Undernutrition among Indian PVTGs

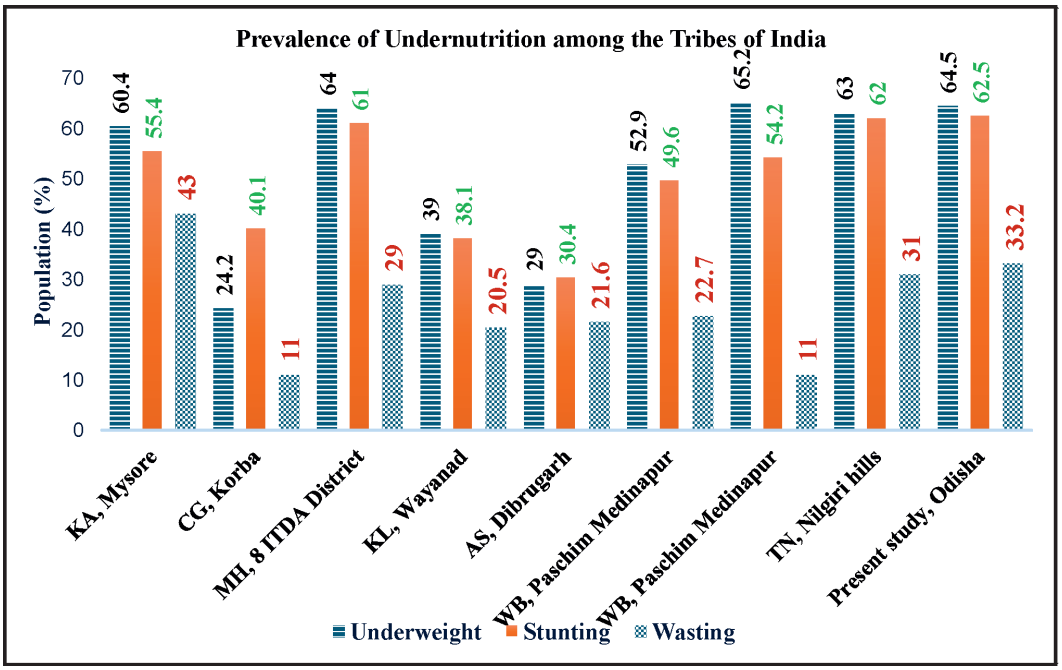

Figure 2: Prevalence of Undernutrition among the Tribes of India

Bengal, Paschim Medinipur district where underweight prevalence is higher than the Bonda children. (**Figure 2 indicates the prevalence of undernutrition among children of the Bonda Particularly Vulnerable Tribal Groups (PVTGs) compared with other Tribes in India).**

Conclusion

This study aimed to assess the prevalence of the nutritional status of children under five years of age among the Bonda tribe. It was demonstrated that the nutritional status of children under five years of age in Bonda is critical. The study found 62.5% stunting, which is indicative of long-term chronic malnutrition. Chronic malnutrition, which can begin before birth and extend throughout childhood, is frequently the cause of this illness. It has an impact on both physical and mental growth. The presence of wasting (33.2%), where children have a low weight for their height, indicates acute malnutrition. This is frequently the outcome of sudden and severe weight loss, which may be brought on by a high frequency of viral illnesses or insufficient food consumption. Children who are wasted are more likely to die or suffer from serious illnesses. According to the results, 64.5% of children are underweight, which includes both stunting and wasting. Being underweight reflects a general condition of malnutrition

and is a clear sign that children are not getting enough nutrients. Therefore, this study emphasises the urgent need for targeted interventions to address the nutritional issues among the Bonda PVTGs and other marginalised groups face. Such interventions include local nutritional programs, healthcare facilities, programs for food security, education, awareness, empowerment, schemes, and policy support. By adopting this approach in a well-organised manner, it is possible to deal with the high prevalence of undernutrition among Bonda PVTGs while simultaneously trying to improve the overall health and wellness of these vulnerable populations.

Ethical Considerations

The ethical approval for the study was obtained from the Institutional Ethics Committee at Dr Harisingh Gour Vishwavidyalaya, Sagar, Madhya Pradesh, India vide letter number: DHSGV/IEC/2022/05. Assent was obtained from the parents of the participants because the children were under five years of age.

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Conflict of Interest

There are no conflicts of interest among the authors.

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