

# Prevalence of undernutrition among tribal preschool children in Wayanad district of Kerala

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## ABSTRACT

**Background:** Nutritional status especially that of preschool children is a sensitive indicator of health and nutritional status of a community. **Aim:** To estimate the prevalence of undernutrition among tribal preschool children and to assess the factors associated with variation in nutritional status. **Methods:** A cross-sectional survey was conducted among 438 tribal preschool children in 10 clusters of Wayanad district of Kerala. Height, weight, mid-arm circumference and hemoglobin level were measured. Children more than two standard deviations (SDs) below the standard median of World Health Organization Multi Centric Growth Reference Study were considered underweight (weight-for-age), stunted (height-for-age) and wasted (weight-for-height) respectively. Qualitative variables such as prevalence of underweight, stunting and wasting were summarized using percentages. Mean (SD) was used, to summarize, quantitative variables such as height and weight. Generalized estimating equation models were constructed to assess associations. Adjusted models included social factors and child morbidities. **Results:** More than half of the children say 58.7% (257/438) had deficits in at least one of the three anthropometric indicators. The prevalence of underweight, stunting and wasting was 39% (171/438), 38% (167/438) and 20.5% (90/438) respectively. The prevalence of anemia was 95.7% (419/438). Bivariate analysis showed significant associations between undernutrition and educational status of parents, tribe to which the child belonged, diarrheal episode and low birth weight. In adjusted analysis, lower educational status of mother (adjusted odds ratio 1.9, 95% confidence intervals 1.2-3) and an episode of diarrhea (1.8, 1.03-3.2) independently predicted undernutrition in a tribal preschool child. **Conclusion:** Undernutrition in the form of stunting, wasting and underweight is very high among the tribal preschool children. There is an urgent need to improve health care services to the tribal population and tribal children.

**Key words:** Anemia, tribal, preschool, undernutrition

## INTRODUCTION

The indigenous population of the nation, known as Adivasi or scheduled tribes (STs), is among the poorest, vulnerable and most marginalized groups of the nation.<sup>[1]</sup> Most of them remain at the lowest stratum of the society due to various factors like geographical and cultural isolation, low levels of literacy, primitive occupations and extreme levels of poverty.<sup>[2]</sup> Health is a prerequisite for human development and wellbeing of a community.

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National level data show that health of indigenous people is significantly poorer than other groups.<sup>[3]</sup> The scenario is not different for the outlier state, Kerala whose 1.5% of the population is tribals.<sup>[4]</sup> Despite the remarkable progress in the field of health, the status of the tribal population is not comparable to the state's averages because of their isolation, remoteness and being largely unaffected by the developmental processes going on in the state. The human development index score of tribals (0.39) is much poorer than the nontribals (0.72) of the state.<sup>[5]</sup> Wayanad district of Kerala has the largest tribal population of the state; it accommodates one-third of the state's STs. About 17% of the district's populations are tribals. The incidence of deprivation is high among tribals (66%) compared to nontribals of both the district (42%) and state (27%).<sup>[5]</sup> Kerala had over the years initiated several focused interventions for development and improvement in health and nutritional status of tribal population.<sup>[6]</sup> In order to assess the progress and to provide inputs for strategic changes to devise and implement new policies for tribal health, it is necessary to assess the current health status of tribal population. The preschool children being the most vulnerable segment, their nutritional status will indeed reflect the health status of this population. The primary objective of this study was to estimate the prevalence of undernutrition among tribal preschool children of Wayanad district as measured by anthropometry and hemoglobin estimation and the secondary objective was to identify factors associated with the variation of nutritional status within the community.

## METHODS

We conducted a cross-sectional survey among tribal preschool children aged between 1 and 6 years residing in Wayanad district of Kerala during August 2010. The district is located on the Western Ghats in the North Eastern part of the state and is home to the largest tribal population in state. Of 36 STs notified for the state, the most populous tribe, Paniyans (22%) and Kurichiyans (9%) along with other tribes such as Kurumans, Kattunayikkar and Cholanayikkar are found in Wayanad. Most of these tribes reside in clusters known as "Uuru."

Of the 26 panchayats (considered as cluster), 10 clusters were randomly selected by probability proportionate to size sampling. Anticipating a wasting prevalence of 33%,<sup>[7]</sup> precision of 80%, an  $\alpha$  error of 5%, cluster size of 50 and assuming design effect of 1.98 the sample size was estimated to be 402. Adding a nonresponse rate of 20%, the final sample size required was 482. The list of children between 1 and 6 years was identified from Anganwadi center. The tribal promoters and anganwadi workers were asked to mobilize all children to an

identified center in each panchayat. The response rate varied from 87% to 95% according to the lists maintained in the Anganwadi centers. The cluster size varied from 37 to 51, and we included all children who attended the camp.

### Launch workshop

We invited all stakeholders for a sensitization workshop for the smooth conduct of the study. It was attended by 40 tribal Community Development Society (CDS) chairpersons and voluntary tribal promoters. CDS are functional units of Kudumbashree mission which has the widest neighborhood group network in Kerala, supporting women in self-employment and micro financing. They have plans to implement a program to improve nutritional status of tribal children. The results of this study would facilitate their planning and be expected to provide a baseline. In this workshop, we explained the study's objectives and format and affirmed our intention to work with the tribals. This workshop both confirmed the tribal community's interest in participating in the study and rallied the support of community leaders. Community consent was sought from chairperson of tribal CDS of each of the 10 panchayats. Written informed consent was obtained from the guardian of each study participant. The study was approved by the Ethics Committee of Government Medical College, Thiruvananthapuram. The height, weight and hemoglobin of each child was recorded in a health card and given to the parent. Children with severe acute malnutrition and anemia were referred to the nearest Primary Health Center.

### Anthropometric measurements

All study participants were measured for height, weight and mid-arm circumference according to the National Health and Nutrition Examination Survey 2009 revised guidelines of CDC Atlanta.<sup>[8]</sup> The height was measured using a standardized portable stadiometer with a fixed vertical backboard and an adjustable headpiece to the nearest 0.1 cm. The weight of the child in kilograms was measured using OMRON digital body weight scale. Weight was recorded to the nearest 0.1 kg. Both the equipments were calibrated before the commencement of data collection. The survey team for data collection consisted of four postgraduate students in community medicine and one lab technician. The investigators were trained in the administration of the questionnaire and on anthropometric measurements. All anthropometric measurements were taken by one investigator. Initial standardization sessions were conducted for measuring weight and hemoglobin. The guardian and the child were explained about the procedure before each measurement. Hemoglobin was measured using Drabkin's cyan meth hemoglobin method. A volume of 20  $\mu$ l of capillary blood was pipetted into 5 ml of

Drabkin's solution and vortexed for 5 min. Hemoglobin concentration was measured at a wavelength of 540 nm by a spectrophotometer. The estimates were performed on the spot of data collection.

Information on sociodemographic characteristics, birth weight, immunization status, breast feeding and weaning practices, diarrheal episodes, utilization of Anganwadi center and Primary Health Centre was collected from the mother by pretested structured questionnaire which was administered by the first author. Based on the hemoglobin levels, anemia was classified as per World Health Organization (WHO) standards.<sup>[9]</sup> Standard deviation (SD) classification defined by WHO was used to grade the nutritional status of the study population. Children more than two SDs below the standard median of WHO Multi Centric Growth Reference Study were considered underweight (weight-for-age), stunted (height-for-age) and wasted (weight-for-height) respectively.

### Statistical analysis

Qualitative variables such as prevalence of underweight, stunting and wasting was summarized using percentages and proportion and quantitative variables such as height and weight using mean (SD). The 95% confidence interval (CI) were estimated using Fliess method in WINPEPI V2.68 software since cluster sampling was used. Generalized estimating equation analysis was done to account for the cluster sampling. Stepwise binary logistic regression analysis with backward – Likelihood ratio method was performed for finding the predictors of nutritional status within the community. The data were analyzed using SPSS for Windows, Version 16.0. Chicago, SPSS Inc.

## RESULTS

A total of 438 preschool children (male 208, female 230) were examined. Majority of the mothers (46.2%) had only primary level education while one-third (31.8%) of

fathers had received high school education. However, 25.7% of the parents had never gone to school. About 93% (382/411) of the fathers were daily wagers. The fathers of the rest of the children had either expired or were estranged. Mothers of 44.5% (195/438) of children were daily wagers predominantly employed under National Rural Employment Guarantee scheme.

Only 90.4% (396/438) of children were put on breast feeding within 2 days of birth. The median duration of exclusive breast feeding in this tribal community was 4 months. About 40.8% (179/438) of the children were exclusively breast fed for at least 6 months. About 54% (236/438) of the preschool children who participated in the survey were still breast fed. The most common preferred weaning food for young infants was Ragi. About 91% (399/438) of the tribal children received supplementary nutrition, and 93.6% (410/438) were fully immunized for their age.

History of diarrhea in the previous 2 weeks of the survey was found in 16.9% (74/438) of the tribal children studied. About 49% (127/259) of the children in our study belonged to the Paniyan tribal group. We could not assess the information on tribal group of 179 children.

### Anthropometry

Overall boys were taller (88.9 cm) and heavier (11.5 kg) than girls (87.9 cm and 11.1 kg, though this difference was not statistically significant (weight  $t = 1.7$ ,  $P = 0.09$  and height = 0.79,  $P = 0.43$ ). However, the difference was significant in the first age band. Boys were significantly taller (73.7 cm) than girls (71.1 cm); ( $t = 2.5$ ,  $P = 0.02$ ). The boys in this age band were also heavier than girls; the mean weight of boys being 9.0 kg and that of girls being 7.9 kg ( $t = 4.6$ ,  $P < 0.001$ ) [Table 1].

### Prevalence of undernutrition

The prevalence of undernutrition (below 2 SD) observed among them in terms of underweight was 39% (95% CI

**Table 1: Age and sex wise data on anthropometry of tribal preschool children**

Age group	Gender	n	Weight (kg) mean (SD)	95% CI of weight	Height (cm) mean (SD)	95% CI of height
1-2	Boy	40	9.0 (1.5)	8.6, 9.4	73.7 (5.4)	71.9, 75.5
	Girl	46	7.9 (0.9)	7.7, 8.1	71.1 (4.5)	69.7, 72.5
2-3	Boy	53	10.3 (1.2)	9.9, 10.7	83.4 (5.9)	81.8, 85
	Girl	55	10.3 (1.6)	9.9, 10.7	83.3 (6.1)	81.7, 84.9
3-4	Boy	52	11.9 (1.5)	11.5, 12.3	91.9 (4.8)	90.5, 93.3
	Girl	57	11.6 (1.5)	11.2, 12	91.3 (5.5)	89.8, 92.8
4-5	Boy	38	13.1 (1.5)	12.7, 13.5	97.6 (4.8)	96.1, 99.1
	Girl	39	13.2 (1.6)	12.6, 13.8	97.9 (5.6)	96.1, 99.7
5-6	Boy	27	14.3 (1.4)	13.7, 14.9	102.9 (5.1)	100.9, 104.9
	Girl	31	14.3 (1.4)	13.7, 14.9	104.1 (3.9)	102.7, 105.5

SD = Standard deviation, CI = Confidence interval

35.56%, 42.5%) (171/438), stunting 38.1% (34.3%, 42%) (167/438) and wasting 20.5% (15.9%, 25.2%) (90/438). The study revealed severe degree (below-3SD) of underweight, stunting and wasting in 8.2% (36/438), 14.6% (64/438) and 2.5% (11/438), respectively. Prevalence of undernutrition in terms of underweight, stunting was similar in both the sexes but wasting was significantly more among boys [Table 2]. About 5.3% (23/438) of the children had deficits in all three anthropometric indices. About 53% (234/438) of the children had deficits in one or two indices. The intraclass co-relation co-efficient was obtained to be 0.013 with a design effect of 1.55.

### Prevalence of anemia

Prevalence of anemia among tribal children was 95.7%; 95% CI 92.3%, 99.1% (419/438). Moderate or severe anemia was found in 73.5%; 58.6%, 74.8% (322/438).

### Factors associated with undernutrition

To obtain the determinants of undernutrition, children were classified as undernourished if they had a deficit in at least one of the three anthropometric indices; stunting, underweight or wasting. Bivariate analysis included parameters listed in Table 3. It indicated that lower educational status of parents, diarrheal episode in last 2 weeks, low birth weight and belonging to Paniya tribe was significantly associated with undernutrition in preschool tribal children.

Generalized estimating equation analysis on predictors of undernutrition in a tribal child showed that the independent determinants of undernutrition were lower education status of mother ( $P < 0.01$ , odds ratio [OR] 1.9, 95% CI 1.2, 3) and a diarrheal episode in last 2 weeks ( $P = 0.03$ , OR 1.8, 95% CI 1.03, 3.2).

## DISCUSSION

A prevalence of underweight above 30% and wasting above 10% are considered serious public health problems.<sup>[10]</sup> Our study revealed that undernutrition was substantially higher in preschool tribal children in Wayanad with the prevalence of underweight, stunting and wasting being 39%, 38% and 20.5% respectively. More than half (58.7%) of the children of both sexes were undernourished. A tribal survey in Kerala conducted by national nutrition monitoring bureau 2 years prior to our study showed a higher prevalence of underweight (43%) and stunting (54%) and a lower prevalence of wasting (15%).<sup>[11]</sup>

Kerala has the lowest proportion of children with underweight (23%), stunting (25%) and wasting (16%)<sup>[3]</sup> and hence the high figures of undernutrition among tribal preschoolers speak of the deprivation of this marginalized community. However, undernutrition among the tribes of Wayanad was much lesser than other tribes of the nation; underweight 55%, stunting 54% and wasting 28%.<sup>[3]</sup> The prevalence of underweight in studies done among tribes in other parts of the country ranged from 29% to 69%, stunting was 30-63% and wasting was 20-59%. The prevalence of severe degrees of undernutrition in Wayanad was also lesser compared to tribals in other parts of the nation.<sup>[11-17]</sup> This speaks of the comparative better position of the tribes of Wayand suggesting the impact of overall better public health policies of Kerala.

The height-for-age indicates linear growth retardation and cumulative growth deficits. It captures chronic malnutrition and reflects failure to receive adequate

**Table 2: Prevalence of undernutrition in tribal preschool children of Wayanad**

Gender	Underweight n (%) (95% CI)	Stunting percentage (95% CI)	Wasting percentage (95% CI)
Boys (n=208)	84 (40.4; 35.0, 45.8)	79 (37.0; 33.3, 42.7)	55 (26.4; 20.1, 32.8)
Girls (n=230)	87 (36.6; 31.1, 44.6)	88 (38.2; 33.3, 43.2)	35 (15.1; 10.5, 19.9)
Total (n=438)	171 (39; 35.56, 42.5)	167 (38.1; 34.3, 42.0)	90 (20.5; 15.9, 25.2)

CI = Confidence interval

**Table 3: Bivariate analysis of risk factors associated with undernutrition among tribal children**

Risk factors	Undernourished children (n = 257) (%)	Normal children (n = 181) (%)	Crude OR	95% CI
Education of mother primary or less	200 (77.8)	108 (59.7)	1.67	1.12, 2.48
Education of father primary or less	178 (69.3)	104 (57.5)	1.67	1.12, 2.48
Diarrheal episodes	54 (21)	20 (11)	2.14	1.23, 3.72
Paniya tribe*	86 (33.5)	41 (22.7)	1.92	1.16, 3.17
Low birth weight#	187 (72.8)	104 (57.5)	1.98	1.32, 2.96
Boy	126 (49)	82 (45.3)	1.16	0.79, 1.7
Breast feeding <6 months	151 (58.8)	108 (59.7)	0.96	0.65, 1.42
Not taking supplementary nutrition from anganwadi	22 (8.6)	17 (9.4)	0.92	0.47, 1.75

\*Information on tribe was available only for 259 children, #Information available only for 266 children, OR = Odds ratio, CI = Confidence interval

nutrition over a long period and is also affected by recurrent and chronic illness. Weight-for-age is a composite index of growth as it accounts both acute and chronic malnutrition. The prevalence of wasting and stunting are reported to be higher among tribal boys than tribal girls.<sup>[11]</sup> In our study, only wasting was found to be higher among boys. Boys were also taller and heavier than girls in the first age band (1-2 years). However, a few studies reported that there was no sex differentials in anthropometry among tribal children.<sup>[3,7]</sup>

We found that 67% of children belonging to Paniya tribal group were undernourished; of whom 50% were underweight. This was higher than a previous report from this tribal group (60%).<sup>[18,19]</sup> They also have low rates of health care utilization. Though there are special tribal schemes and programs, the Paniyas seldom avail these, compared to other tribal groups. They also demonstrate high levels of resignation to their situation and have been found to underreport their health conditions, which indicates their extreme levels of deprivation and marginalization.<sup>[18]</sup> The policy makers should think of culturally sensitive strategies to mainstream such backward tribes so that their nutritional status, health and development don't lag behind other communities.

The nutritional status of young children is directly affected by infant and young child feeding practices. In our study feeding practices did not emerge as a risk factor for undernutrition. However, some of the feeding practices were poor among the tribals of Kerala compared to nontribals. For example, the proportion of tribal children put on breast within 2 days of birth was lower than that reported by the general population of Kerala (95.7%).<sup>[3]</sup> About 9% of tribal infants in our study were deprived of the highly nutritious first milk (colostrum). Similarly, a lower proportion of tribal children were exclusively breast fed (41%) compared to the nontribals of the state (58%). However, when compared to tribals in India, the median duration of exclusive breast feeding (3 months) was slightly higher in tribals of Wayanad (4 months).<sup>[3]</sup> However, 54% of the children in the study continued to get breast milk.

Our study showed that 59% of the tribal children who received supplementary nutrition were undernourished. This could be because, though collected, Amritham mix, the take home ration given for preschoolers might not be well accepted by a majority of the children. The high immunization coverage among the tribal children in our study demonstrates that health care services are accessible, acceptable and are being utilized by these communities. This was a remarkable finding suggesting that we need to make health care services sensitive to the needs of tribals.

Our data extend previous findings that maternal education has a strong relationship with nutritional status of children. Studies have shown that mothers who have no education are 3 times more likely to have underweight children than mothers who have completed at least 12 years of education.<sup>[18,19]</sup> One of the key factors for healthy life ways for all human societies is female literacy and subsequent awareness to several health and nutritional aspects of life. Empowerment of tribal women in Kerala is thus the need of the hour for initiating health promotional activities in tribal communities. There is a potential opportunity of using existing community networks such as Kudumbasree and community volunteers for this.

The prevalence of an episode of diarrhea among tribal children in our study was higher (16%) than that reported among tribals in Orissa (13%).<sup>[20]</sup> Since a diarrheal episode was a significant independent predictor of undernutrition in a tribal child, prevention and management of diarrheal diseases needs to be given priority in this setting.

Anemia was widespread among tribal children of Wayanad. The prevalence of anemia was higher than children of other STs of India (76.8-86.7%).<sup>[3,8]</sup> We did not explore the determinants of anemia. The high prevalence of sickle cell disease in tribals of Kerala is well documented in literature.<sup>[21]</sup> Although we attempted to look into the sickle cell test status, majority of tribals were ignorant about the same and no documents were available at the time of study for verification.

### Strengths and limitations

Although our findings offer insights into the extent of undernutrition among tribal children, they must be interpreted in the context of certain study limitations. Some of the outcomes were based on self-report that is vulnerable to recall biases. Since the analysis was cross-sectional, causality cannot be assumed. We also could not bring out some important risk factors of undernutrition such as poor dietary intake, recent infections, presence of sickle cell anemia and tribe to which the child belong. We suggest that the dietary intake behavior of tribals be explored to identify strategies that could make a sustained difference. Our study was unique in discussing the prevalence of undernutrition among a marginalized population (tribals) of a high performing state in health; Kerala.

## CONCLUSION

The prevalence of undernutrition among the tribal children is higher than nontribal children of Kerala. But their nutritional status is better in comparison to tribal children in other states of the country suggesting

the impact of better public health policies of the state. However, the current situation calls for an urgent need to improve health care services to the tribal population and tribal children. The study thus has policy implications. The evidence from this article is a pointer for all those high performers in health to look into the hidden morbidities existing among its marginalized communities.

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