

Ethnic variation in stunting and its concomitant factors among indigenous preschool children of Purulia district, West Bengal, India

Variación étnica en el retraso del crecimiento y sus factores concomitantes entre los niños indígenas en edad preescolar del distrito de Purulia, Bengala Occidental, India

Variação étnica sobre a baixa estatura para a idade e seus fatores concomitantes entre as crianças indígenas em idade pré-escolar indígenas do distrito de Purulia, West Bengal, Índia

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Abstract

This study aimed to investigate variations in the prevalence of stunting by age, sex, and ethnicity, as well as its associated factors. The present cross-sectional study was conducted in three blocks of Purulia district, focusing on children from two distinct ethnic groups (Kurmi and Sabar). A total of 701 study participants (boys: 372; girls: 329) were investigated, from the Kurmi (377) and Sabar (324) communities, within the age group of 1–5 years. The children's stunting status was assessed in terms of height using WHO-recommended Z-score values. The overall rate of stunting was 58.2%, with the Sabar children (75%) having a significantly higher rate of stunting than the Kurmi

ones (43.77%) ($\chi^2 = 69.87, p < .001$). A significant association was also observed between the prevalence of stunting and socio-behavioural variables. Binary logistic regression analysis revealed that birth weight (BW) was a significant predictor of stunting among Kurmi boys (Wald = 16.08, $p < .001$). Colostrum feeding status (CFS) was also a significantly strong predictor of stunting, irrespective of sex, among the Kurmi children (Wald = 18.56, $p < .001$). Number of sibs (NS) (Wald = 9.75, $p < .001$) was a predictor among the studied children; more specifically, it was a predictor among Kurmi girls (Wald = 7.71, $p < .05$). Similarly, among the Sabar children, birth order (BO) was found to be a significant predictor of stunting (Wald = 8.71, $p < .01$). Furthermore, it was found that ethnicity (Wald = 37.96, $p < .001$) was the strongest predictor of stunting after controlling for the effects of all other socio-behavioral variables. The study revealed ethnic variation in the impact of socio-behavioral determinants on stunting status among the studied children, with different socio-demographic and behavioral characteristics serving as significant predictors of stunting. *Rev Arg Antrop Biol* 27(2), 114, 2025. <https://doi.org/10.24215/18536387e114>

Keywords: ethnicity; India; nutritional status; preschool

Resumen

Este estudio tuvo como objetivo investigar las variaciones en la prevalencia del retraso del crecimiento por edad, sexo y origen étnico, así como sus factores asociados. El presente estudio transversal se llevó a cabo en tres bloques del distrito de Purulia, centrándose en niños de dos grupos étnicos distintos (Kurmi y Sabar). Se investigó un total de 701 participantes (niños: 372; niñas: 329) de las comunidades Kurmi (377) y Sabar (324), dentro del grupo de edad de 1 a 5 años. El estado de retraso del crecimiento de los niños se evaluó en función de la estatura utilizando los valores de puntuación Z recomendados por la OMS. La tasa general de retraso del crecimiento fue del 58,2%, y los niños Sabar (75%) tuvieron una tasa de retraso del crecimiento significativamente mayor que los Kurmi (43,77%) ($\chi^2 = 69,87, p < ,001$). También se observó una asociación significativa entre la prevalencia del retraso del crecimiento y las variables socioconductuales. El análisis de regresión logística binaria (BLR, por sus siglas en inglés) reveló que el peso al nacer es un predictor significativo del retraso del crecimiento entre los niños Kurmi (Wald = 16,08, $p < ,001$). El estado de alimentación con calostro también fue un predictor significativamente fuerte del mismo, con independencia del sexo, entre los niños Kurmi (Wald = 18,56, $p < ,001$). El número de hermanos (Wald = 9,75, $p < ,001$) fue un predictor entre los niños estudiados; más específicamente, entre las niñas Kurmi (Wald = 7,71, $p < ,05$). De manera similar, entre los niños Sabar se encontró que el orden de nacimiento era un predictor significativo de retraso en el crecimiento (Wald = 8,71, $p < ,01$). Además, se encontró que el origen étnico (Wald = 37,96, $p < ,001$) era el predictor más fuerte del retraso del crecimiento después de controlar los efectos de todas las demás variables socioconductuales. El estudio reveló una variación étnica en el impacto de los determinantes socioconductuales en el retraso del crecimiento entre los niños analizados, con diferentes características sociodemográficas y conductuales que sirven como predictores importantes del retraso del crecimiento. *Rev Arg Antrop Biol* 27(2), 114, 2025. <https://doi.org/10.24215/18536387e114>

Palabras Clave: etnicidad; India; estado nutricional; preescolares

Resumo

Este estudo teve como objetivo investigar variações na prevalência de baixa estatura por idade, sexo e etnia, bem como seus fatores associados. O presente estudo transversal foi realizado em três quarteirões do distrito de Purulia, com foco em crianças de

dois grupos étnicos distintos (Kurmi e Sabar). Um total de 701 participantes (meninos: 372; meninas: 329) das comunidades Kurmi (377) e Sabar (324) foram incorporados a essa pesquisa, compreendendo a faixa etária de 1 a 5 anos. O estado de baixa estatura para a idade das crianças foi avaliado com base na altura, utilizando os valores do escore Z recomendados pela OMS. A taxa global de baixa estatura para a idade foi de 58,2%, e as crianças Sabar (75%) tiveram uma taxa significativamente mais elevada do que as Kurmi (43,77%) ($\chi^2 = 69,87$, $p < ,001$). Revelou-se também que houve associação significativa entre a prevalência de baixa estatura e variáveis sociocomportamentais. A análise de regressão logística binária revelou que o peso ao nascer foi um preditor significativo de baixa estatura para a idade entre os meninos Kurmi (Wald = 16,08, $p < ,001$). O estado de alimentação com colostro também foi um preditor significativamente forte do mesmo, independentemente do sexo, entre as crianças Kurmi (Wald = 18,56, $p < ,001$). O número de irmãos (Wald = 9,75, $p < ,001$) foi, também, um preditor entre as crianças estudadas; mais especificamente, foi um preditor entre as meninas Kurmi (Wald = 7,71, $p < ,05$). Da mesma forma, entre as crianças Sabar, a ordem de nascimento foi considerada um preditor significativo de nanismo (Wald = 8,71, $p < ,01$). Além disso, verificou-se que a origem étnica (Wald = 37,96, $p < ,001$) foi o preditor mais forte de baixa estatura para a idade após controlar os efeitos de todas as outras variáveis sociocomportamentais. O estudo revelou uma variação étnica no impacto dos determinantes sociocomportamentais sobre a situação de baixa estatura para a idade entre as crianças estudadas, com diferentes características sociodemográficas e comportamentais servindo como preditores significativos de nanismo. Rev Arg Antrop Biol 27(2), 114, 2025. <https://doi.org/10.24215/18536387e114>

Palavras-chave: etnia; Índia; estado nutricional; pré-escola

Undernutrition is one of the world's most serious problems but least-addressed development challenges. It has been estimated that 148 million children are stunted (low height-for-age) worldwide. Stunting in early childhood can cause delayed cognitive development, and it could hamper the productivity of future life (Food and Agriculture Organization of the United Nations [FAO], 2024; United Nations Inter-Agency Group for Child Mortality Estimation, 2023). Moreover, it indicates growth failure and predicts many other outcomes, including cognitive deficits and future economic opportunities, confining a country's ability to accumulate human capital (World Bank, s.f.).

Despite several developmental schemes and programmes, the latest editions of the Joint Malnutrition Estimate (JME) by the World Health Organization (WHO), the United Nations Children's Fund (UNICEF) and the World Bank addressed that, globally, 23.2% of children under five years old are stunted and 6.6% are wasted, with a share of 4% overweight in 2024 (World Health Organization, 2025). The preschool age group is the foundation for lifetime health, strength, and intellectual vitality (Verma & Prinja, 2008). Assessing nutritional status among pre-school children is becoming a major priority. This age group is particularly fraught with the risk of protein-energy malnutrition (Gupta & Shukla, 1992).

In India, childhood undernutrition is severe, and it is a major underlying cause of child mortality. In developing countries, undernutrition is mainly poverty-induced. However, the immediate causes are dietary deprivation, aggravating and conditioning factors like infections, infestations, illiteracy, large family size and many other socio-demographic determinants (Bagchi, 1986). The nutritional status of children is determined by the in-terplay of various socio-demographic and socio-economic factors (Biswas & Bose, 2010; Biswas *et al.*, 2011), birth weight (Halli *et al.*, 2022; Jana *et al.*,

2023), birth order, birth spacing, duration of breastfeeding, mother's age at birth, mother's education and occupation (Sk *et al.*, 2021), as well as nutritional patterns (Pava Yépez *et al.*, 2024).

Over the last few decades, the most extensive and internationally recommended indicators (i.e. weight-for-height (W/H), weight-for-age (W/A), and height-for-age (H/A)) have often been employed worldwide to determine the nutritional status of children under 5 years old (WHO, 2006).

The present study was undertaken to estimate the age, sex, and ethnic variations in the prevalence of stunting. It also endeavoured to establish the relationship between stunting status and socio-demographic and behavioral factors among the preschool children of Kurmi and Sabar indigenous groups of Purulia district of West Bengal.

MATERIALS AND METHODS

Area

The preschool children included in this study belong to Kurmi and Sabar communities. The people of Kurmi community mainly reside in Jharkhand, Odisha and West Bengal states. In the latter, they are distributed in the districts of Purulia, Bankura, East Midnapur, West Midnapur, and Jhargram, where they are classified as an Other Backward Class community by the State government. They are primarily agriculturalists (O'Malley, 1910). Sabar of Purulia is a marginalized tribal community, mainly found in the eastern plateau region of India. The Sabars are the Mundari-speaking tribes extensively spread over hill regions of the state of Odisha, Madhya Pradesh, Andhra Pradesh, Jharkhand, and West Bengal (Basu *et al.*, 2004). In West Bengal, Sabar is known as Kharia, Kheria, and Savar (Vidyarthi & Upadhyay, 1980). The scheduled tribes of West Bengal shared 5.8% (5,296,963) of the total population, and the Sabar tribe was only 2% (108,707) of the total population of the state (Census of India, 2011).

The present cross-sectional study was undertaken at three community development blocks (Puncha, Manbazar I, and Barabazar) in Purulia district, West Bengal, India. The study area is very remote and situated 350 km away from Kolkata, the provincial capital of West Bengal (Figure 1).

The study participants

The research was conducted from March 2022 to May 2023 among preschool children from the household level, and Integrated Child Development Service (ICDS) scheme centre, while those children who were not available in ICDS centres were visited house to house. In the first approach, the ICDS authorities, local community leaders, and children's parents were informed about the objective of the research and engaged to participate in the study. An attempt was made to include the entire sample from preschoolers from those centres where Kurmi and Sabar's children are highly concentrated. Accordingly, healthy (devoid of apparent acute disease and illness) children aged 1 to 5 years were included in carrying out the work. Every centre was visited once for new subjects to be enrolled. Finally, 45 Integrated Child Development Service (ICDS) scheme centres were randomly selected from the three blocks (Puncha, Manbazar I and Barabazar) of Purulia district of West Bengal. A total of 701 preschool children enrolled at these centres were investigated, comprising both Kurmi and Sabar ethnic groups (Table 1). The age of the children were ascertained from the immunization card, birth certificate and Anganwadi register.

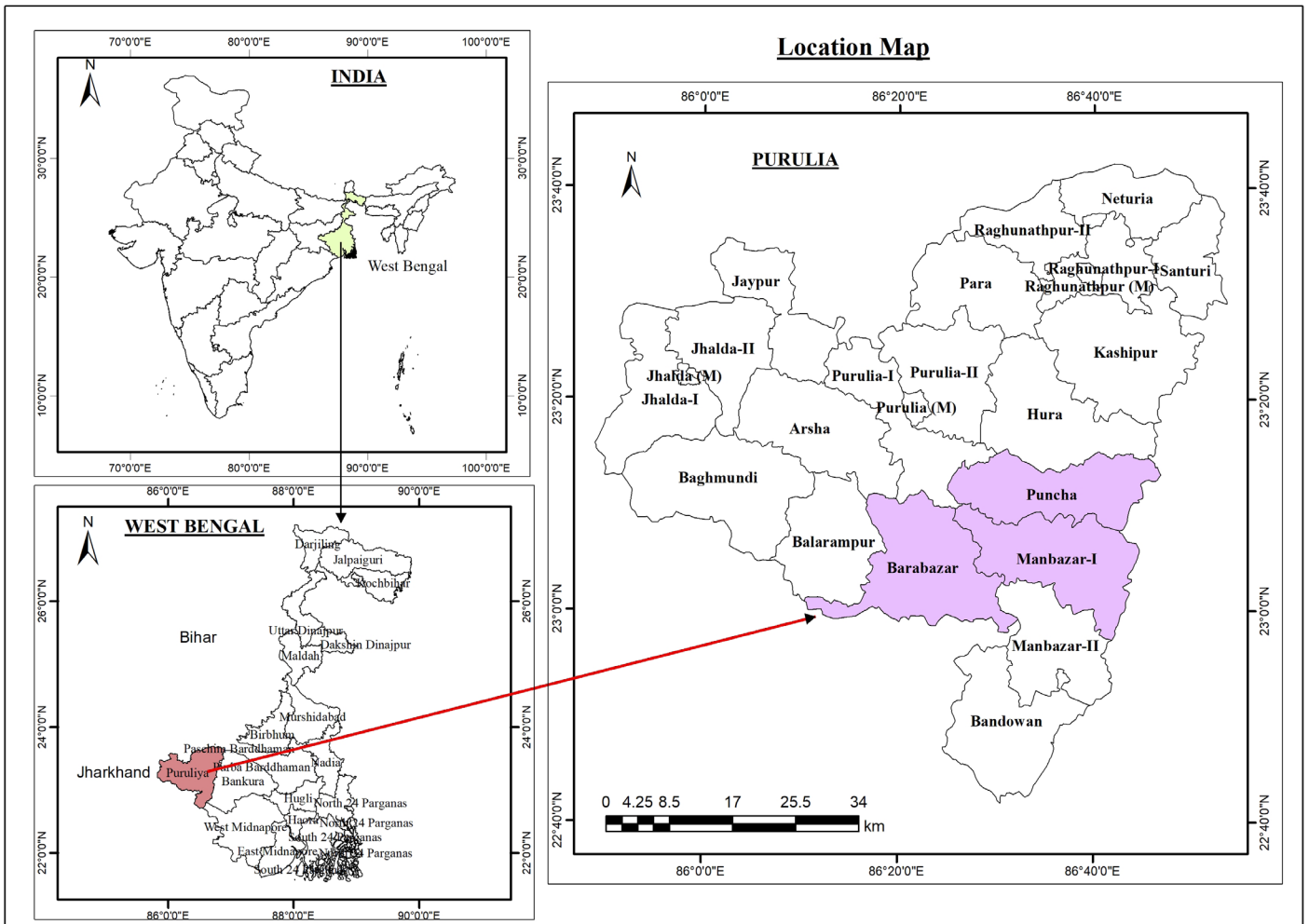


FIGURE 1. Location of the three community development blocks (Puncha, Manbazar I, and Barabazar) in Purulia district, West Bengal, India, where the study was conducted.

TABLE 1. Ethnic and sex specific distribution of the preschool children.

Sex	Kurmi	Sabar	Ethnic-combined
Boys	197	175	372
Girls	180	149	329
Total	377	324	701

Sample size calculation

The sample size of study was estimated as per Cochran's infinite sample size formula (Cochran, 1963). The minimum sample size was calculated in 644 preschool children as follows:

$$n_0 = \frac{z^2 p(1-p)}{e^2} \quad n_0 = \frac{1.96^2 * 0.58 * 0.42}{0.04^2} = \frac{3.8416 * 0.2436}{0.0016} = 585 + 10\% = 644$$

Where n_0 = sample size. "Z" indicates the selected critical value of desired confidence level. "p" indicates the estimated proportion of the population. The estimated variability (undernutrition) of this area is 58% ($p = .58$). Lastly, "e" denotes the desired level of precision.

Ethical Approval

The institutional ethical endorsement was obtained from the Sidho-Kanho-Birsha University's Institutional Ethical Committee. Prior to the survey, informed consent was obtained from the children's parents.

Anthropometric measurement

Height (cm) was measured following the standard method (Lohman *et al.*, 1988). It was measured using a Martin anthropometer (GPM) to the nearest 0.1 cm.

Socio-demographic variables

Socio-demographic information was collected through a pre-tested schedule, including specific information on age, sex, ethnicity, birth weight (BW), colostrum feeding status (CFS), number of sibs (NS) and birth order (BO). The BW and CFS of the children were grouped into two categories: Normal birth weight (NBW) and low birth weight (LBW), and CFS was yes and no, respectively. NS and BO were grouped into three categories: no sibs, 1 sib and >1 sibs; and 1st, 2nd, and > 2nd birth order, respectively.

Assessment of nutritional status

The WHO age and sex-specific < -2 Z scores were followed to define stunting. Thus, our study used the WHO cut-off < -2 SD HAZ (SD: Standard Deviations; HAZ: height-for-age specific Z score) to evaluate stunting (World Health Organization [WHO], 2006).

Statistical analyses

The Statistical Package for Social Sciences (SPSS) Version 25 software was used for statistical analyses. Emergency Nutrition Assessment (ENA) software was used to collect anthropometric data. Student's t-test tested ethnic and sex differences in means of height. Comparison of means was computed through Scheffe's one-way ANOVA (Scheffé, 1953) to test for age differences in mean height for each sex. Chi-squared tests were performed to assess the association between stunting status and discrete variables. Binary logistic regression analyses (dependent = stunting status = yes [1] /no [0]) were performed separately with BW, CFS, NS, and BO as independent variables. Furthermore, multivariate logistic regression analyses were also performed to identify the most important independent predictor(s) of stunting status. All statistical tests were set at $p < .05$.

RESULTS

Significant age variations, and ethnic, and sex differences in mean height were found among the studied preschool children (Table 2). Generally, girls were shorter than boys at all ages except at four and five years among Kurmi children, and at all ages among

Sabar children. We observed significant age variations in mean height among Kurmi ($F = 120.05$; $p < .001$) and Sabar boys ($F = 204.55$; $p < .001$), as well as among girls (Kurmi: $F = 186.55$; $p < .001$; Sabar: $F = 110.95$; $p < .001$). A significant sex difference also existed in mean height at the age of one year among Kurmi children and at the age of 4 years among Sabar children.

TABLE 2. Descriptive statistics of height (cm) by age, sex and ethnic groups.

Age (years)	Kurmi						t	Sabar						t	t ¹	t ²	t ³	
	Boys			Girls				Boys			Girls							
	n	Mean	SD	n	Mean	SD		n	Mean	SD	n	Mean	SD					
1	30	73.34	3.31	18	71.46	2.45	2.09*	33	70.79	4.40	22	69.88	6.18	0.64	2.58*	2.58*	1,02	
2	41	81.40	6.86	56	79.77	4.99	1.35	38	78.08	4.38	29	77.06	4.30	0.95	3.35**	2.54*	2.49*	
3	43	88.90	5.41	34	88.02	3.87	0.8	41	85.99	4.62	35	84.80	5.11	1.06	3.94***	2.65*	2.94***	
4	50	94.55	6.22	42	95.04	5.35	-0.4	39	91.51	3.72	36	89.23	6.13	1.97*	5.08***	2.70*	4.47***	
5	33	99.85	4.62	30	100.22	3.86	-0.34	24	98.01	3.14	27	97.79	3.59	0.23	2.92**	1,69	2.45*	
F	120.05***			186.55***				204.55***			110.95***							

SD: Standard Deviation. t: Sex difference. t¹: Ethnic difference in mean height among the children. t²: Ethnic differences in mean height among boys. t³: Ethnic differences in mean height among girls. F: ANOVA F-value indicating differences in mean height among age groups within each sex and ethnic group. ***: $p < .001$. **: $p < .01$. *: $p < .05$.

The overall prevalence of stunting (ethnic, age and sex combined) was 58.2%. The prevalence of stunting among Kurmi children was 43.77%, and 75% among Sabar children (Table 3). There was a significant ethnic difference ($\chi^2 = 69.87$; $p < .001$) in the prevalence of stunting, and Sabar children were significantly more stunted than Kurmi children. The rate of stunting among the Kurmi was high at the age of 1 year for both boys and girls, while among the Sabar it was at 2 years old for boys and at 1 year old for girls.

TABLE 3. Age, sex and ethnic specific prevalence of stunting among the studied preschool children.

Age (years)	Kurmi						Sabar						Overall	
	Boys		Girls		Sex-combined		Boys		Girls		Sex-combined		n	%
	n	%	n	%	n	%	n	%	n	%	n	%		
1	17	56.67	11	61.11	28	58.33	28	84.85	16	72.73	44	80.00	72	69.90
2	19	46.34	24	42.86	43	44.33	34	89.47	19	65.52	53	79.10	96	58.54
3	17	39.53	10	29.41	27	35.06	32	78.05	23	65.71	55	72.37	82	53.59
4	22	44.00	20	47.62	42	45.65	30	76.92	30	83.33	60	80.00	102	61.08
5	15	45.45	10	33.33	25	39.68	13	54.17	18	66.67	31	60.78	56	49.12
Overall	90	45.69	75	41.67	165	43.77[^]	137	78.29	106	71.14	243	75.00[^]	408	58.20

[^]: Significant ethnic difference in prevalence of stunting ($\chi^2 = 69.87$; $p < .001$).

The rate of stunting was higher among boys than girls in both communities. Among Kurmi boys, 45.69% were stunted, whereas among girls, 41.67% were stunted. Among Sabar boys, 78.29% were stunted, whereas among girls, 71.14% were stunted.

The association between stunting and socio-demographic variables is depicted in Table 4. The results revealed that BW ($\chi^2 = 16.64$; $p < .001$) among Kurmi boys, CFS ($\chi^2 = 4.30$; $p < .05$) and NS ($\chi^2 = 10.15$; $p < .01$) among Kurmi girls, and BO ($\chi^2 = 9.24$; $p < .05$) among Sabar boys were all significantly associated with the stunting status.

TABLE 4. Sex and ethnic specific association between stunting and socio-demographic variables.

Independent variables	Kurmi						Sabar						Ethnic combined						Overall									
	Boys			Girls			Boys			Girls			Sex combined			Boys			Girls			n	%	χ^2				
	n	%	χ^2	n	%	χ^2	n	%	χ^2	n	%	χ^2	N	%	χ^2	n	%	χ^2	n	%	χ^2							
Birth weight	LBW	50	64.10	16.64***	36	48.65	2.81	86	56.58	16.64***	87	83.65	3.74	58	70.73	0.10	145	77.96	1.36	137	75.27	28.93***	94	60.26	3.74	231	68.34	27.29***
	NBW	39	34.21		36	36.00		75	35.05		47	71.21		41	73.21		88	72.13		86	47.78		77	49.36		163	48.51	
Colostrum feeding status	Yes	49	40.50	3.40	34	34.69	4.30*	83	37.90	7.31*	46	73.02	1.61	36	72.00	0.03	82	72.57	0.55	95	51.63	13.50***	70	47.30	6.48**	165	49.70	18.75***
	No	41	53.95		41	50.00		82	51.90		91	81.25		70	70.71		161	76.30		132	70.21		111	61.33		243	65.85	
Number of siblings	No sib	29	39.19	2.08	32	49.23	10.15**	61	43.88	4.44	33	71.74	2.99	31	75.61	0.75	64	73.56	0.34	62	51.67	13.30***	63	59.43	12.49***	125	55.31	18.49***
	> 1 sib	43	48.86		24	29.27		67	39.41		36	75.00		26	72.22		62	73.81		79	58.09		50	42.37		129	50.79	
Birth order	1st	18	51.43		19	57.60		37	54.41		68	84.95		49	68.06		117	76.47		86	74.14		68	64.76		154	69.68	
	2nd	39	41.94	1.00	35	41.67	4.78	74	41.81	0.26	38	65.52	9.24*	42	72.41	1.75	80	68.97	3.62	77	50.99	15.31***	77	54.23	4.94	154	52.56	15.95***
	> 2nd	16	48.48		16	59.26		32	53.33		63	87.50		41	66.13		104	77.61		79	75.24		57	64.04		136	70.10	

NBW: Normal birth weight. LBW: Low Birth Weight. Sib.: Siblings. ***: p < .001. **: p < .01. *: p < .05.

Binary logistic regression analysis was undertaken to identify the individual predictors of stunting, and the model was set with stunting status (yes [0]/no [1]) as a dependent variable, and BW, CFS, NS and BO as independent variables (Table 5). These regression analyses were performed separately for each independent variable. Results revealed that, overall, BW (Wald = 26.86; $p < .001$) and CFS (Wald = 18.56; $p < .001$) were the strongest predictors of stunting among the studied children, irrespective of sex and ethnicity. Moreover, BW was found to be a significant predictor of stunting among Kurmi children (Wald = 16.43; $p < .001$). Similarly, NS (Wald = 9.75; $p < .001$) was a strong predictor among the studied children; more specifically, it was a strong predictor among Kurmi girls (Wald = 7.71; $p < .05$). BO (Wald = 14.68; $p < .001$) strongly predicted stunting among the studied children. More specifically, it strongly predicted stunting in Sabar boys (Wald = 8.36; $p < .001$). Sabar boys with > 2nd BO had a significantly higher risk (OR = 3.68; CI = 1.52–8.92) of stunting than those of < 2nd birth order.

Table 6 presents the results of multivariate logistic analysis to identify independent predictors of stunting. The results revealed that children born with low birth weight (Wald = 15.44; $p < .001$) were twice as likely to be stunted (AOR = 1.96; CI = 1.40–2.75) compared to children born with normal birth weight. Among boys, low birth weight was a significant risk factor for stunting (Wald = 20.47; $p < .001$). Those born with low birth weight had about three times the risk of being stunted (AOR = 3.05; 95% CI = 1.88–4.95). Colostrum feeding status was found to be a significant independent predictor of stunting (Wald = 5.41; $p < .05$). The children who did not receive colostrum had a 1.5 times higher risk (AOR = 1.50, CI = 1.07–2.11) of stunting compared to the children who received it.

TABLE 5. Binary logistic regression analyses between stunting status (independent variable) and socio-demographic variables (independent variables).

Ethnicity	Sex	Independent variables	B	S.E. B	beta	95% CI for beta		Wald	Sig.
						Lower	Upper		
Kurmi	Boys	# Birth Weight (BW)	1.23	0.31	3.43	1.88	6.28	16.08	< .001**
	Girls		0.52	0.31	1.68	0.91	3.91	2.79	.10
	Sex combined		0.88	0.22	2.41	1.58	3.70	16.43	< .001**
Sabar	Boys	# Colostrum Feeding Status (CFS)	0.73	0.38	2.07	0.98	4.35	3.66	.06
	Girls		-0.12	0.39	0.88	0.41	1.89	0.10	.75
	Sex combined		0.31	0.27	1.37	0.81	2.31	1.35	.24
Ethnic combined	Boys	# Birth Weight (BW)	1.20	0.23	3.33	2.13	5.20	27.91	< .001**
	Girls		0.44	0.23	1.56	0.99	2.44	3.72	.05
	Sex-combined		0.83	0.16	2.29	1.68	3.13	26.86	< .001**
Kurmi	Boys	# Colostrum Feeding Status (CFS)	0.54	0.30	1.72	0.96	3.07	3.38	.07
	Girls		0.63	0.31	1.88	1.03	3.43	4.26	.04
	Sex combined		0.57	0.21	1.77	1.17	2.68	7.25	.01**
Sabar	Boys	# Birth Weight (BW)	0.47	0.37	1.60	0.77	3.33	1.59	.21
	Girls		-0.06	0.38	0.94	0.44	2.00	0.03	.87
	Sex combined		0.20	0.27	1.22	0.72	2.05	0.55	.46
Ethnic combined	Boys	# Colostrum Feeding Status (CFS)	0.79	0.22	2.21	1.44	3.38	13.30	< .001**
	Girls		0.57	0.22	1.77	1.14	2.74	6.43	.01**
	Sex-combined		0.67	0.16	1.95	1.44	2.65	18.56	< .001**

B: Unstandardized coefficient representing change in the dependent variable for a one-unit change in the predictor variable. **S.E.B.:** Standard error of the B coefficient. **Beta:** Standardized coefficient indicating change in the dependent variable in standard deviations for a one-standard-deviation change in the predictor variable. **CI:** Confidence Interval. **Sig.:** Level of significance. # Birth weight 2,500 g and above, and Colostrum Feeding Status after birth set as reference category. *: Reference categories. **: Statistically significant value.

TABLE 5 (CONT.). Binary logistic regression analyses between stunting status (independent variable) and socio-demographic variables (independent variables).

Ethnicity	Sex	Independent variables	B	S.E. B	beta	95% CI for beta		Wald	Sig.		
						Lower	Upper				
Kurmi	Boys	No sibs*						2.07	.35		
		1 sib	0.39	0.32	1.48	0.79	2.77	1.52	.22		
		>1 sibs	0.50	0.41	1.64	0.73	3.70	1.44	.23		
	Girls	No sibs*							9.88	.01**	
		1 sib	-0.85	0.35	0.43	0.22	0.84	6.02	.01**		
		> 1 sibs	-1.19	0.43	0.30	0.13	0.71	7.71	.01**		
	Sex combined	No sibs*							4.39	.11	
		1 sib	-0.18	0.23	0.83	0.53	1.31	0.63	0.63	.43	
		> 1 sibs	0.42	0.30	1.53	0.85	2.73	2.02	2.02	.16	
	Sabar	Boys	No sibs*						2.94	.23	
			1 sib	0.17	0.47	1.18	0.47	2.95	0.13	0.13	.72
			> 1 sibs	0.72	0.45	2.06	0.86	4.94	2.63	2.63	.10
Girls		No sibs*							0.75	.69	
		1 sib	-0.18	0.52	0.84	0.30	2.33	0.11	0.11	.74	
		> 1 sibs	-0.38	0.44	0.69	0.29	1.64	0.72	0.72	.40	
Sex combined		No sibs*							0.34	.85	
		1 sib	0.01	0.35	1.01	0.51	2.00	0.00	0.00	.97	
		> 1 sibs	0.16	0.31	1.17	0.64	2.14	0.25	0.25	.62	
Ethnic combined		Boys	No sibs*						12.95	< .001**	
			1 sib	0.26	0.25	1.30	0.79	2.10	1.06	1.06	.30
			> 1 sibs	0.99	0.28	2.68	1.55	4.64	12.42	< .001**	
	Girls	No sibs*							12.27	< .001**	
		1 sib	-0.69	0.27	0.50	0.29	0.85	6.44	.01**		
		> 1 sibs	0.23	0.28	1.25	0.72	2.19	0.64	0.64	.43	
	Sex-combined	No sibs*							18.17	< .001**	
		1 sib	-0.18	0.18	0.83	0.58	1.19	0.98	0.98	.32	
		> 1 sibs	0.62	0.20	1.86	1.26	2.74	9.75	< .001**		
	Kurmi	Boys	1st BO*						1.00	.61	
			2nd BO	0.30	0.32	1.35	0.72	2.51	0.88	0.88	.35
			> 2nd BO	0.26	0.41	1.30	0.59	2.89	0.42	0.42	.52
Girls		1st BO*							4.63	.10	
		2nd BO	-0.29	0.34	0.75	0.39	1.44	0.76	0.76	.38	
		> 2nd BO	0.71	0.45	2.04	0.84	4.92	2.50	2.50	.11	
Sex combined		1st BO*							2.63	.27	
		2nd BO	0.01	0.23	1.01	0.65	1.59	0.00	0.00	.95	
		> 2nd BO	0.46	0.30	1.59	0.88	2.87	2.39	2.39	.12	
Boys		1st BO*							8.71	.01**	
		2nd BO	0.74	0.46	2.11	0.85	5.23	2.58	2.58	.11	
		> 2nd BO	1.30	0.45	3.68	1.52	8.92	8.36	< .001**		
Sabar	Girls	1st BO*						1.72	.42		
		2nd BO	0.38	0.54	1.46	0.50	4.25	0.48	0.48	.49	
		> 2nd BO	-0.30	0.40	0.74	0.34	1.62	0.55	0.55	.46	
Sex combined	1st BO*							3.59	.17		
	2nd BO	0.57	0.35	1.77	0.89	3.53	2.63	2.63	.10		
	> 2nd BO	0.44	0.29	1.56	0.89	2.75	2.38	2.38	.12		

TABLE 5 (CONT.). Binary logistic regression analyses analyses between stunting status (independent variable) and socio-demographic variables (independent variables).

Ethnicity	Sex	Independent variables	B	S.E. B	beta	95% CI for beta		Wald	Sig.
						Lower	Upper		
Ethnic combined	Boys	1st BO*						14.84	< .001**
		2nd BO	0.42	0.25	1.52	0.93	2.48	2.76	.10
		> 2nd BO	1.07	0.28	2.92	1.69	5.04	14.79	< .001**
	Girls	1st BO*						4.89	.09
		2nd BO	-0.25	0.26	0.78	0.46	1.30	0.91	.34
		> 2nd BO	0.41	0.28	1.50	0.87	2.59	2.16	.14
	Sex combined	1st BO*						15.66	< .001**
		2nd BO	0.10	0.18	1.11	0.78	1.58	0.33	.57
		> 2nd BO	0.75	0.20	2.12	1.44	3.11	14.68	< .001**

B: Unstandardized coefficient representing change in the dependent variable for a one-unit change in the predictor variable. **S.E.B.:** Standard error of the B coefficient. **Beta:** Standardized coefficient indicating change in the dependent variable in standard deviations for a one-standard-deviation change in the predictor variable. **CI:** Confidence Interval. **Sig.:** Level of significance. # Birth weight 2,500 g and above, and Colostrum Feeding Status after birth set as reference category. *: Reference categories. **: Statistically significant value.

TABLE 6. Multivariate logistic regression analyses (enter method) of stunting with independent variables, including ethnicity.

Independent variables	Sex	B	S.E. B	AOR	95.0% CI for AOR		Wald	Sig.	
					Lower	Upper			
Birth Weight (BW)	Boys	1.12	0.25	3.05	1.88	4.95	20.47	< .005*	
	Girls	0.27	0.25	1.31	0.80	2.13	1.17	.28	
	Overall	0.67	0.17	1.96	1.40	2.75	15.44	< .005*	
Colostrum Feeding Status (CFS)	Boys	0.43	0.25	1.54	0.94	2.52	2.93	.09	
	Girls	0.41	0.25	1.51	0.92	2.47	2.69	.10	
	Overall	0.41	0.17	1.50	1.07	2.11	5.41	.02*	
Number of Siblings (NS)	Boys	1 sib	-0.32	0.43	0.73	0.32	1.67	0.56	.45
		> 1 sibs	-0.31	0.63	0.73	0.21	2.50	0.24	.62
	Girls	1 sib	-0.90	0.37	0.41	0.20	0.85	5.75	.02*
		> 1 sibs	-0.26	0.60	0.77	0.24	2.49	0.19	.67
	Overall	1 sib	-0.60	0.28	0.55	0.32	0.95	4.67	.03*
		> 1 sibs	-0.37	0.42	0.69	0.30	1.59	0.75	.39
Birth Order (BO)	Boys	2nd BO	0.71	0.42	2.04	0.89	4.67	2.85	.09
		> 2nd BO	1.12	0.62	3.07	0.91	10.30	3.28	.07
	Girls	2nd BO	0.27	0.38	1.31	0.62	2.77	0.50	.48
		> 2nd BO	0.13	0.60	1.14	0.35	3.67	0.05	.83
	Overall	2nd BO	0.53	0.28	1.69	0.98	2.92	3.56	.06
		> 2nd BO	0.70	0.42	2.02	0.88	4.60	2.78	.10
Ethnicity	Boys	1.11	0.26	3.03	1.83	5.02	18.54	< .005*	
	Girls	1.10	0.27	3.02	1.79	5.07	17.34	< .005*	
	Overall	1.12	0.18	3.08	2.15	4.40	37.96	< .005*	

B: Unstandardized coefficient representing change in the dependent variable for a one-unit change in the predictor variable. **S.E.B.:** Standard error of the B coefficient. **AOR:** Adjusted Odds Ratio. **LBW:** Low Birth Weight. **Sig.:** Level of significance. *: Statistically significant value.

Ethnicity was the strongest independent predictor (Wald = 37.96; $p < .001$) of stunting among the studied children. The risk of stunting was higher in both boys (AOR = 3.03; CI = 1.83–5.02) and girls (AOR = 3.02; CI = 1.79–5.07) of the Sabar community compared to the Kurmi community. The results of inferential statistical analysis revealed that ethnicity was the strongest predictor of stunting among the independent variables.

DISCUSSION

The UNICEF evaluation focuses on stunting among children under five years old, a condition reflecting chronic undernutrition (United Nations Children's Fund [UNICEF], 2017), which can be the result of a child having low height due to factors such as prolonged illness, disease, or food scarcity. One of the significant targets of the Sustainable Development Goals (SDGs) is reducing the prevalence of stunting among children under five years old. Despite the prevalence of stunting among preschool children globally, progress seems too slow to achieve the 2025 global nutrition target of reducing the prevalence of stunting by 40%. There are an estimated 149 million children under the age of five who are stunted, and 130 million children will be stunted by 2025 (Global Nutrition Report, 2020). In India, a significant risk factor for child survival is stunting, mainly due to the undernutrition in expectant mothers (Singh, 2016). According to the Global Monitoring Report (2012), the worldwide extent of undernutrition remains unsatisfactory, and progress toward reducing it is gradual. Economic growth is weakly associated with reduced stunting at the state level. Household wealth is one of the most substantial contributors to changes in stunting prevalence in a country over time. The average district-wide difference in stunting in India between the richest and poorest wealth quintiles is 26.8% (Liou *et al.*, 2020; Nie *et al.* 2019).

This study disclosed the prevalence and concomitant factors of stunting among Kurmi and Sabar preschool children. The results clearly showed that, based on the WHO classification of severity of malnutrition, the prevalence of stunting was high (30–39) (WHO Expert Committee on Physical Status, & World Health Organization, 1995) among the children of both communities separately. We found that stunting was more prevalent among Sabar children than Kurmi. One of the reasons for the comparatively high prevalence observed in the Sabar community could probably be their life-styles and food habits. The living strategy of the tribal population is different and entirely dependent on cultivation, forest products, and hunting. Few community members have recently engaged in government service or small-scale businesses (Divakar *et al.*, 2013). The study also revealed that boys were found more likely than girls to be stunted. Various research, both in India and overseas, have shown similar outcomes (Bork & Diallo, 2017; Thurstans *et al.*, 2020; Wamaniet *et al.*, 2007).

The rate of stunting in the present study was higher than those reported in an earlier study on preschool children from West Bengal (39.2%, Biswas *et al.*, 2011; 50%, Mukhopadhyay & Biswas, 2011; 37.2%, Mondal *et al.*, 2012; 54.2%, Bisai, 2014; 47.9%, Mahapatra *et al.*, 2019; 51.9%, Stiller *et al.*, 2020; 38.9%, Gope *et al.*, 2022). However, the overall prevalence of stunting in this study was lower than in a previous study conducted in different regions of India (86.6%, Kshatriya & Ghosh, 2008; 60%, Yadav & Singh, 1999; 62.8%, Awasthi & Pande, 1997; 66.0%, Mitra *et al.*, 2007).

Poor diet, low socioeconomic conditions, environmental and socio-demographic inequalities, and ethnicity are the leading causes of undernutrition in developing countries (Lucovnik *et al.*, 2018; Maia *et al.*, 2008; Pal *et al.*, 2017; Tigga *et al.*, 2015). According to

Biswas *et al.* (2011), social factors like religion, caste and parents' educational status are significantly associated with weight-for-age and height-for-age. A study reported that behavioral and socioeconomic variables were found to be the most influential factors of childhood nutritional status (Rajaram *et al.*, 2007). A study from India (Bharati *et al.*, 2008) also reported that a mother's low education level was a significant risk factor for under-nutrition among younger children. Many studies reported that maternal education has significant effect on nutritional status of children (Iftikhar *et al.*, 2017; Muluye *et al.*, 2020; Owais *et al.*, 2019; Stamenkovic *et al.*, 2016).

The present study revealed that low birth weight (LBW), no colostrum feeding, high number of sibs (NS), and high birth order (BO) had a substantial impact on stunting among the participating children. Many studies found that children born with low birth weight are more prone to become stunted in their childhood (Aryastami *et al.*, 2017; Halli *et al.*, 2022; Rahman *et al.*, 2016; ; Sania *et al.*, 2015; Santos *et al.*, 2009). Some other studies disclosed that not offering colostrum and poor breastfeeding practices are associated with all forms of malnutrition (Ahmad & Mishra, 2022; Aggarwal & Srivastava, 2017; Dhattrak *et al.*, 2013). The practice of not giving colostrum to the newborns may be due to the mother's illiteracy and other social factors that must be addressed.

A baby's weight at birth below 2,500 g (5.5 lb) is defined as low birth weight. The World Health Organization aims for a 30% reduction in the prevalence of LBW babies by 2030. The current global reduction rate is 0.30%, which must be faster to fulfill the target. It has been found to be a significant public health problem and it is associated with a range of both short and long-term consequences. Worldwide, it was estimated that about 15 to 20% of all births are LBW, constituting more than 20 million births a year (WHO, 2014).

The results of the multivariate analysis revealed LBW, no colostrum feeding, and high BO are the risk factors of stunting among the studied preschool children. LBW, CFS and BO were also significant predictors of stunting. Furthermore, ethnicity was found to be the strongest predictor among them. More importantly, the present study revealed that high NS had a strong independent impact on stunting among Kurmi girls. A study from West Bengal (Biswas & Bose, 2011) also found that a high NS had a strong independent impact on underweight as well as on stunting among girls. Another study from India (Pande, 2003) reported that preschool children born after multiple same-sex siblings experienced poor outcomes, suggesting that parents desired some balance in sex composition.

CONCLUSION

The results of the present research revealed that the prevalence of stunting among the studied children was very high, and Sabar children were more stunted than their neighbouring (Kurmi) children. It was also found that different socio-demographic and behavioral characteristics were significant predictors of stunting. These findings under-score the multifactorial nature of stunting. Therefore, appropriate authorities should take a proper ethnic-specific programme for nutritional intervention. Moreover, ethnic-specific awareness programmes on health and nutrition should be promoted to optimize the adverse effects of socio-demographic and behavioral characteristics on the stunting status of Sabar and Kurmi children in the Puruli district. The results of this study could be useful for health professionals, policymakers, and researchers. Noteworthy, the present work in this area might have a significant

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impact on the future health and vitality of these children.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

Sadaruddin Biswas: Conceptualization; Formal analysis; Methodology; Software; Supervision; Writing – review & editing. Shiule Gope: Investigation, Data curation; Validation; Writing – original draft; Writing – review & editing.

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