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How the Nutritional Status of Children be Explained from the Observed Maternal and Child Characteristics: A Study on a Group of Preschool Children in North Bengal, India

Arindam Biswas[1], Argina Khatun[1] and Nitish Mondal[2]

[1] Department of Anthropology, University of North Bengal,
Raja Rammohunpur, Bagdogra, Bairatisal, West Bengal

[2] Department of Anthropology, School of Human Sciences, Sikkim University, Gangtok, Sikkim

Abstract

Children have accounted for a high global burden of undernutrition in recent decades. It has been accepted that undernourished children have long-term negative impacts on their health, including a decline in intellectual and mental development as well as physical growth retardation. Maternal characteristics play a significant role in child malnutrition. The objective of the present study is to examine how the nutritional status of a child can be explained by maternal and child characteristics. This cross-sectional study was conducted on 1035 (524 males and 511 females) preschool children aged 24-71 months from Maynaguri Block, Jalpaiguri district, West Bengal, India. The results showed the prevalence of stunting and underweight among the children studied as 23.67% and 23.57% respectively. Binary logistic regression analysis revealed that factors such as mothers' age at marriage, BMI of the mothers, educational level of the mother, place of delivery, age of the child, birth weight of the children, number of siblings, family type, and family income have a strong relationship with child undernutrition. Appropriate intervention programs should focus on maternal and child characteristics that may lead the way to improve the nutritional status of undernourished children so as to reach their full potential during childhood.

***Keywords*:** Maternal and child characteristics, socio-demographic factors, stunting, underweight, preschool children.

Introduction

Undernutrition is directly related to early childhood morbidity and mortality in lower-middle-income countries, with long-term psychological and physiological repercussions (Monden and Smith, 2009; Ozaltin *et al.*, 2010; Sanctis *et al*., 2021). It has been observed that during the past few decade children have contributed to 23.8% of the world's undernutrition burden (McGuire *et al*., 2015). The NFHS-5 (2019-21) has reported that the prevalence of stunted (low height-for-age) and underweight (low weight-for-age) among children was 35.5% and 32.1% respectively, with 23.1% of women in the reproductive age range having a lower BMI (<18.50 kg/m^2). Further, undernourished children suffer long-term negative effects on their health in terms of decline in intellectual and mental development, increased risk of infections and retarded physical growth (Shrimpton *et al*., 2001; Zere *et al*., 2003; WHO, 2018; de Onis *et al*., 2018; De Sanctis *et al*., 2021). Long-term chronic undernutrition and short-term acute undernutrition are complex phenomena influenced by factors of biological, socio-economic, behavioural, and environmental origin (Bantamen *et al.,* 2014; Tsedeke *et al.,* 2016; Shahid *et al.,* 2022; Yigezu *et al.,* 2024). Long-term rather than short-term food insufficiencies affect the indicators of linear and cumulative growth, such as stunting (Fenske *et al*., 2013).

Since mothers are the primary caregivers of their children, understanding the contributions of maternal characteristics to a child's nutritional status is essential for addressing the issue of child undernutrition (Girma *et al*., 2002; Michael, 2006). Several researchers reported about the association between maternal and child characteristics and socio-demographic variables. For example, there is a strong association between maternal BMI and weight-for-height (WHZ) score for children (Negash *et al*., 2015) and between maternal BMI and stunting (Chirande *et al.,* 2015). At the same time, the prevalence of overweight and obesity is more common as is undernutrition, both nutritional conditions occurring in the same household. Recent trends have indicated that the magnitude of overnutrition is much greater than undernutrition in the category of mother, who are more overweight or obese while the children are stunted or underweight at the same level of household (Doak *et al.*, 2005; Meenakshi, 2016; Kumar *et al.*, 2021; Bose *et al.*, 2022). Studies have also reported that maternal stature has a significant impact on low birth weight and intrauterine growth restriction (WHO, 1995; Kramer *et al*., 2003; Sen *et al.*, 2010). It has also been found that low monthly family income is associated with child undernutrition (Kavosi *et al.*, 2014; Tette *et al*., 2016; Debnath *et al.*, 2018; Bose *et al.*, 2022; Gupta *et al*., 2024), and mother's education, place of delivery, and lower wealth index are associated with stunting among children (Megabiaw and Rahman, 2013).

Children with lower birth weight (Sayed *et al.*, 2001; Paul *et al.*, 2011) and higher birth orders (Paul *et al*., 2011) are also more likely to be undernourished. Based on such revelations, the objective of the study is to examine to what extent the maternal and child characteristics are able to explain the nutritional status of a child in a specific context.

Material and Methods

This cross-sectional investigation was conducted among 1035 preschool children (males: 524, females: 511) aged 24-71 months residing in Maynaguri Block, Jalpaiguri district, West Bengal, India, from June 2023 to November 2023. We selected 40 Integrated Child Development Service (ICDS) centres operating at the level of *Gram Panchayats,* namely, Domohoni I, Domohoni II, Barnis, Maynaguri, and Dharmapur, as study units. The present study was conducted only among the Bengali-speaking children enrolled under those ICDS for operational convenience. A stratified random sampling method was applied to select the representative participants from each of the defined age categories (i.e., 24-35, 36-47, 48-59, 60-71 months) and sex (male and female). The ICDS workers were also involved to inform and encourage the mothers of the selected children to participate in the study. The participants were free from physical deformities and were not suffering from any chronic disease(s) at the time of data collection. Necessary permission for research with regard to this particular study was obtained from the University of North Bengal, West Bengal, India.

Data Collection

Weight (to the nearest 0.1 kg) and height (to the nearest 0.1 cm) of the participating children and their mothers were measured using the standard anthropometric procedures (Weiner and Lourie, 1981). The age of the children was determined using the birth certificate or immunization certificate and was further verified by the ICDS workers. Data on socio-demographic variables, including age of the child, age of the mother at the time of the study, mother's age at marriage, mother's education, family types, family size, family income, place and type of delivery, and birth weight of the concerned child, were collected using a pre-structured and pre-tested research schedule. AB, the first author, took the responsibility of collecting all the relevant data including anthropometric measurements.

Dependent Variables

Estimation of height-for-age Z-scores (HAZ) and weight-for-age Z-scores (WAZ) were done to classify stunting and underweight by using WHO Anthro software. Z-scores of

less than 2 standard deviations (-2SD) below the reference population's median were considered to be indicative of child undernutrition. The derived anthropometric indicators, such as stunting (low height-for-age) and underweight (low weight-for-age) are reliable, recommended and widely used to determine the magnitude of undernutrition in children.

Independent variables

Maternal and child characteristics include the age at marriage of mothers (≤18 years and >18 years), age of the mothers at the time of interview (≤25 years and >25 years), the BMI of the mothers (<18.5 kg/m^2, 18.5-24.9 kg/m^2, and >25 kg/m^2), educational level of the mothers (primary, secondary, higher secondary and above), age of the child under study (24-35 months, 36-47 months, 48-59 months, and 60-71 months), sex of the child (male and female); birth weight (<2.50 kg and ≥2.50 kg), birth order (1^{st}, 2^{nd}, 3^{rd} and above. The socio-demographic variables include the type of delivery (vaginal and caesarean), place of delivery (public health institution and private health institution), family type (nuclear, joint, and extended), and family income (INR <7500, INR 7500-15000 and INR >15000).

Statistical Analyses

All types of statistical analysis were computed using the Statistical Package for Social Science (SPSS v.18.0). The sex-specific age variation was analyzed for Z-score value of height and Z-score value of weight using one-way variance analysis (ANOVA). A chi-square was computed to observe an association between the age categories of the children and the prevalence of stunting and underweight. The binary logistic regression analyses were used to examine the association between maternal and child characteristics and socio-demographic (independent variables) factors with underweight and stunting (dependent variables) independently. The reference categories used for the independent variables are as follows: age at marriage of the mothers (>18 years), age of the mothers at the time of interview (>25 years), BMI of the mothers (18.5-24.9 kg/m^2), educational level of the mothers (higher secondary and above), sex of the children (male), age of the children (60-71 months), birth weight of the children (≥2.50 kg), birth order of the children (1^{st}), number of siblings (single), birth interval (≤1 year), type of delivery (vaginal), place of delivery (public health institution), family type (extended), and monthly family income (>15000 INR). A minimum p-value <0.05 was used as a cut-off to determine the significance level.

Results

Table 1 presents the means and standard deviation of the Z-score value of height-for-age among boys and girls. Among boys, the mean value has changed significantly with age, with the lowest value being observed in the age group of 24-35 months ($p<0.05$). Among girls, the mean value is found to be statistically significant, with the lowest value occurring in the age group of 36-47 months ($p<0.05$). Whereas the mean and standard deviation values of the Z-score value of weight for age among boys and girls show that the mean value significantly decreases gradually with age, among boys the lowest value has been observed in the age group of 36-47 months. In the case of girls, the mean value is also statistically significant, the lowest value being observed in the age group of 36-47 months.

Table 2 describes the prevalence of stunting and underweight among children in North Bengal. The highest percentage of stunting occurs among aged 24-35 months old children of both sexes, and the lowest percentage is found in the age group of 60-71 months old children of both sexes. The prevalence of underweight is higher among boys aged 36-47 months, and the lower percentage is found at the age of 48-59 months among boys; for girls, the highest and lowest percentage of underweight occur in the age of 36-47 months and 60-71 months respectively. Overall, the girls show a higher prevalence of stunting and underweight than boys. The association between age groups and stunting is statistically significant for boys ($\chi^2=21.257$; $p<0.05$), but in the case of girls, the difference is not significant. In the case of boys, age groups and underweight are statistically significant ($\chi^2=8.816$; $p<0.05$) but not so in the case of girls.

Table 3 describes the frequency and percentile distribution of maternal and child characteristics and sociodemographic variables. Around half of the mothers got married at ≤18 years; around 40% of the mothers were aged ≤25 years at the time of the study; around 10% of the mothers had a BMI <18.50 kg/m^2 (underweight) and 20% of the mothers had a BMI >25 kg/m^2 (overweight). One out of four mothers received education up to primary level; 34.78% of mothers had a caesarean section delivery; 94.49% of deliveries took place in public health institutions. Curiously, both male and female children have similar representation; the majority of the children were in the age category 48-59 months, followed by 36-47 months, 24-35 months, and 60-71 months; around one-third of the children were born with a low birth weight (<2.50 kg); around 58.94% of children were of the first birth order; 43.48% of children had no sibling. The majority of the study participants belonged to nuclear families, falling in the family income category of 7500-1500 (INR).

Table 4 shows that children of the mothers, who got married ≤18 years (odds: 1.40 times), had a BMI >25 kg/m^2 (odds: 4.05 times), delivered their child in private health institutions (odds: 9.42 times), and belonged to the family income categories <7500 (INR) (odds: 3.15 times) and 7500-15000 (INR) (odds: 1.82 times), were more likely to have stunted children compared to the respective reference categories. Mothers, whose age at the time of the study was (≤25 years), received education up to primary level and lived in nuclear families, were less likely to be stunted than their respective reference categories. Children who were below 60 months, born with low birth weight, and had one sibling were more likely to be stunted than their respective reference categories.

Table 5 reveals that mothers with a BMI <18.5 kg/m^2 were less likely to have underweight children (odds: 0.61 times, $p<0.05$), compared to the reference category (18.5-24.9 kg/m^2), but the trend was reversed for those with a higher BMI >25 kg/m^2 (odds: 4.71 times, $p<0.01$). The results also indicate that women with educational levels between primary (odds: 0.56 times) and secondary (odds: 0.46 times) levels and who belonged to the monthly family income categories <7500 (INR) (odds: 0.37 times) and 7500-15000 (INR) (odds: 0.46 times) were less likely to have underweight children compared to the reference categories ($p<0.05$). Similarly, children who had siblings 2 and above (odds: 0.35 times) and who were born with a low birth weight (odds: 0.30 times) were less likely to be underweight compared to their respective reference categories ($p<0.05$).

Discussion

The present cross-sectional investigation tries to assess the prevalence of undernutrition and influencing factors such as maternal and child characteristics, nutritional status, and socio-demographic variables among children aged 24-71 months in the North Bengal region, India. The study has revealed a higher overall prevalence of stunting (24.66% vs. 22.70%) and underweight (25.44% vs. 21.76%) among girls than boys. Although the prevalence of undernutrition among the studied population is found to be lower compared to the findings of NNBM (2012, 2017) and NFHS-5 (2019-2020), yet the trend of sex-wise difference remains similar. Several studies have also revealed a substantial gender inequity in undernutrition, with girls in India being at higher risk compared to boys (Sen and Mondal, 2010; Ramachandran, 2014; Debnath *et al.*, 2018; Bose *et al.*, 2022). Boys are perceived to have better intra-household access to food, basic amenities, or healthcare access than girls, since preference for sons endures in Indian societies (Trent *et al.,* 2015; Kugler and Kumar, 2017; Aurino, 2017; Sinha *et al.,* 2017). The research findings reveal

that the prevalence of undernutrition (i.e., stunting and underweight) is nearly identical to that reported among children in Punjab (Kaur *et al.*, 2005), Himachal Pradesh (Singh *et al.,* 2016), Himachal Pradesh (Kansal and Talwar, 2017), Kerala (Radhamani and Rajeev, 2017), Himachal Pradesh tribal children (Negi and Talwar, 2021), and West Bengal Santal children (Mahapatra *et al.*, 2019). However, compared to the previous studies conducted in West Bengal by Das and Bose (2009), Mandal and Bose (2009), Giri *et al.* (2017), and Scopazzini (2021), the present study shows a lower prevalence of stunting and undernutrition.

In India, undernutrition is a major public health issue that is linked to detrimental effects on productivity, health, cognitive abilities, and socio-economic status. A complex interaction of biological, socio-economic, and cultural factors in the population affects the prevalence of undernutrition. In general, the differences in the prevalence of undernutrition in different population studies could be attributed to various risk factors such as the child's gender, family type, socio-economic status, birth order, number of siblings and family income (Biswas *et al*., 2011; Paul *et al*., 2011; Megabiaw and Rahman, 2013; Bisai *et al*., 2014; Kavosi *et al*., 2014; Rahman, 2016; Tette *et al*., 2016; Gupta *et al*., 2024). The present investigation has reported a strong correlation between maternal and child characteristics, as well as between socio-economic factors and the prevalence of undernutrition (i.e., stunting and underweight) among the participants. The study has also found statistically significant associations between maternal and child characteristics, as well as between socio-demographic variables and undernutrition (e.g., stunting and underweight). For example, early age (≤18 years) at child delivery increases the risk of undernourished children because of the physical and psychological burden associated with childbearing and rearing at a tender age, which corroborates with the study conducted among the Roma children of Serbia (Čvorović, 2022). Further, the maternal BMI is strongly linked to the child's nutritional status (Chirande *et al.,* 2015; Rahman *et al.,* 2015; Tigga *et al.,* 2015; Siddiqa *et al*., 2023). The present study has found that mothers with normal BMI are less likely to produce undernourished children, as was the case with the Indian children studied by Subramanian *et al*. (2010).

Studies have reported that economic development has led to significant changes and replacement of traditional foods in diets with high-calorie and fat-containing food, along with processed food (Kosaka and Umezaki, 2017; Debnath *et al.,* 2018; Temponi and Melendez, 2020; Bose *et al.,* 2021). The shift in diet towards high energy content and low micronutrient intake, coupled with a sedentary lifestyle, has contributed to the household's double burden of malnutrition among mothers that are overweight (BMI>25 kg/m^2) and stunted children within households. Scholars have argued that lower maternal

education levels are associated with a higher risk of undernutrition (Ajao *et al.,* 2010; Rahman *et al.*, 2015; Bindu *et al*., 2017; Zhihui *et al.*, 2020; Porwal *et al.*, 2021; Siddiqa *et al*., 2023; Gupta *et al*., 2024), corroborating to the trend in our study. Research indicates that low-birth-weight children (<2.50 kg) are more likely to experience stunting and underweight than their normal counterparts (Sayed *et al.*, 2001; Paul *et al.*, 2011; Naregal *et al.*, 2023). Lower-income families are found to have stunted and underweight children, corroborating to our findings (Kavosi *et al.*, 2014; Tette *et al*., 2016). According to Rana *et al.* (2020), monthly income has higher odds at child stunting. The inadequate financial resources result in less dietary diversity, increased susceptibility to infectious diseases, and limited access to quality healthcare. Moreover, various studies have shown a significant association between family income and undernutrition in Indian children (Tigga *et al.,* 2015; Murarkar *et al.,* 2020; Khanra *et al.,* 2021; Khanra *et al.,* 2023). The present study has of course limitations. A large sample size, a community-based study and information on participants' dietary intake could have provided a more comprehensive understanding of the problem under study.

Conclusion

The findings have revealed that preschool children in North Bengal are more likely to be undernourished because they are strongly linked to maternal and child characteristics, as also they are influenced by socio-demographic and socio-economic status determinants. Appropriate intervention programs should focus on maternal and child characteristics that could improve the nutritional status of undernourished children enabling them to reach their full potential during childhood.

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Table 1: Age and Sex-specific Mean (SD) Z-score Value of Height and Weight of the Studied Population

Z score value of height for the age						
Age (months)	**Boys**			**Girls**		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**
24-35	129	-1.45	1.31	121	-1.35	1.35

36-47	134	-1.34	1.06	134	-1.64	1.05
48-59	146	-1.10	1.03	160	-1.24	1.04
60-71	115	-.80	1.02	96	-.97	1.06
F	8.344**			7.036**		
Z score value of Weight for the age						
Age (months)	**Boys**			**Girls**		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**
24-35	129	-1.26	1.21	121	-1.01	1.31
36-47	134	-1.27	1.06	134	-1.41	1.07
48-59	146	-1.05	1.28	160	-1.29	1.06
60-71	115	-.85	1.34	96	-1.04	1.23
F	3.227*			3.412*		

**p<0.001, *p<0.05

Table 2: Frequency and Percentage Distribution of Stunting and Underweight of the Studied Population

Stunting				
Age (months)	**Boys**		**Girls**	
	Present	**Absent**	**Present**	**Absent**
24-35	45 (34.88)	84 (65.12)	36 (29.75)	85 (70.25)
36-47	32 (23.88)	102 (76.12)	36 (26.86)	98 (73.14)
48-59	30 (20.55)	116 (79.45)	40 (25.00)	120 (75.00)
60-71	12 (10.43)	103 (89.57)	14 (14.58)	82 (85.42)
24-71	119 (22.70)	405 (77.30)	126 (24.66)	385 (75.34)
Chi square Boys χ2-21.257** (p<0.001), Girls χ2-7.297 (p>0.05)				

Underweight				
Age (months)	**Boys**		**Girls**	
	Present	**Absent**	**Present**	**Absent**
24-35	33 (25.58)	96 (74.42)	34 (28.09)	87 (71.91)
36-47	38 (28.36)	96 (71.64)	39 (29.10)	95 (70.90)
48-59	24 (16.44)	122 (83.56)	37 (23.12)	123 (76.88)
60-71	19 (16.52)	96 (83.48)	20 (20.83)	76 (79.17)
24-71	114 (21.76)	410 (78.24)	130 (25.44)	381 (74.56)
Chi square Boys χ2-8.816* ($p<0.05$), Girls χ2-2.926 ($p>0.05$)				

**p<0.001, *p<0.05

Table 3: Frequency and Percentage Distribution of Maternal and Child Characteristics and Socio-demographic Variables

Variables	Category	Frequency	Percentage (%)
Age at marriage (years)	≤18 years	497	48.01
	>18 years	538	52.99
Age of the mothers at the time of study (years)	≤25 years	422	40.77
	>25 years	613	59.23
BMI of the mothers	<18.5 kg/m^2	109	10.53
	18.5-24.9 kg/m^2	714	68.98
	>25 kg/m^2	212	20.48
Educational level of the mothers	Primary	412	39.81
	Secondary	386	37.30
	Higher Secondary and above	237	22.89
Sex of the child	Male	524	50.62
	Female	511	49.38

Age of the child	24-35 months	250	24.16
	36-47 months	268	25.89
	48-59 months	303	29.27
	60-71 months	214	20.68
Birth Weight	<2.50 kg	279	26.96
	≥2.50 kg	756	73.04
Birth Order	1st	610	58.94
	2nd	356	34.40
	3rd and above	69	6.66
Number of Siblings	Single	450	43.48
	1	484	46.77
	2 and above	101	9.75
Birth Interval	≤ 1 year	575	55.56
	> 1 year to < 3 years	278	26.86
	≥3 years	182	17.58
Type of Delivery	Vaginal	675	65.22
	Caesarean	360	34.78
Place of Delivery	Public health institution	978	94.49
	Private health institution	57	5.51
Family Type	Nuclear	565	54.59
	Joint	125	12.08
	Extended	345	33.33
Family Income (monthly)	<7500 (INR)	294	28.40
	7500-15000 (INR)	584	56.43
	>15000 (INR)	157	15.17

Table 4: Binary Logistic Regression of Stunting with Maternal Child Characteristics and Socio-demographic Variables

Variables	Category	Nutritional categories		Odds	95 % CI
		Stunting (%)	Normal (%)		
Age at marriage (years)	≤18 years	108 (10.43)	389 (37.58)	1.40*	1.02-1.89
	>18 years®	137 (13.24)	401 (38.74)	1.00	
Age of the mothers at the time of study (years)	≤25 years	117 (11.30)	305 (29.47)	0.66*	0.48-0.89
	>25 years®	128 (10.43)	485 (46.86)	1.00	
BMI of the mothers	<18.5 kg/m^2	32 (3.09)	77 (7.44)	0.90	0.58-1.40
	18.5-24.9 kg/m^2®	195 (18.84)	519 (50.14)	1.00	
	>25 kg/m^2	18 (1.73)	194 (18.74)	4.05**	2.43-6.74
Educational level of the mothers	Primary	117 (11.30)	295 (28.50)	0.51**	0.34-0.76
	Secondary	88 (8.50)	298 (28.79)	0.69	0.45-1.04
	Higher Secondary and above®	40 (3.86)	197 (19.03)	1.00	
Sex of the child	Male®	119 (11.5)	405 (39.13)	1.00	
	Female	126 (12.17)	385 (37.19)	0.89	0.66-1.18
Age of the child	24-35 months	81 (7.83)	169 (16.33)	0.28**	0.17-0.46
	36-47 months	68 (6.57)	200 (19.32)	0.40**	0.24-0.66
	48-59 months	70 (6.76)	233 (22.51)	0.46*	0.28-0.75
	60-71 months®	26 (2.51)	188 (18.16)	1.00	

Birth Weight	<2.50 kg	129 (12.46)	150 (14.49)	0.21**	0.15-0.28
	≥2.50 kg®	116 (11.20)	640 (61.84)	1.00	
Birth Order	1st®	136 (13.14)	474 (45.80)	1.00	
	2nd	99 (9.56)	257 (24.83)	1.18	0.56-2.46
	3rd and above	10 (0.96)	59 (5.70)	2.11	0.63-7.00
Number of Siblings	Single®	87 (8.40)	363 (35.07)	1.00	
	1	140 (13.53)	344 (33.24)	0.55*	0.35-0.85
	2 and above	18 (1.74)	83 (8.01)	0.68	0.27-1.69
Birth Interval	≤1 year®	125 (12.07)	450 (34.48)	1.00	
	>1 year to < 3 years	80 (7.73)	198 (19.13)	0.84	0.39-1.79
	≥3 years	40 (3.86)	142 (13.72)	1.12	0.47-2.66
Type of Delivery	Vaginal®	165 (15.94)	510 (49.28)	1.00	
	Caesarean	80 (7.73)	280 (27.05)	0.95	0.69-1.29
Place of Delivery	Public health institution®	243 (23.48)	735 (71.01)	1.00	
	Private health institution	2 (0.19)	55 (5.31)	9.42*	2.25-39.43
Family Type	Nuclear	149 (14.35)	416 (40.19)	0.63*	0.45-0.88
	Joint	31 (2.99)	94 (9.08)	0.77	0.47-1.26
	Extended®	65 (6.28)	280 (27.07)	1.00	
Family Income (monthly)	<7500 (INR)	96 (9.27)	198 (19.13)	3.15**	1.87-5.29
	7500-15000 (INR)	128 (12.37)	456 (44.06)	1.82*	1.10-2.99
	>15000 (INR)®	21 (2.03)	136 (13.14)	1.00	

*p<0.05, ** p<0.001; ®Reference category

Table 5: Binary Logistic Regression of underweight with maternal and child characteristics and socio-demographic variables.

Variables	Category	Nutritional categories		Odds	95 % CI
		Underweight (%)	Normal (%)		
Age at marriage (years)	≤18 years	119 (11.50)	378 (36.52)	0.86	0.63-1.18
	>18 years®	125 (12.08)	413 (39.90)	1.00	
Age of the mothers at the time of study (years)	≤25 years	102 (9.85)	320 (30.92)	1.13	0.82-1.56
	>25 years®	142 (13.72)	471 (45.51)	1.00	
BMI of the mothers	<18.5 kg/m^2	39 (3.77)	70 (6.76)	0.61*	0.38-0.94
	18.5-24.9 kg/m^2®	190 (18.36)	197 (19.03)	1.00	
	>25 kg/m^2	15 (1.45)	524 (50.63)	4.71**	2.68-8.25
Educational level of the mothers	Primary	100 (9.66)	312 (30.14)	0.56*	0.36-0.85
	Secondary	108 (10.43)	278 (26.86)	0.46**	0.30-0.70
	Higher Secondary and above®	36 (3.48)	201 (19.42)	1.00	
Sex of the child	Male®	114 (1.01)	410 (39.61)	1.00	
	Female	130 (12.56)	381 (36.81)	0.79	0.59-1.06

Age of the child	24-35 months	67 (6.47)	183 (17.68)	0.76	0.47-1.21
	36-47 months	77 (7.44)	191 (18.45)	0.69	0.43-1.08
	48-59 months	60 (5.80)	243 (23.48)	1.07	0.67-1.69
	60-71 months®	40 (3.86)	174 (16.81)	1.00	
Birth Weight	<2.50 kg®	116 (11.21)	163 (15.75)	0.30**	0.21-0.40
	≥2.50 kg	128 (12.37)	628 (60.68)	1.00	
Birth Order	1st®	129 (12.46)	481 (46.47)	1.00	
	2nd	96 (9.27)	260 (25.12)	0.64	0.28-1.44
	3rd and above	19 (1.84)	50 (4.83)	1.10	0.35-3.44
Number of Siblings	Single®	86 (8.03)	364 (35.17)	1.00	
	1	126 (12.17)	358 (34.59)	0.70	0.44-1.11
	2 and above	32 (3.09)	69 (6.66)	0.35*	0.15-0.82
Birth Interval	≤1 year®	121 (11.70)	454 (43.86)	1.00	
	>1 year to < 3 years	78 (7.54)	200 (19.23)	1.46	0.63-3.36
	≥3 years	45 (4.35)	137 (13.24)	1.90	0.74-4.83
Type of Delivery	Vaginal®	170 (16.42)	505 (48.80)	1.00	
	Caesarean	74 (7.15)	286 (27.63)	1.08	0.77-1.51

Place of Delivery	Public health institution ®	235 (22.70)	743 (71.79)	1.00	
	Private health institution	9 (0.87)	48 (4.64)	0.97	0.43-2.15
Family Type	Nuclear	144 (13.91)	421 (40.68)	0.82	0.58-1.15
	Joint	29 (2.80)	96 (9.27)	1.02	0.61-1.70
	Extended®	71 (6.86)	274 (26.47)	1.00	
Family Income (monthly)	<7500 (INR)	83 (8.01)	211 (20.39)	0.37**	0.21-0.63
	7500-15000 (INR)	141 (13.62)	443 (42.80)	0.46*	0.27-0.76
	>15000 (INR)®	20 (1.03)	137 (13.24)	1.00	

*p<0.05,**p<0.01, ®Reference category

Address for correspondence: Argina Khatun, Assistant Professor, Department of Anthropology, University of North Bengal, Raja Rammohunpur, Bagdogra, Bairatisal, West Bengal 734013. Email Id: argina.khatun@nbu.ac.in

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