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Effect of Number of Rooms and Sibs on Nutritional Status among Rural Bengalee Preschool Children from Eastern India

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A B S T R A C T

In developing countries including rural India, undernutrition among preschool children is one of the main barriers of the national development. However, there exists scanty information on the prevalence of underweight and stunting and their socio-demographic predictors among preschool children in India and West Bengal. The aim of the present study was to investigate the prevalence of underweight and stunting and the impact of two socio-demographic indicators, namely number of living rooms (NLR) and number of sibs (NS), on them among 1–5 year old Bengalee rural preschool children of Integrated Child Development Services (ICDS) Centres. This cross sectional study was undertaken at 30 randomly selected ICDS centre of Chapra Block, Nadia District, West Bengal, India. A total of 673 children, aged 1–5 years were studied. The overall (age and sex combined) rates of underweight and stunting were 54.40 % and 39.20%, respectively. NLR was significantly associated with the prevalence of underweight (χ^2=4.34, df=1, p<0.05) and stunting (χ^2= 8.98, df=1, p<0.01) among girls. Similarly, NS had a significant association with prevalence of underweight (χ^2=10.29, df=1, p<0.001) and stunting (χ^2=5.42, df=1, p<0.05) among girls. Girls with <2 NLR had significant higher risk of being underweight (OR=1.64, C.I=1.30–2.62) or stunted (OR=2.23, C.I=1.31–3.80) than those with ≥ 2 NLR. Moreover, girls with ≥3 NS had significant higher rate of underweight (OR=2.03, CI=1.32–3.146) or stunting (OR=1.69, C.I= 1.09–2.63) than those with <3 sibs. Logistic regression analyses also revealed that both NLR as well as NS were strong predictors of underweight (NLR: Wald=4.30, p<0.05; NS: Wald=8.74, p<0.001) and stunting (NLR: Wald=10.17, p< 0.001; NS: Wald= 5.38, p<0.05) among girls. Gender discrimination could be a likely cause for this sex difference in the impact of NRL and NS. Moreover, logistic regression were also undertaken with underweight and stunting status (yes/no) as dependent variables and NLR and NS (combined) as independent variables to identify their effects, when considered together, on undernutrition. Results showed that NS had significant impact on underweight (Wald=8.28, p< 0.001) rather than NLR among girls. Results also demonstrated that NLR had significant impact on stunting (Wald=6.874, p<0.01) rather than NS.

Key words: *underweight, stunting, living room, sibs, India*

Introduction

In developing countries, 183 million preschool-age children are underweight and 226 million are stunted[1]. These estimates highlight the magnitude of the different forms of malnutrition and their critical importance relating to public health. It has been reported that the prevalence of stunting in India is 48%[2]. This figure provides important evidence of a global nutrition problem that must be addressed. However, they mask the variation in proportions of underweight and stunted children within and between countries as well as differences in life styles and other bio-social factors. Malnutrition is one of the leading causes of disease infancy and childhood[3]. Globally, undernutrition is an underlying cause of at least half of all childhood deaths[4]. This makes prevention of undernutrition in children one of the top priorities in efforts to reduce childhood mortality[5]. The effects of malnutrition on children are not limited to physical health, but extend to mental, social and spiritual wellbeing. They could be transmitted from one generation to another, constituting a vicious spiral[6].

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Furthermore, the causes of malnutrition are seen as deeply rooted in environmental factors, such as poverty and poverty related factors[7]. These factors are also described as immediate, underlying and basic causes[8]. It is important to assess the relationship between socio-demographic variables with nutritional status indicators to improve the nutritional status of a population.

Age, weight and height, are usually combined to form three indicators of nutritional status, i.e. weight-for-age, height-for-age and weight-for-height[9] which are compared with international reference population data such as those collected by the US National Center for Health Statistics (NCHS). Weight-for-age (WAZ), Height-for-age (HAZ), and weight- for-height (WHZ) less than -2 Z-score of NCHS reference data indicate underweight, stunting and wasting, respectively[10,11]. These indicators are widely used because of their simplicity and usefulness in diagnosing and estimating the problem of malnutrition[12] and for global comparison. These measurements have also been used for guiding intervention programmes.

During preschool age period, children have special nutritional needs due to their rapid growth and development[13]. However, underweight and stunting among them are important health problems in rural India[14] including West Bengal[15]. Hitherto, there exists little information of the prevalence of underweight and stunting and their socio-demographic determinants among preschool children in India[16] and West Bengal[15].

Keeping this in mind, the present study was undertaken to determine age and sex variations in the prevalence of underweight and stunting. It also attempted to establish the relationship between two nutritional parameters and two markers of underlying causes, ie., large family size (NS) and environmental poverty (NLR) among 1–5 year (12–71 months) old ICDS children of Bengalee ethnicity from Chapra Block, Nadia District, West Bengal, India.

Materials and Methods

This cross sectional study was undertaken between June 2009 to August, 2009 at Chapra Block, Nadia District, West Bengal, India. The study area is situated (Coordinates: 23°31' N to 23°52' N and 88°35' E to 88°58' E) at the India-Bangladesh international border (figure 1), approximately 140 km from Kolkata, the provincial capital of West Bengal. The area is remote and mostly inhabited by Bengalee Muslims. Thirty centres were randomly selected out of 335 centers of the Chapra Block, Nadia District. All children (who were presented at day of study) from above mentioned centres were included in this study. The response rate was approximately 55%. A total of 673 children (323 boys and 350 girls) aged 1–5 years (12–71 months) were measured. All preschool children (1–5 years old) living in Chapra Block are enrolled at these centres. Formal ethical approval was obtained from Vidyasagar University and ICDS authorities prior to the commencement of the study. Ages of the children were ascertained on monthly based from the Anganwadi registers and subsequently confirmed by parents of the children with relevant documents and for analyses, it was grouped in to twelve months intervals. Information on ethnicity, number of living rooms of the family (NLR) of the children and number of living sibs of the children (NS) were obtained from the parents by asking specific questions.

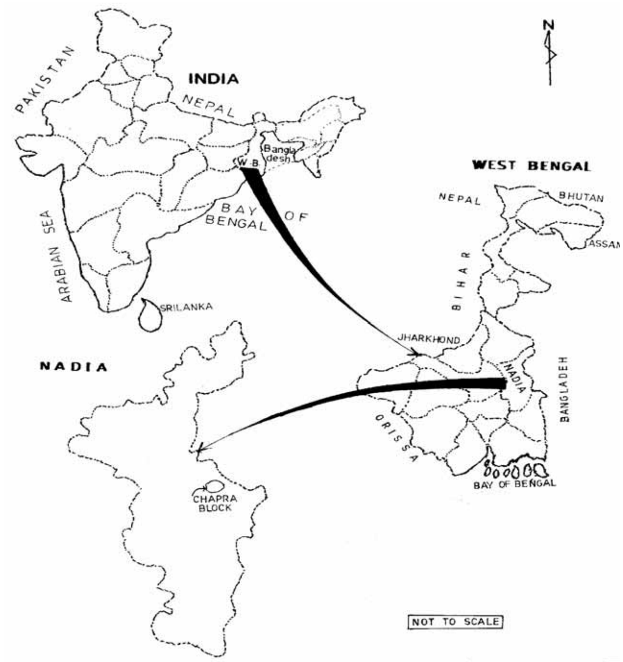

Fig. 1. Location Map of Chapra Block, Nadia District, West Bengal.

Weight and height were taken by first author (SB) on each subject following the standard techniques and precisions as described by Lohman et al. 1988[17]. Weight was measured digital weigh machine (Personal Scale; Made in China) nearest 0.1 kg. And height was measured Martin anthropometer (Galaxy International; New Delhi, Made in India) nearest 0.1 cm. Technical errors of measurements (TEM) were found to be within reference range (≤1.5%)[18] and these not incorporated in statistical analyses.

Two commonly used undernutrition indicators, i.e., underweight and stunting were used to evaluate the nutritional status of the subjects. The United States National Centre for Health Statistics (NCHS)[9,19] age and sex specific – 2 z-scores were followed to define underweight and stunting. The following scheme was utilized:

- Underweight: <–2 WAZ (Z-score for weight-for age)
- Stunting :<–2 HAZ (Z-score for height-for age)

Where WAZ and HAZ refer to weight-for-age and height-for-age and sex specific z scores, respectively, of NCHS[19].

The WHO[10] classification was followed for assessing severity of malnutrition by percentage prevalence ranges of this indicator among children. The classification is:

	Low (%)	Medium (%)	High (%)	Very High (%)
Underweight	<10	10–19	20–29	≥30
Stunting	<20	20–29	30–39	≥40

Statistical analyses were undertaken using Statistical Package for Social Science, Version 11.0 (SPSS) software. For anthropometric data, a software package based on National Center for Health statistics (NCHS) database as provided with Epi Info-16 software was used.

The distribution of weight and height were not significantly skewed therefore not necessitating their normalization. Between sexes differences in means of weight and height were tested by student's t-test. ONEWAY (Scheffe's Procedure) analyses was undertaken to test for age differences in mean weight as well as mean height in each sex. Number of living rooms (NLR) of the family of the children was categorized into the following two categories: <2 and ≥2. Similarly number of sibs of the children (NS) was grouped in to two categories: Less than three sibs (<3 sibs) and three & above sibs (≥3 sibs). χ^2-tests (with odds ratio) were performed to evaluate the association between discrete variables. Logistics regression analyses (dependent = underweight status = yes/no as well as dependent = stunting status = yes/no) were performed separately with NLR and NS as independent variables as well as together both NRL and NS as independent variable. Significant level was set at ($p<0.05$.).

Results

Age combined mean (standard deviations in parentheses) weight (Table 1) of the subjects were 11.7 kg (±2.44) and 11.2 kg (±2.24) among boys and girls, respectively. Significant age difference in mean weight were observed among boys (df1=4, df2=318) (F=137.63, $p<0.001$) and girls (df1=4, df2=345)(F=135.60, $p<0.001$). Significant sex differences ($p<0.05$) also existed in mean weight at ages 2 to 4 years. The age combined mean height (table 1) of the subjects were 89.3 cm (±9.72) and 88.9 cm (±10.20) among boys and girls, respectively. Significant age difference in mean height were observed among boys (df1=4, df2=318) (F=316.93, $p<0.001$) and girls (df1=4, df2=345) (F=278.96, $p<0.001$). Significant sex differences ($p<0.05$) also existed in mean height at ages 2 to 4 years.

The rate of stunting (age combined) was higher among boys (43.34%) compared with girls (34.43 %) [χ^2=4.41 df=1, p=0.04, OR=1.394, CI=1.002–1.902] (Table 2). Similar rates of underweight (Boys=54.49%, Girls=54.29%) [χ^2=0.003 df=1 p=0.96, OR=1.008, CI=0.744–1.366] were found in both sexes. Boys aged 5 years had higher prevalence rate of stunting (61.90%) compared to girls (29.87%) at 4 years age. Similarly, boys aged 5 years had higher prevalence rate of underweight (76.19%) compared to girls (45.95%) at 1 year age. The overall (age and sex combined) rates of underweight and stunting were 54.4% and 39.2%, respectively. Based on World Health Organization (WHO, 1995) classification of severity of malnutrition, the overall prevalence of underweight and stunting were very high (≥30) and high (30–39%), respectively.

TABLE 1
MEAN (SD) OF WEIGHT (KG) AND HEIGHT (CM) BY AGE AND SEX OF THE CHILDREN

Age in years	Weight (kg)			Height (cm)		
	Boys (N=323)	Girls (N=350)	t-value	Boys (N=323)	Girls (N=350)	t-value
1	8.78	8.64	0.62	76.31	75.59	0.82
(N1=72, N2=74)	(1.18)	(1.55)		(4.15)	(6.19)	
2	10.68	10.18	2.30*	85.31	83.72	2.28*
(N1=74, N2=68)	(1.39)	(1.19)		(4.18)	(4.09)	
3	12.41	11.53	3.81***	92.78	90.79	2.66**
(N1=84, N2=94)	(1.59)	(1.49)		(5.26)	(7.72)	
4	13.96^	12.88	4.39***	98.86^	97.52	2.03*
(N1=21, N2=37)	(1.65)	(1.35)		(4.40)	(3.60)	
5	14.01^	13.93	0.20	101.20^	102.19	–0.80
(N1=72, N2=74)	(1.69)	(1.28)		(5.68)	(3.80)	
Age combined	11.65	11.21	2.49**	89.30	88.89	0.54
(N1=323, N2=350)	(2.44)	(2.24)		(9.72)	(10.20)	
	F=137.63***	F=135.60***		F=316.93***	F=278.96***	

Standard deviations are presented within parentheses
p<0.05, **p<0.01, ***p<0.001
^ = no significant age differences
SD = standard deviations
N1= number of boys
N2 = number of girls

TABLE 2
PREVALENCE (%) OF UNDERWEIGHT AND STUNTING BY AGE AND SEX OF THE CHILDREN

Age in years	Underweight			Stunting		
	Boys	Girls	Sex combined	Boys	Girls	Sex combined
1	70.83	45.95	58.22	56.90	47.30	52.05
2	56.76	52.94	54.93	32.43	30.88	31.69
3	42.86	58.51	51.12	39.29	32.98	35.96
4	43.06	59.74	51.68	40.28	29.87	34.90
5	76.19	51.35	60.34	61.90	37.84	46.55
Age combined	54.49	54.29	54.40	43.34	34.43	39.20
	χ^2=0.003, df = 1, OR=1.394, CI=1.002–1.902			χ^2=4.41*, df = 1, OR=1.008 CI=0.744–1.366		

* p<0.05

TABLE 3
SEX SPECIFIC UNDERNUTRITION WITH NUMBER OF LIVING ROOMS (NLR) AND NUMBER OF SIBS (NS)

Independent variables	Prevalence undernutrition						Prevalence undernutrition					
	Boys						Girls					
	Underweight			Stunted			Underweight			Stunted		
	N (%)	χ^2	OR	N (%)	χ^2	OR	N (%)	χ^2	OR	N (%)	χ^2	OR
NLR < 2	140 (55.6)	0.53	1.22 (0.72– 2.10)	109 (43.3)	0.003	0.98 (0.58 –1.70)	145 (57.8)	4.34*	1.64 (1.30– 2.62)	101 (40.2)	8.98**	2.23 (1.31 – 3.80)
NLR ≥ 2	36 (50.7)			31 (43.7)			45 (45.5)			23 (23.2)		
NS < 3	119 (54.8)	0.03	0.96 (0.60–1.53)	89 (41)	0.23	1.33 (0.84–2.13)	96 (47.1)	10.29***	2.03 (1.32–3.146)	62 (30.4)	5. 42*	1.69 (1.09–2.63)
NS ≥ 3	57 (53.8)			51 (48.1)			94 (64.4)			62 (42.5)		

OR = Odds ratios with confidence intervals within parentheses.

Table 3 presents sex specific underweight as well as stunting by NLR and NS. Significant association of underweight with NLR (χ^2=4.34, df=1, p<0.05) as well as association of stunting with NLR (χ^2=8.98, df=1, p<0.01) were found among girls. Similarly, NS had a significant association with underweight (χ^2=10.29, df=1, p<0.001) as well as stunting (χ^2=5.42, *df=1*, p<0.05) among girls. Table 3 also represents that girls with <2 NLR had significant higher risk of being underweight (OR=1.64, CI=1.30–2.62) or stunted (OR=2.23, CI= 1.31–3.80) than those with ≥ 2 NLR. Moreover, girls with ≥3 sibs had significant higher risk of being underweight (OR=2.03,

TABLE 4
LOGISTICS REGRESSION OF UNDERNUTRITION WITH NUMBER OF LIVING ROOMS (NLR) AND NUMBER OF SIBS (NS) AS INDEPENDENT (RUN SEPARATELY) VARIABLES

Independent variables	Sex	Dependent variables	B	S.E.B	Beta	Wald	Sig.
NLR	Boys	Underweight	0.195	0.269	1.215	0.525	0.47
		Stunting	–0.017	0.271	0.984	0.004	0.95
	Girls	Underweight	0.496	0.239	1.642	4.304	0.04
		Stunting	0.800	0.271	2.225	8.737	0.00
NS	Boys	Underweight	–0.043	0.238	0.958	0.033	0.86
		Stunting	0.288	0.238	1.334	1.458	0.23
	Girls	Underweight	0.710	0.223	2.034	10.169	0.00
		Stunting	0.525	0.226	1.690	5.383	0.02

CI=1.32–3.146) or stunted (OR=1.69, C.I=1.09–2.63) than those with <3 sibs.

Thereafter, logistic regressions were undertaken with underweight status (yes/no) stunting status (yes/no) as dependent variables and NLR and NS (separately) as independent variables. Results revealed that (Table 4) NLR had significant impact on underweight (Wald=4.30, $p<0.05$) status and stunting (Wald=8.74, $p<0.001$) status among girls. Similarly NS had significant impact on underweight (Wald=10.17, $p<0.001$) status as well as stunting status (Wald=5.38, $p<0.05$) among girls. Both these variables were good independent predictors of underweight status as well as stunting status among girls. Further logistic regression (Table 5) were undertaken with underweight status (yes/no) stunting status (yes/ no) as dependent variables and NLR and NS (combined) as independent variables to identify their effects, when considered together, on undernutrition. Results showed that NS had significant impact on underweight (Wald= 8.28, $p<0.001$) rather than NLR among girls. Results also demonstrated that NLR had significant impact on stunting (Wald=6.874, $p<0.01$) rather than NS.

Discussion

In rural India, the most important public health problems are that of underweight and stunting among preschool children and this not only obstructs the growth of children, but also has long-term implications, it has a negative impact on future human performance, health and life expectations of the individuals[20]. It has been shown that the nutritional status of preschool children is affected by different socio-demographic factors. Moreover, gender differences in the impact of socio-demographic factors on nutritional status are very pronounced[20]. It has been reported that about 53% of all deaths in young children are attributable to being underweight[5]. Although the majority of underweight children live in developing countries, mainly in Asia and Africa, it has been found to be increasing in Africa and decreasing in Asia[21]. Presently, undernutrition is responsible for nearly 5·2 million annual child deaths in the developing world[22]. In India, half of all under-five children suffer from undernutrition[23].

In this present study, based on WHO[10] classification of severity of malnutrition, the overall prevalence of underweight as well as stunting were very high (≥ 40%) and high (30–39%), respectively. This finding is indicative of high level of chronic undernutrition among these children resulting from prolonged food deprivation. The rate of stunting (26.6%) was higher and underweight (63.3%) was lower than those reported in an earlier study[24] on ICDS children from West Bengal. A few previous studies have shown lower prevalence of undernutrition than the present study[25,26] while other studies have reported higher prevalence[27,28]. From our study it is clear that the nutritional status of the subjects is not satisfactory and it seems that there is scope for much improvement in the form of enhanced dietary intake.

More importantly, the present study revealed that low NLR and high NS had strong independent impact on underweight as well as stunting among girls but not boys. A recent study from India[29] found that both girls and boys who were born after multiple same-sex siblings experienced poor outcomes, suggesting that parents want some balance in sex composition. However, the preference for sons persists, and boys who were born after multiple daughters had the best possible outcomes. These results are consistent with those being reported in our study. The effects of household wealth status as well as number of living rooms remain significant predictors of undernutrition[30–32]. This is similar to the finding of strong association of NLR with undernutrition amongst girls being reported by us. It must be added here that NLR is a reliable indicator of socio-econoimc status or poverty.

Moreover, both low NLR as well as high NS were strongly associated and were significant predictors of underweight and stunting among girls but not boys. The sex differences in these associations could be due to gender discrimination. In case of NLR, girls with lower NLR are more likely to be discriminated against thus resulting in greater chances of being underweight or stunted. Similarly, higher rates of underweight and stunting with greater NS amongst girls is also indicative of preferential treatment of boys in terms of nutritional intake. This again is suggestive of gender discrimination in meeting the nutritional requirements of the girl child. Most importantly, both these factors (NLR and NS) do not have any significant impact on underweight as well as stunting status among the boy child. This is clearly indicative of gender discrimination against the girl child resulting in them suffering from chronic undernutrition.

From the above discussion we suggest that similar studies should be undertaken among children of other populations of not only West Bengal but also from diverse parts of India. Children of rural areas should be given priority. Hitherto, there is a paucity of studies from India which have dealt with these important covariates of undernutrition among pre-school children. This is a major strength of our study.

The findings of our study have important implications for public health policy-makers, planners and organizations seeking to meet national and international developmental targets. Of paramount importance is not only to increase the amount of food supplementation given to children but also to promote gender equality, decrease the number of offspring as well as poverty of different populations. Such measures should result in decreased rates of underweight as well as stunting among rural children, particularly among preschool girls of India.

Lastly, it must be mentioned here that information on NLR as well as NS are easily obtainable and does not require the use of any expensive equipment or methods. Thus both these variables can be used as proxy measures in determining the risk of underweight and stunting among female pre-school children. These two parameters can be particularly useful in the detection and identification of high risk pre-school girls in rural areas of developing countries. However, validation studies are required using larger sample sizes among diverse ethnic groups.

Abbreviations

Number of living room (NLR), Number of sibs of the children (NS), Weight for age Z-Score (WAZ) and Height for age Z-Score (HAZ).

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UČINAK SOCIODEMOGRAFSKIH VARIJABLI NA PREHRAMBENI STATUS KOD BENGALI PREDŠKOLSKE DJECE U ISTOČNOJ INDIJI

S A Ž E T A K

U zemljama u razvoju, uključujući ruralne dijelove Indije, podhranjenost među predškolskom djecom je jedna od glavnih prepreka nacionalnom razvoju. No ne postoje dovoljne informacije o prevalenciji podhranjenosti i sociodemografskim prediktorima kod predškolske djece u Indiji i zapadnom Bengalu. Cilj ovog istraživanja bio je istražiti prevalenciju podhranjenosti i usporenog rasta i razvoja te utjecaja sociodemografskih faktora, odnosno broja soba u kojima se živi (NLR) i broja braće i sestara (NS), među jedno- do petogodišnjacima iz ruralnih predjela, a preko Centara za integrirani razvoj djece. Ova transverzalna studija je provedena na 30 slučajno odabranih centara i ukupno 673 djece je ispitano. Opća stopa podhranjenosti iznosila je 54,40%, a usporenog rasta i razvoja 39,20% (kombinacija dobi i spola). Utvrđeno je da je NRL u značajnoj korelaciji s prevalencijom podhranjenosti (χ^2=4,34, df=1, p<0,05) i usporenim rastom i razvojem (χ^2=8,98, df=1, p<0,01) kod djevojčica. Također, NS je u pozitivnoj korelaciji s prevalencijom podhranjenosti (χ^2=10,29, df=1, p<0,001) i usporenim rastom i razvojem (χ^2=5,42, df=1, p<0,05) kod djevojčica. Djevojčice s <2 NLR su izložene mnogo većem riziku od podhranjenosti (OR=1,64, C.I=1,30–2,62) ili usporenom rastu i razvoju(OR=2,23, C.I=1,31–3,80) od onih s ≥2 NLR. Također, djevojčice s ≥3 NS su imale značajno višu stopu podhranjenosti (OR=2,03, C.I=1,32–3,146) ili usporeni rast i razvoj (OR=1,69, C.I=1,09–2,63) nego one s <3 braće i sestara. Regresijska analiza je otkrila da su i NLR i NS snažni prediktori podhranjenosti (NLR: Wald=4,30, p<0,05); NS: Wald= 8,74, p<0,001) i usporenog rasta i razvoja (NLR: Wald=10,17, p<0,001; NS: Wald=5,38, p<0,05) kod djevojčica. Spolna diskriminacija bi mogla biti uzrok velikih spolnih razlika kod utjecaja NRL i NS. Također, regresijska analiza je pokazala i da NS ima značajniji utjecaj na podhranjenost (Wald=8,28, p<0,001) od NRL kod djevojčica, dok NRL ima značajniji utjecaj na usporeni rast i razvoj (Wald=6,874, p<0,01) od NS.