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Undernutrition and associated factors among children aged 5-10 years in West Bengal, India: a community-based cross-sectional study

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Abstract

Background: In the previous few decades, India has made significant progress in reducing child mortality and fertility rates; yet, undernutrition remains one of the country's primary public health issues. The goal of this study was to determine the extent of child malnutrition in West Bengal, India, as well as the risk factors linked with it. In diverse districts of West Bengal, a community-based cross-sectional study was undertaken utilizing multi-stage stratified cluster sampling followed by systematic random sampling. Anthropometric, individual, and household characteristics were collected from 2070 children in this study. Height-for-age, weight-for-age, and BMI-for-age z-scores were calculated. The levels and factors related with child undernutrition were studied using univariate and multivariate logistic regression analysis.

Results: Stunting, underweight, and thinness were shown to be prevalent in 25.48%, 33%, and 26.88% of children, respectively. With age, the likelihood of a child becoming malnourished increased. In comparison with girls, boys had a greater chance of being malnourished. Separately, parental educational and occupational statuses were linked to child malnutrition. Undernourished children were more likely to have a mother who was uneducated or undereducated (stunting: OR = 1.46; underweight: OR = 1.49; thinness: OR = 1.49). Children from economically disadvantaged families were more likely to be malnourished. Children from households with untreated drinking water and poor sanitation were more likely to be malnourished.

Conclusions: The current study showed that there are several risk variables linked to child malnutrition. Undernutrition was caused by illiteracy, filthy drinking water, and poor sanitation, all of which were independent risk factors.

Keyword: Children, Undernutrition, Stunting, Thinness, Socio-demographic factor

Background

Undernutrition is a state of poor health caused by a lack of nutrients in the body. It is still regarded as one of the most serious public health issues in developing countries, particularly in Southeast Asia and Sub-Saharan Africa [1]. It is one of the most common causes of morbidity and mortality among children all around the world [2]. Every year, more than 10 million children die from diseases that

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are preventable and treatable. Undernutrition is responsible for at least half of these deaths [3]. If no treatments are implemented, close to one billion children will be cognitively and physically handicapped by 2020, according to the Global Monitoring Report [4] and Levels and Trends in Child Mortality Report [5]. According to the fourth assessment on the global nutrition situation, the worldwide extent of undernutrition remains unacceptable, and progress toward reducing it is gradual [6].

Because school age is a period of rapid physical and mental development, persistent malnutrition during this time stunts their development [7]. There is a growing understanding that childhood malnutrition is a big



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issue since its consequences are long-lasting and extend beyond infancy. It has both immediate and long-term consequences [8]. Chronic malnutrition is linked to delayed motor and cognitive development, a lower IQ, poor social skills, a delay in physical growth, susceptibility to infectious infections, and major health problems later in life [3, 9, 10]. Long-term malnutrition has been linked to negative repercussions in adulthood, including stunted physical growth, reduced work capacity, poor reproductive outcomes, and an increased risk of chronic diseases [11].

The reasons for undernutrition in children are varied and complex. Undernutrition in children is caused by complex interactions between a variety of factors such as genetic endowments, nutritional status, sociodemographic, reproductive, physical environment, and regional factors [3, 8, 10, 12-17].

One of India's primary human development issues continues to be undernutrition. Despite the fact that India has made significant progress in the last few decades in terms of reducing child mortality and fertility rates, undernutrition among children continues to take many lives. Since 1992, many national health surveys in India have been conducted to offer information on health indicators at subnational levels, including the National Family Health Survey (NFHS), District Level Household Survey, and Annual Health Survey. These national health surveys on undernutrition, on the other hand, are mainly limited to children under the age of five. The fourth in a series of nationwide surveys, the NFHS-4, found that malnutrition is still widespread in India, with the number of malnourished children under the age of five in West Bengal exceeding that of a decade before (stunting 33%, wasting 20%, and underweight- 32% respectively) [18]. While the condition in younger children is well-known, the situation in older children is less well-known. In India, the health information system has not kept pace with the epidemiological shift [19]. As a result, evaluating the magnitude of undernutrition and identifying risk factors for it has the potential to play a key role in developing developmental strategies to improve the nutritional condition of children in this state. The goal of the study was to determine the prevalence of stunting, underweight, and thinness in children aged 5 to 10 years in West Bengal, India, as well as their associated factors.

Methods

Study design and study area

From September 2017 to March 2018, a communitybased cross-sectional study was done in various districts of West Bengal employing multi-stage stratified cluster sampling followed by systematic random sampling methodology.

Sample size and sampling technique

The required sample size was calculated using a single population proportion with the following assumption: 38.7% prevalence of underweight [20], 95% confidence interval, and 3% marginal error. A design effect of 2 was utilized because a multi-stage sampling procedure was used to choose participants. Exclusion was given 10% of the total, while non-responses were given 10% of the total. As a result, the study requires 2430 (rounded to 2500) volunteers.

In the present study, the participants were selected from six districts (Howrah, Purba Medinipur, Paschim Medinipur, Jargram, Bankura, Purulia) of West Bengal. From each district, five blocks were chosen at random, followed by the selection of six clusters (four villages and two words from town/municipality, roughly whenever possible) from each block. Then, using a systematic random sampling procedure, fifteen participants per cluster were identified. The sampling interval was calculated by dividing the total number of families with children aged 5–10 years in the cluster by the needed number of subjects (fifteen). The first household was chosen at random using the lottery method, and subsequent houses were identified by adding the sampling interval to the random number.

The participants were interviewed and measured in their homes on the same day, as agreed upon by setting up prior appointments. A second visit was performed when mother-child couples were not present at the time of data collection. When that did not work, the nearby family was considered. The younger kid was included in the study for homes with more than one child (aged 5-10 years) to close the time gap for comparing the nutritional state of children in study areas. The study included children who had spent at least 80% of their lives in the study area since birth. Participants with a history of acute or chronic disorders were not allowed to participate in the study. Because they did not meet these criteria, the authors rejected 153 (6.12%) individuals. A total of 239 people out of 2347 who were eligible declined to participate in the study, and 34 were eliminated owing to missing or incomplete data. As a result, 2074 children (88.37%) of those who were eligible) took part in the study. Outliers were defined as participants with height-for-age z-scores (HAZ) of -6 or > + 6. Four outliers (participants) were excluded from the dataset.

Before beginning the data collection, the study team (supervisors, research team, and field examiners) paid a brief visit to the study areas to meet local community leaders and heads of families and to inform them on the study's goal, data collection processes, etc. During visits to the homes of those who agreed to participate in the study, written informed consent was collected from the guardians (left thumb impression for illiterate guardians in the presence of two literate witnesses). The Vidyasagar University Ethics Review Committee provided ethical approval and permission prior to the start of this investigation. This study was performed in accordance with the ethical standards of the committee and with the Helsinki Declaration.

Study variables

The study's key outcome variable was the nutritional status of the children. Socio-demographic variables (age of the child, child sex, residence, religion, caste, family size, parental education and occupation, economic situation, and household socio-economic status) and environmental health conditions (water supply, availability of latrine, and housing conditions) were the independent variables.

The participants' socio-demographic factors and environmental health conditions were studied using a semistructured questionnaire created after examining related research. The survey questionnaire was prepared in English first and then translated into Bengali. The Bengali version was then translated into English once more. The modified Kuppuswami scale was used to assess the socio-economic status of the individuals [21]. Prior to data collection, the questionnaire was pretested on 50 respondents who were not part of the main study.

Participants' height and weight were measured using a recognized procedure and appropriate landmarks. An anthropometer (Hindustan Minerals) was used to measure height to the nearest 0.1 cm, and a portable weighing machine (Libra) was used to measure weight to the nearest 0.1 kg. A total of two measurements were taken on each subject. When two initial height measurements did not meet the 0.4 cm requirement, two more measurements were performed, with the mean of the closest records chosen as the best estimate. During the measurements, all individuals wore light clothing and were barefooted. The body mass index (BMI) was calculated using the subjects' height and weight measurements. Participants' ages were taken from their birth certificates.

For data collection, thirty field examiners (15 males and 15 females) with a Bachelor of Science in Human Physiology and fluency in the local language (Bengali) were recruited. All of the examiners went through two training programs, where they learned about the protocol, anthropometry procedures, and interviewing techniques. The instruments were verified for correctness against a standard on a regular basis. The principal investigators used to go to the field to double-check field examiners' interviews and anthropometric measurements. Every questionnaire was double-checked for accuracy and logical consistency. A conference was held between the supervisors, research team, and field examiners at the end of each cluster data collection to discuss practical problems and main concerns.

Statistical analysis

Stunting, defined as height-for-age *z*-score (HAZ) < -2; underweight, defined as weight-for-age *z*-score (WAZ) < -2; and thinness, defined as BMI-for-age z-score (BAZ) < -2, were the study's key outcome variables. Height, weight, and BMI values were converted into z-scores of the indices HAZ, WAZ, and BAZ using the WHO Anthro software, version 3.2.2. To summarize the data, categorical variables were summarized using frequency and percentage, while continuous variables were summarized using mean and standard deviation. For continuous and categorical data, Student's t-test and chi-square test were used to analyze the differences. One-way ANOVA was employed to assess the age variation of height, weight, and BMI. The levels and factors related with child undernutrition were studied using univariate and multivariate logistic regression analysis. The Statistical Package for Social Sciences was used to conduct all of the analyses (version 20). A statistically significant p value of 0.05 was used.

Results

There were a total of 2070 children in this study, with 1049 (50.68%) of them being female. The children's average age was 93.57 months. Approximately 83% of participants were Hindu, whereas 17% were Muslim. The majority of the participants (81.5%) lived in rural areas, while 383 (18.5%) lived in urban areas. The rates of illiteracy among fathers and mothers were found to be 21% and 31%, respectively. The fathers' occupations were varied. About 85% of the women were housewives. A large proportion of the households (63.82%) lacked access to water and relied on public tube-well water for consumption. Thirteen percent of the homes did not have access to a latrine. Each household had an average family size of 5.47 people. The average monthly income per capita was around Rs. 1619.56/US\$ 24.25. Around 63% of the participants came from families with a monthly per capita income of less than Rs. 2000, whereas 14.78% came from families with a monthly per capita income of more than Rs. 4000. Approximately 61% of those polled belonged to the lower socio-economic class.

The participants' average height, weight, and BMI were 120.18 ± 10.18 cm, 21.89 ± 6.37 kg, and 14.97 ± 3.09 kg/m², respectively (Table 1). The age- and sex-specific mean height, weight, and BMI were all below the median reference values of WHO [22] (Fig. 1).

Stunting, underweight, and thinness were shown to be prevalent in 25.51%, 32.99%, and 26.91% of children, respectively. Severe stunting, underweight, and thinness

	Age, years	Number	Number Height		Weight		BMI		
			Mean \pm SD	95% CI	Mean \pm <i>SD</i>	95% CI	Mean \pm SD	95% CI	
Воу	5	160	111.2 ± 9.89	109.66-112.74	18.56 ± 6.36	17.57–19.56	14.99 ± 4.74	14.25-15.73	
	6	166	115.54 ± 8.27	114.27-116.81	19.55 ± 5.77	18.66-20.43	14.48 ± 3.16	13.99–14.96	
	7	177	118.88 ± 6.79	117.87–119.89	21.04 ± 4.09	20.43-21.65	14.83 ± 2.14	14.51-15.15	
	8	212	123.19 ± 8.3	122.07-124.32	23.17 ± 5.47	22.43-23.91	15.14 ± 2.45	14.81-15.67	
	9	169	124.88 ± 9.52	123.43-126.33	24.95 ± 6.5	23.96-25.94	15.86 ± 3.07	15.39-13.32	
	10	137	128.57 ± 8.38	127.15-129.98	26.44 ± 7.45	25.18–27.7	15.81 ± 3.23	15.26-16.35	
	All	1021	120.32 ± 10.22	119.69–120.95	22.22 ± 6.52	21.82-22.62	15.16 ± 3.22	14.96-15.36	
	F ratio		87.393 (<i>p</i> < 0.001)		42.143 (p < 0.001)		4.724 (<i>p</i> < 0.001)		
Girl	5	174	109.99 ± 7.74	108.93-111.14	16.98 ± 4.68	16.27–17.68	13.96 ± 3.19	13.49–14.44	
	6	180	113.83 ± 7.61	112.71-114.95	18.58 ± 4.22	17.96–19.19	14.29 ± 2.72	13.89–14.69	
	7	191	118.9 ± 7.59	117.82–119.98	20.69 ± 4.29	20.07-21.29	14.58 ± 2.36	14.24-14.91	
	8	204	122.92 ± 7.64	121.73-122	22.5 ± 5.07	21.8-23.2	14.8 ± 2.44	14.46-15.13	
	9	165	126.34 ± 7.9	125.13-127.56	25.09 ± 7.17	23.98–26.19	15.54 ± 3.41	15.01-16.06	
	10	135	130.85 ± 6.41	129.76-131.94	27.03 ± 5.9	26.02–26.8	15.77 ± 3.26	15.21-16.32	
	All	1049	120.04 ± 10.15	119.43-120.66	21.57 ± 6.21	21.19-21.94	14.77 ± 2.94	14.59– 14.95	
	F ratio		171.794 (<i>p</i> < 0.001)		83.987 (<i>p</i> < 0.001)		9.114 (<i>p</i> < 0.001)		
Both sexes	5	334	110.57 ± 8.84	109.62-111.52	17.74 ± 5.59	17.13–18.34	14.46 ± 4.04	14.02-14.89	
	6	346	114.65 ± 7.96	113.81-115.49	19.04 ± 5.04	18.51–19.58	14.38 ± 2.94	14.08–14.69	
	7	368	118.89 ± 7.21	118.15–119.63	20.86 ± 4.2	20.43-21.29	14.7 ± 2.27	14.46-14.93	
	8	416	123.06 ± 7.98	122.29–123.83	22.84 ± 5.29	22.33-23.35	14.97 ± 2.45	14.73-15.21	
	9	334	125.6 ± 8.79	124.66-126.55	25.02 ± 6.84	24.28-25.75	15.7 ± 3.25	15.35-16.05	
	10	272	129.7 ± 7.54	128.8–130.6	26.72 ± 6.73	25.93-27.53	15.78 ± 3.25	15.4-16.17	
	All	2070	120.18 ± 10.18	119.74–120.62	21.89 ± 6.37	21.62-22.17	14.97 ± 3.09	14.83-15.1	
	F ratio		245.241 (p < 0.001)		119.895 (p < 0.001)		12.622 (p < 0.001)		

Table 1 Mean \pm SD of physical characteristics of the participants (n = 2070)

were found to be prevalent in 7.1%, 13.04%, and 12.42% of the population, respectively. Approximately 7% of the participants were overweight or obese. The prevalence of stunting was studied across three BMI groups (thinness, normal, and overweight-obese), and it was discovered that 26% of thin children and 16% of normal children were stunted. Around 17% of children in the overweight-obese group were also stunted (Table 2).

Determinants of undernutrition

Bivariate and multivariate logistic regression analyses were used to evaluate the factors related with undernutrition. Stunting, underweight, and thinness were all studied separately. Stunting was found to be substantially linked with child age, residence, maternal education and occupation, per capita monthly income, family size, type of house, socio-economic position, and household water source in a bivariate study (Table 3). The final multivariate logistic regression analysis revealed that stunting was significantly associated with the advanced age of children (8–10 years), lower per capita monthly income (Rs. 2000) (AOR 1.77; 95% CI 1.17–2.69), and households that used public tube-well water for consumption (AOR 1.33; 95% CI 1.05–1.69). When compared to children whose mothers were housewives, children whose mothers were laborers or cultivators had a higher risk of stunting (AOR 1.67; 95% CI 1.192.34). Children from families with fewer than four members were more likely to be stunted (AOR 1.68; 95% CI 1.08–2.64). Similarly, children from poorer socio-economic homes were found to have a higher risk of stunting.

The frequency of underweight was higher among boys in the bivariate analysis. Underweight was also linked to child age, residence, parental education and occupation, religion, caste, per capita monthly income, type of house, toilet availability, socio-economic level, and household water source (Table 4). The results of the multivariate analysis revealed that males were substantially more likely than girls to be underweight (AOR 1.32, 95% CI 1.09–1.6). Children's advanced age was connected with a higher risk of being underweight. When comparing children from rural areas to those from urban areas, the probability of being underweight was 1.33 times higher. Children whose fathers worked as laborers (AOR 1.44; 95% CI 1–2.08) and cultivators (AOR 1.68; 95% CI 1.19–2.37) had a higher risk of being underweight than



children whose fathers worked in service or ran a business. Children whose mothers were laborers or cultivators had 1.55 times higher risk of being underweight than children whose mothers were housewives. Similarly, children whose mothers were illiterate or only able to sign had a higher risk of being underweight (AOR 1.62; 95% CI 1.14–2.12), followed by children whose mothers had only primary education (AOR 1.59; 95% CI 0.95–2.65) compared to those whose mothers had secondary education. Muslim children were found to be more likely than Hindu children to be underweight (AOR 1.35; 95% CI 1.06–1.71). Children from households without access to a latrine had 1.53 times higher risk of being underweight. Underweight was related with a lower socio-economic position (AOR 1.42; 95% CI 0.98–2.02).

The bivariate analysis revealed that child age, residence, religion, parental education and occupation, per capita monthly income, socio-economic position, housing type, and latrine availability were all linked with thinness (Table 5). After correcting for socio-demographic and household factors in a multivariate model, older children were found to have a lower risk of being thin. When compared to children whose fathers ran a business or were in service, children whose fathers were laborers (AOR 2.64; 95% CI 1.74–3.98) and cultivators (AOR 2.41; 95% CI 1.64–3.56) had higher probabilities of being thin. Table 2 Nutritional status classification of the participants according to gender, BMI-for-age (z-score), and height-for-age (z-score)

Height for age		BMI-for-age											
		\leq - 2 SD			> - 2 <i>SD</i> to < + 2	2 SD		\geq - 2 SD					
		Classification	n	%	Classification	n	%	Classification	n	%			
Boys	≤ -2 SD	U.W. + S.	70	24.73	S.	65	9.88	O.W. + S.	16	20			
					U.W. + S.	116	17.63						
	> — 2 SD	U.W.	143	50.53	U.W.	35	5.32	O.W.	64	80			
		Т.	70	24.73	Ν.	442	67.17						
Girls	\leq -2 SD	U.W. + S.	76	27.74	S.	76	10.58	O.W. + S.	7	12.28			
					U.W. + S.	102	14.21						
	> — 2 SD	U.W.	115	41.97	U.W.	25	3.48	O.W.	50	87.72			
		Т.	83	30.29	Ν.	515	71.73						
All	≤ -2 SD	U.W. + S.	146	26.21	S.	141	10.25	0.W. + S.	23	16.79			
					U.W. + S.	218	15.84						
	> - 2 SD	U.W.	258	46.32	U.W.	60	4.36	O.W.	114	83.21			
		Т.	153	27.47	N.	957	69.55						

U.W underweight, S stunting, T thin, N normal, O. W overweight

In terms of mother's occupation, children whose mothers worked as a laborer or a cultivator were more likely to be thin (AOR 1.62; 95% CI 1.18–2.22) than children whose mothers worked as housewives. Children whose mothers were illiterate or had low educational levels had a muchincreased risk of being thin. Children from families without access to a latrine were more likely to be thin. When compared to children from upper socio-economic households, the likelihood of being thin was higher among children from lower socio-economic families (AOR 1.68; 95% CI 1.12–2.39), followed by children from middle socioeconomic families (AOR 1.2; 95% CI 0.64–2.27).

Discussion

Despite significant economic improvement over the last two to three decades and an overarching goal of addressing health needs through a variety of comprehensive programs, India's health outcomes have been less outstanding. Stunting, underweight, and thinness were shown to be prevalent in 25.51%, 32.99%, and 26.91% of the children in this study, respectively. The prevalence of stunting among the children investigated was moderate, but the prevalence of underweight was very high, according to the WHO scale of severity malnutrition [23]. Various research, both in India and overseas, have shown similar outcomes. When compared to a communitybased cross-sectional research conducted in West Bengal, where 26.5% of children were stunted and 38.7% were underweight, this study demonstrated a lower prevalence of stunting and underweight [20]. In Orissa, India's south-eastern state, the prevalence of underweight, stunting, and thinness was 24.61%, 39.51%, and 48.35%,

respectively [24]. In comparison with global estimates, the prevalence of stunting among children in this study was lower than that reported in Bangladesh (60%) [17], Ethiopia (39.8%) [13], and Egypt (53.2%) [15] but greater than that in Brazil (15.5%) [12].

The likelihood of a child being undernourished increased with age, according to one study. In terms of stunting and thinness, the age gap was significant. The increased frequency of parasite infection seen with increasing age may be linked to the higher prevalence of undernutrition among older children [12]. Similarly, many studies in India and elsewhere have found that older children are more prone than younger children to become malnourished [3, 12, 13, 25]. In comparison with girls, boys had a greater chance of being malnourished. Male children were also shown to be more likely than female children to be undernourished, according to several studies [8, 15]. The cause of the gender gap in undernutrition is unknown; however, some studies have found that boys are more influenced by environmental stress while playing, such as frequent illnesses and exposure to toxins and air pollution, than girls [8, 15].

The literature on the causes of malnutrition is extensive. Low diet, poor socio-economic conditions, environmental, socio-demographic inequality, and ethnicity are the main causes of undernutrition in developing countries [10, 12, 26, 27]. According to Maia et al., socio-economic, cultural, and environmental factors that interfere with nutrient intake have a greater impact on malnutrition [12].

Parental educational and occupational statuses were found to be independently linked with children's

Table 3 Factors associated with stunting among children aged 5–10 years

Variables		Stunti	ng				
		%	χ^2 (p value)	COR (95% CI)	<i>p</i> value	AOR (95% CI)	p value
Sex	Male	26.15	0.439 (0.508)	1.07 (0.88–1.3)	0.508	1.09 (0.89–1.34)	0.402
	Female	24.88		Reference		-	
Age	5	20.06	44.117 (0.000)	Reference		_	
	б	17.05		0.82 (0.56–1.21)	0.313	0.83 (0.56–1.23)	0.351
	7	22.28		1.14 (0.79–1.63)	0.472	1.21 (0.8–1.77)	0.319
	8	27.4		1.5 (1.07–2.12)	0.02	1.71 (1.19–2.45)	0.004
	9	33.83		2.04 (1.43–2.89)	0.000	2.39 (1.65-3.45)	0.000
	10	34.19		2.07 (1.43–2.99)	0.000	2.26 (1.55–3.3)	0.000
Residence	Rural	26.44	4.278 (0.039)	1.32 (1.01–1.72)	0.042	1.24 (0.94–1.64)	0.126
	Urban	21.41		Reference		-	
Religion	Hindu	24.91	1.845 (0.174)	Reference		_	
2	Muslim	28.41		1.2 (0.93–1.54)	0.171	1.18 (0.89–1.55)	0.24
Cast	Lower (SC and ST)	29.4	3.43 (0.064)	1.27 (0.99–1.63)	0.061	1.15 (0.88–1.52)	0.301
	Other	24.68		Reference		_	
Occupational status of the father	Laborer	28.55	5.745 (0.057)	1.34 (1.05–1.69)	0.018	1.07 (0.78–1.46)	0.686
	Cultivator	26.07		1.18 (0.93–1.49)	0.175	1.08 (0.8–1.45)	0.609
	Business/service	23.01		Reference		_	
Educational status of the father	Illiterate or just able to sign	26.02	2.99 (0.393)	1.24 (0.89–1.73)	0.198	1.17 (0.86–1.64)	0.029
	Up to primary	26.61	,	1.28 (0.96–1.71)	0.092	1.07 (0.71–1.46)	0.209
	Secondary	26.04		1.22 (0.87–1.7)	0.25	1.09 (0.6–1.85)	0.606
	Above secondary	21.05		Reference		_	
Occupational status of the mother	Housewife	24.91	12.983 (0.002)	Reference		_	
	Laborer/cultivator	33.77	, , , , , , , , , , , , , , , , , , ,	1.54 (1.14–2.06)	0.004	1.67 (1.19–2.34)	0.003
	Business/service	15.48		0.55 (0.3–1.01)	0.053	0.72 (0.37-1.41)	0.339
Educational status of the mother	Illiterate or just able to sign	28.73	11.884 (0.008)	2.01 (1.31-3.09)	0.001	1.46 (0.81–2.62)	0.211
	Up to primary	25.44	, , , , , , , , , , , , , , , , , , ,	1.71 (1.12–2.59)	0.013	1.43 (0.83–2.47)	0.196
	Secondary	24.18		1.59 (1.01–2.54)	0.049	1.3 (0.85–2.39)	0.173
	Above secondary	16.67		Reference		_	
Economic status	Rs. < 2000	28.23	14.898 (0.001)	1.65 (1.21-2.24)	0.002	1.77 (1.17–2.69)	0.007
	Rs. 2001–4000	21.88	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1.17 (0.82–1.68)	0.386	1.22 (0.81–1.84)	0.341
	Rs. > 4000	19.28		Reference		_	
Family size	< 4	26.83	5.775 (0.056)	1.65 (1.08-2.52)	0.021	1.68 (1.08–2.64)	0.022
	5-8	25.61		1.55 (1.02-2.35)	0.041	1.51 (0.98–2.34)	0.061
	> 9	18.18		Reference		_	
Type of house	Kutcha	28.76	6.843 (0.033)	1.35 (1.06–1.72)	0.014	1.15 (0.69–1.29)	0.738
.)	Semi pucca	24.33		1.08 (0.84–1.39)	0.558	1.03 (0.61–1.13)	0.228
	Pucca	22.96		Reference		_	
Availability of latrine	Yes	24.86	2.878 (0.09)	Reference		_	
	No	29.71	(, , , ,	1.28 (0.97-1.69)	0.086	1.15 (0.81-1.63)	0.442
Water source	Tube well	27.78	10 116 (0 001)	1 4 (1 14–1 74)	0.002	1 33 (1 05–1 69)	0.016
	Deep tube well	21.50		Reference		_	2. 9. 9
SES	Lower	27.59	21,239 (0.000)	2.94 (1.75–4.94)	0.000	2.55 (1.19-5.48)	0.016
	Middle	24 57	(0.000)	2.51 (1.47-4.29)	0.001	2.36 (1.28-4.36)	0.006
	Upper	1149		Reference	0.001	_	0.000
	oppo	11.72					

Table 4 Factors associated with underweight among children aged 5–10 years

% χ^2 (y rate)QR (95% C)y rateAR (95% C)y rateSexMale35.76.916 (0.009)1.28 (1.09-1.54)0.0091.22 (1.09-1.64)0.005AgeS0.011 (0.87Reference1.10 (0.55-1.08)0.210.11 (0.55-1.08)0.21Age31.71.10 (0.75-1.37)0.9721.10 (0.55-1.08)0.210.0080.11 (0.75-1.08)0.0261.58 (1.13-2.21)0.008Age31.71.10 (0.75-1.08)0.2261.58 (1.13-2.21)0.0081.55 (1.11-1.21)0.0111.65 (1.11-1.22)0.0011.65 (1.11-2.21)0.0111.55 (1.11-1.22)0.011 <th>Variables</th> <th></th> <th>Under</th> <th>weight</th> <th></th> <th></th> <th></th> <th></th>	Variables		Under	weight				
Sex Male 35.75 6.916 (0009) 1.28 (1.06-1.54) 0.093 1.32 (1.09-1.6) 0.005 Age 5 20.04 9.611 (0.087) Refreence 8 0.01 7 0.095 1.10 (0.95-1.68) 0.31 7 30.98 1.11 (0.79-1.51) 0.522 1.53 (1.31-2.21) 0.004 8 33.17 1.21 (0.09-1.66) 0.226 1.53 (1.31-2.21) 0.004 10 36.37 1.30 (1.1-1.20) 0.044 1.73 (1.22-2.444) 0.002 Reidence Rural 34.38 8.138 (0.004) 1.42 (1.11-1.82) 0.005 1.33 (1.03-1.72) 0.014 Reidgon Hindu 31.84 5.992 (0.014) Refreence 1.008-1.40 0.049 Cast Cower GC and ST) 37.64 4.233 (0.44) 1.23 (1.03-1.40 0.003 1.44 (1-2.08) 0.049 Cubator 37.44 1.23 (0.041) 1.23 (1.33-1.20) 0.001 1.44 (1-2.08) 0.049 Cast Cower GC and ST) 37.44 1.23 (0.13-2.11)			%	χ^2 (p value)	COR (95% CI)	p value	AOR (95% CI)	p value
AgeFemale<	Sex	Male	35.75	6.916 (0.009)	1.28 (1.06–1.54)	0.009	1.32 (1.09–1.6)	0.005
AgeSS <t< td=""><td></td><td>Female</td><td>30.31</td><td></td><td>Reference</td><td></td><td></td><td></td></t<>		Female	30.31		Reference			
66699109090101001010100 <td>Age</td> <td>5</td> <td>29.04</td> <td>9.611 (0.087)</td> <td>Reference</td> <td></td> <td></td> <td></td>	Age	5	29.04	9.611 (0.087)	Reference			
111		6	30.92		1.09 (0.79–1.52)	0.592	1.19 (0.85–1.68)	0.31
831.721 (2087-16)0.2011.75 (1.3-2.17)0.001999.231.39 (1.9.2)0.011.75 (1.3-2.17)0.01ReidenceRual3.831.38 (0.004)1.42 (1.1-1.80)0.011.69 (1.1.9-2.10)0.01ReigionHindu3.649.20 (0.1)1.62 (1.1.1-1.62)0.011.50 (1.0.1-1.62)0.01ReigionHindu3.642.30 (0.1)1.28 (1.1.1-1.62)0.011.50 (1.0.1-1.62)0.01CastMusim3.742.31 (0.0.1-1.62)0.011.50 (1.0.1-1.62)0.011.50 (1.0.1-1.62)0.01CastLabora3.762.31 (0.00)1.74 (1.38-2.10)0.011.74 (1.3.2.10)0.011.74 (1.3.2.10)0.01Cautational status of the faithLabora3.782.31 (1.0.1-1.62)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.2.10)0.011.74 (1.5.1.10)0.011.74 (1.5.1.10)0.011.74 (1.5.1.10)0.011.74 (1.5.1.10)0.011.74 (1.5.1.10)0.011.74 (1.5.1.10)0.011.74 (1.5.1.10)0.011.74 (1.5.1.10) <t< td=""><td></td><td>7</td><td>30.98</td><td></td><td>1.1 (0.79–1.51)</td><td>0.576</td><td>1.31 (0.93–1.84)</td><td>0.125</td></t<>		7	30.98		1.1 (0.79–1.51)	0.576	1.31 (0.93–1.84)	0.125
992362139 (1-92)0,4917,122-2400,000Relidence16 (1.1-2.10)1.011.67 (1.1-2.10)1.011.67 (1.1-2.10)1.011.67 (1.1-2.10)1.01Relidence17403.185.00 (1.01)1.011.01 (1.1-2.10)1.011.011.011.01Religion11003.185.00 (1.01)1.011.01 (1.01)1.011.011.011.01CastLower (SC and ST)3.742.31 (2.00)1.26 (1.1-2.10)0.001.26 (1.1-2.10)1.011.011.01Caupational status of the factLower (SC and ST)3.742.31 (2.01)1.01 <td></td> <td>8</td> <td>33.17</td> <td></td> <td>1.21 (0.89–1.66)</td> <td>0.226</td> <td>1.58 (1.13–2.21)</td> <td>0.008</td>		8	33.17		1.21 (0.89–1.66)	0.226	1.58 (1.13–2.21)	0.008
10130130130130130130130ResidenceHural343813(00)142(11-112)130131(13-12)131ReligionHindu314592(010)Referece13(10-17)0.01CasLower (SC and ST)324233 (00)12(10-12)0.0314(10-16)0.13CasLower (SC and ST)374233 (00)17(138-21)0.0014(10-20)0.01Cautation al status of the fatterInteracer (sub schwarz)231 (200)17(138-21)0.0014(10-20)0.01Business/service3632318 (000)17(138-21)0.0014(10-20)0.0112(00-11)Cautational status of the fatterInteracer (sub schwarz)363231(7-31)0.0012(00-11)0.01Cautational status of the fatterInteracer (sub schwarz)363231(7-31)0.0112(00-11)0.0112(00-11)0.01Cautational status of the fatterInteracer (sub schwarz)373373373		9	36.23		1.39 (1–1.92)	0.048	1.73 (1.22–2.44)	0.002
ResidenceRural (Mar)Rural (Mar)ResidenceReferenceResidenceRe		10	38.97		1.56 (1.11–2.19)	0.01	1.69 (1.19–2.4)	0.004
IndexIdeaI	Residence	Rural	34.38	8.138 (0.004)	1.42 (1.11–1.82)	0.005	1.33 (1.03–1.72)	0.031
ReligionHindu31.89.82 (0.01)ReferenceU1.3 (0.61.7)0.141.3 (0.1-1.6)0.04CastLower (Scan ST)37.04.23 (0.01)1.28 (1.1-1.0)0.101.1 (0.85-1.4)0.05Cocupational status of the fatherLaborer37.02.31 (0.00)1.74 (1.3e-2.18)0.0001.44 (1-2.08)0.001Cotupational status of the fatherLiborer2.001.74 (1.3e-2.18)0.0011.40 (1-2.08)0.001Educational status of the fatherIllerater Just able to sig9.042.33 (1.7-1.8)0.0011.70 (0.615)0.901Cotupational status of the fatherIllerater Just able to sig9.042.34 (1.00.1-2.28)0.0011.20 (0.615)0.901Cotupational status of the fatherIllerater Just able to sig9.042.946 (0.00)2.010.11.20 (0.615)0.901Cotupational status of the motionHistory Statule to sig9.042.956 (0.00)Reference1.20 (1.1-2.21)0.0011.50 (1.3-2.12)0.011Educational status of the motionHistory Statule to sig9.042.956 (0.00)2.17 (1.2-2.21)0.0011.50 (1.1-2.12)0.012Educational status of the motionIllerater Just able to sig9.042.01 (1.0-2.12)0.0011.50 (1.1-2.12)0.011Educational status of the motionIllerater Just able to sig9.041.30 (0.8-0)1.50 (1.1-2.12)0.0111.50 (1.1-2.12)0.011Educational status of the motionIllerater Just able to sig9.04 <t< td=""><td></td><td>Urban</td><td>26.89</td><td></td><td>Reference</td><td></td><td></td><td></td></t<>		Urban	26.89		Reference			
Number38.64135 (1.06-1.71)0.0141.3 (1.01-1.62)0.0341.1 (0.85-1.4)0.058CastOther37.642.23 (0.04)1.28 (1.1-1.62)0.0381.1 (0.85-1.4)0.040Occupational status of the fatterLaborer37.942.23 (1.00.1)1.74 (1.38-2.16)0.0001.68 (1.19-2.37)0.003Educational status of the fatterBisiness/service37.84-ReferenceEducational status of the fatterIlliterate or just able to sign36.8-1.73 (1.31-2.29)0.0001.09 (0.65-1.5)0.89Occupational status of the fatterIlliterate or just able to sign36.8-1.73 (1.31-2.29)0.0011.23 (0.83-1.84)0.32Occupational status of the fatterNove secondary36.8-Reference1.33 (1.31-2.910.0001.50 (0.65-1.5)0.50Above secondary12.044.742.0950(0.001Reference1.55 (1.13-2.12)0.0120.121 (1.29-2.27)0.0011.50 (0.59-2.65)0.031.50 (0.59-2.65)0.0350.0011.50 (0.59-2.65)0.031.50 (0.59-2.65)0.031.50 (0.59-2.65)0.0311.55 (1.13-2.12)0.0210.0210.025 (0.50, 0.73, 0.0211.01 (0.69-1.59)0.0211.01 (0.69-1.59)0.0211.01 (0.69-1.59)0.0211.01 (0.69-1.59)0.0211.01 (0.69-1.59)0.0211.01 (0.69-1.59)0.0211.02 (0.59-1.510.0211.02 (0.59-1.510.0211.02 (0.59-1.510.021<	Religion	Hindu	31.84	5.982 (0.014)	Reference			
CastLower (SC and ST)37.64.23 (0.4)1.28 (1.1-1.6)0.0381.10.85-1.4)0.038Occupational status of the fatterLaborer37.83.23 (3.0.4)1.74 (1.38-2.10)0.0001.44 (1-2.08)0.014Cuptational status of the fatterIlliferate or just able to sign37.847.33 (1.38-2.16)0.0001.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.78 (1.31-2.08)0.0011.58 (1.31-2.08)0.0011.58 (1.31-2.08)0.0011.58 (1.31-2.08)0.0011.58 (1.31-2.08)0.0011.58 (1.31-2.08)0.0011.58 (1.31-2.08)0.0011.58 (1.31-2.08)0.0011.58 (1.31-2.08)0.0011.58 (1.31-2.08)0.0011.59 (1.31-2.08)0.0011.59 (1.31-2.08)0.0011.59 (1.31-2.08)0.0111.59 (1.31-2.08)0.0111.59 (1.31-2.08)0.0111.59 (1.31-2.08)0.0111.59 (1.31-2.08)0.0111.59 (1.31-2.08)0.0111.59 (1.31-2.08)0.0111.59 (1.31-2.08)0.0111.59 (1.31-2.08)0.0111.59 (1.51-2.08)0.0111.59 (1.		Muslim	38.64		1.35 (1.06–1.71)	0.014	1.3 (1.01–1.68)	0.043
OrderGénerSeriesReference1.4(1-2.08)0.011.4(1-2.08)0.01Cutivator2.031.7(1.38-2.18)0.001.4(1-2.08)0.010.010.01Cutivator2.037.3(1.31-2.28)0.001.17 (0.5-1.58)0.090.010.010.01Educational status of the fatherIlliterator just able to sig3.032.3(1.7-3.18)0.001.07 (0.5-1.58)0.010	Cast	Lower (SC and ST)	37.64	4.233 (0.04)	1.28 (1.1–1.62)	0.038	1.1 (0.85–1.4)	0.508
Occupational status of the faith CultivatorLaborer37.9532.318 (000)1.74 (138-2.18)0.0011.44 (1-2.08)0.001Educational status of the faitherBusiness/service6673.011.73 (13.8-2.10)0.0011.58 (1.19-2.37)0.001Educational status of the faitherIllerate or just able to sig0.042.33 (1.7-3.18)0.0011.79 (0.6-1.56)0.897Educational status of the faitherIllerate or just able to sig3.647.71 (1.23-2.28)0.0011.23 (0.83-1.84)0.302Occupational status of the motherHousewife2.040.956 (0.00)Reference1.71 (1.23-2.28)0.0011.55 (1.13-2.12)0.007Educational status of the motherHousewife2.040.950 (0.00)Reference1.71 (1.29-2.27)0.0001.55 (1.13-2.12)0.017Educational status of the motherIllerate or just able to sig3.022.056 (0.01)2.65 (1.77-3.90)0.001.62 (1.14-2.12)0.32Educational status of the motherIllerate or just able to sig3.333.336 (0.00)1.38 (0.88-2.01)1.11 (0.68-1.38)0.72Educational status of the motherReference1.33 (0.81-02)1.33 (0.88-2.01)1.11 (0.68-1.39)0.211.14 (0.67-2.13)0.72Educational status of the motherReference1.33 (0.80-2.11)1.24 (0.87-1.71)0.241.44 (0.72-2.13)0.72Educational status of the motherReference1.33 (0.82-0.11)1.34 (0.82-1.89)1.39 (0.92-1.30)0.81Educationa		Other	32		Reference			
Cultivator37.841.73 (1.38-2.16)0.001.68 (1.19-2.37)0.003Business/service26.05ReferenceReferenceNo1.17 (0.5-1.56)0.957Educational status of the fatherIlliterate or just able to sign36.41.73 (1.31-2.30)0.001.09 (0.5-1.56)0.957Occupational status of the motherAbove secondary36.41.71 (1.23-2.36)0.011.23 (0.83-1.84)0.302Above secondary20.74Apperence1.71 (1.29-2.27)0.0001.55 (1.13-2.12)0.017Educational status of the motherIlliterate or just able to sign39.024.329 (0.000)2.65 (1.77-3.96)0.0021.52 (1.14-2.12)0.021Educational status of the motherIlliterate or just able to sign39.024.329 (0.001)2.65 (1.77-3.96)0.0001.59 (0.50-2.65)0.001Educational status of the motherIlliterate or just able to sign39.024.329 (0.001)2.65 (1.77-3.96)0.0021.59 (0.50-2.65)0.012Educational status of the motherIlliterate or just able to sign39.024.329 (0.020)1.59 (0.39-1.02)0.0201.59 (0.14-2.12)0.020Economic statusSecondary37.413.336 (0.001)1.98 (1.48-2.64)0.0021.33 (0.88-2.01)0.11Economic statusFa. 200037.413.336 (0.001)1.29 (0.87-1.71)0.441.41 (0.97-2.13)0.02Family sizeSe. 200037.413.336 (0.001)1.29 (0.87-1.71)0.440.4020.31Ap	Occupational status of the father	Laborer	37.95	32.318 (0.000)	1.74 (1.38–2.18)	0.000	1.44 (1-2.08)	0.049
Business/service2605 40.48Reference1.7 (0.7 - 1.5)0.901.7 (0.7 - 1.5)0.90Educational status of the fatherIlliterate or just able to sign36.31.73 (1.3 - 2.2)0.001.02 (0.5 - 1.5)0.91Secondary36.41.73 (1.3 - 2.2)0.001.23 (0.3 - 1.4)0.920.92Occupational status of the motherHousewife47.4 20.956 (0.00)Reference0.920.90 (1.5 - 1.5)0.92Business/service32.084.32 9(0.00)6.65 (1.7 - 3.0)0.92 (1.4 - 2.1)0.920.92 (1.4 - 2.1)0.92Business/service32.084.32 9(0.00)6.56 (1.7 - 3.0)0.92 (1.4 - 2.1)0.920.92 (1.4 - 2.1)0.92Business/service32.084.32 9(0.00)5.65 (1.7 - 3.0)0.92 (1.6 - 1.4 - 2.1)0.920.92 (1.6 - 1.4 - 2.1)0.92Business/service32.084.32 9(0.00)5.65 (1.7 - 3.0)0.62 (1.1 - 2.1)0.930.930.93Business/service32.084.33 9(0.00)1.3 (0.8 - 0.0)1.52 (0.5 - 0.8)0.930.93Business/service33.61 (1.4 - 1.5)1.33 (0.8 - 0.0)1.33 (0.8 - 0.0)1.33 (0.8 - 0.0)1.33 (0.8 - 0.0)1.33 (0.8 - 0.0)1.33 (0.8 - 0.0)1.33 (0.8 - 0.0)1.44 (0.5 - 1.4)0.92Business/service32.8 (0.9)1.34 (0.1 - 1.6)1.33 (0.8 - 0.0)1.33 (0.8 - 0.0)1.33 (0.8 - 0.0)1.33 (0.8 - 0.0)1.44 (0.5 - 1.4)0.92Business/service32.8 (0.9) <td< td=""><td></td><td>Cultivator</td><td>37.84</td><td></td><td>1.73 (1.38–2.16)</td><td>0.000</td><td>1.68 (1.19–2.37)</td><td>0.003</td></td<>		Cultivator	37.84		1.73 (1.38–2.16)	0.000	1.68 (1.19–2.37)	0.003
Educational status of the faither Up to primaryM48 33.6329.464 (0.000) 2.33 (1.7-3.18)0.000 0.0011.71 (0.6-1.56) 0.9570.899Cocupational status of the mother Housewife33.641.73 (1.31-2.29)0.0001.23 (0.83-1.84)0.302Cocupational status of the mother Housewife47.4720.956 (0.000)Reference		Business/service	26.05		Reference			
Up to primary33.631.73 (1.31-2.29)0.0001.09 (0.65-1.5)0.957Secondary33.641.71 (1.23-2.36)0.0011.23 (0.83-1.84)0.302Above secondary20.74ReferenceReference1.71 (1.29-2.27)0.0001.55 (1.13-2.12)0.007Business/service32.080.54 (0.3-0.9)0.0250.84 (0.46-1.52)0.572Educational status of the motherIlliterate or just able to sign39.0241.329 (0.000)2.65 (1.77-3.96)0.0001.55 (1.13-2.12)0.032Educational status of the motherIlliterate or just able to sign39.0241.329 (0.000)2.65 (1.77-3.96)0.0001.59 (0.95-2.65)0.88Economic statusSecondary2.881.3 (0.83-2.03)0.251.11 (0.68-1.83)0.738Above secondary19.44ReferenceReference1.14 (0.67-1.13)0.711Rs. 2001-40002.6911.22 (0.87-1.71)0.2491.14 (0.67-1.13)0.716Rs. 2001-40002.6911.22 (0.87-1.71)0.2491.14 (0.67-2.13)0.71Rs. 2001-40002.511.35 (0.94-1.94)0.139 (0.95-2.03)0.891Atoma3.832.994 (0.224)1.24 (0.85-1.79)0.2611.44 (0.97-2.13)0.71Secondary3.8382.994 (0.224)1.74 (0.85-1.79)0.2611.44 (0.97-2.13)0.75Family size ≤ 4 3.2342.994 (0.224)1.74 (0.85-1.79)0.2611.44 (0.97-2.13)0.75Secondary3.8082.995 (0.000) </td <td>Educational status of the father</td> <td>Illiterate or just able to sign</td> <td>40.48</td> <td>29.464 (0.000)</td> <td>2.33 (1.7–3.18)</td> <td>0.000</td> <td>1.17 (0.6–1.56)</td> <td>0.899</td>	Educational status of the father	Illiterate or just able to sign	40.48	29.464 (0.000)	2.33 (1.7–3.18)	0.000	1.17 (0.6–1.56)	0.899
NormN		Up to primary	33.63		1.73 (1.31–2.29)	0.000	1.09 (0.65–1.5)	0.957
Above secondary20.74ReferenceOccupational status of the motherHousewife44.7420.956 (0.000)ReferenceLaborer/cultivator20.241.71 (1.29-2.27)0.0001.55 (1.13-2.12)0.007Business/service32.080.54 (0.3-09)0.0250.84 (0.46-1.52)0.572Educational status of the motherIlliterate or just able to sign39.0241.329 (0.00)2.65 (1.77-3.96)0.0001.59 (0.95-2.65)0.08Secondary23.881.3 (0.83-2.03)0.251.11 (0.68-1.83)0.738Above secondary19.44Reference1.11 (0.68-1.49)0.746Rs. 2001-400026.911.22 (0.87-1.71)0.2491.14 (0.63-1.49)0.746Rs. 2001-400023.21Reference1.33 (0.88-2.01)0.171Rs. 2001-400023.21Reference1.39 (0.95-2.65)0.08Family size ≤ 4 32.342.994 (0.224)1.24 (0.85-1.79)0.211.40 (0.97-2.13)0.07Secondary23.21Reference1.33 (0.94-1.94)0.1051.39 (0.95-2.03)0.089Type of house ≤ 4 32.342.994 (0.224)1.24 (0.85-1.79)0.211.40 (0.97-2.13)0.07Availability of latrineKutcha38.082.2156 (0.000)1.73 (1.38-2.18)0.0001.05 (0.78-1.41)0.765Availability of latrineYes31.052.123 (0.000Reference1.44 (1.14-1.83)0.0220.99 (0.75-1.33)0.973Availability of latrineYes		Secondary	33.64		1.71 (1.23–2.36)	0.001	1.23 (0.83–1.84)	0.302
Occupational status of the mother Housewife 44.74 20.956 (0.00) Reference Laborer/cultivator 20.24 1.71 (1.29-2.27) 0.00 1.55 (1.13-2.12) 0.07 Business/service 32.08 0.54 (0.3-0.9) 0.025 0.84 (0.46-1.52) 0.52 Educational status of the mother Illiterate or just able to sign 39.02 41.329 (0.000) 2.65 (1.77-3.96) 0.00 1.62 (1.14-2.12) 0.032 Educational status of the mother Illiterate or just able to sign 39.02 41.329 (0.000) 2.65 (1.77-3.96) 0.00 1.62 (1.14-2.12) 0.032 Educational status of the mother Illiterate or just able to sign 39.02 41.33 (0.83-2.03) 0.55 0.00 1.62 (1.14-2.12) 0.02 Secondary 19.44 33.33 (0.000) 1.98 (1.48-2.64) 0.000 1.33 (0.88-2.01) 0.71 Rs < 2000		Above secondary	20.74		Reference			
Laborer/cultivator20.24.1.71 (1.29-2.27)0.000.1.55 (1.13-2.12)0.007Business/service32.08.0.54 (0.3-09)0.025.0.84 (0.46-1.52)0.021Librate or just able to sign39.021.329 (0.00).2.55 (1.77-3.96)0.000.1.62 (1.14-2.12)0.032Libroterimary34.33.2.2 (1.49-3.27)0.000.1.59 (0.95-2.65)0.08Secondary19.44.2.2 (1.49-3.27)0.000.1.53 (0.88-2.01)0.71Above secondary19.44.3.3336 (0.00).1.98 (1.48-2.64)0.000.1.33 (0.88-2.01)0.71Res 200020.51.2.2 (0.87-1.71)0.249.1.44 (0.97-2.13)0.74Rs. > 400020.21.2.994 (0.224).1.24 (0.85-1.79)0.210.1.44 (0.97-2.13)0.74Family size<4	Occupational status of the mother	Housewife	44.74	20.956 (0.000)	Reference			
Business/service32.08 11/1 (breated rights able to sign32.08 14.329 (000)0.54 (0.3-0.9)0.0250.84 (0.46-1.52)0.021Educational status of the motive11/1 (breated rights able to sign39.024.1329 (000)2.65 (1.77-3.96)0.0001.62 (1.14-2.12)0.03012 (1.14-3.21)2.20 (1.49-3.27)0.0001.59 (0.95-2.65)0.080.0251.11 (0.68-1.83)0.732 (1.14-3.21)Above secondary19.44Agove secondary1.440.0001.33 (0.88-2.01)0.171Economic statusRs < 2000		Laborer/cultivator	20.24		1.71 (1.29–2.27)	0.000	1.55 (1.13–2.12)	0.007
Educational status of the motherIlliterate or just able to sign39.02 $41.329(0.000)$ $2.65(1.77-3.96)$ 0.000 $1.62(1.14-2.12)$ 0.032 Up to primary 34.73 $2.2(1.49-3.27)$ 0.000 $1.59(0.95-2.65)$ 0.08 Secondary 23.88 $1.3(0.83-2.03)$ 0.25 $1.11(0.68-1.83)$ 0.738 Above secondary 19.44 Reference $1.22(0.87-1.71)$ 0.249 $1.14(0.63-1.49)$ 0.716 Economic statusRs. ≤ 2000 2.54 2.324 Reference $1.22(0.87-1.71)$ 0.249 $1.14(0.63-1.49)$ 0.746 Rs. ≥ 000 2.32 Reference $1.35(0.94-1.94)$ 0.105 $1.39(0.95-2.03)$ 0.089 Family size ≤ 4 3.234 $2.994(0.224)$ $1.24(0.85-1.79)$ 0.261 $1.44(0.97-2.13)$ 0.07 $5-8$ 3.43 $1.35(0.94-1.94)$ 0.105 $1.39(0.95-2.03)$ 0.089 ≥ 9 2.788 Reference $1.44(0.97-2.13)$ 0.075 Type of houseKutcha 3.08 $2.956(0.000)$ $1.73(1.38-2.18)$ 0.000 $1.55(0.78-1.41)$ 0.765 Availability of latrineKutcha 3.08 $2.2123(0.000)$ Reference $1.44(0.97-2.13)$ 0.973 Availability of latrineYes 3.28 $2.2123(0.000)$ Reference $1.53(1.11-2.1)$ 0.171 Water sourceTube well 3.52 $8.682(0.03)$ $1.34(1.1-1.62)$ 0.003 $1.19(0.96-1.48)$ 0.105 SESLower 3.671 $3.118(0.$		Business/service	32.08		0.54 (0.3–0.9)	0.025	0.84 (0.46–1.52)	0.572
Up to primary Secondary 34.73 $2.2 (1.49-3.27)$ 0.000 $1.59 (0.95-2.65)$ 0.08 Secondary 23.88 $1.3 (0.83-2.03)$ 0.25 $1.11 (0.68-1.83)$ 0.738 Above secondary 19.44 Reference $1.22 (0.87-1.71)$ 0.249 $1.14 (0.63-1.49)$ 0.716 Rs. 2000 26.91 $1.22 (0.87-1.71)$ 0.249 $1.14 (0.63-1.49)$ 0.746 Rs. $2001-4000$ 26.91 $1.22 (0.87-1.71)$ 0.249 $1.14 (0.63-1.49)$ 0.746 Rs. 24000 23.2 Reference $1.24 (0.85-1.79)$ 0.261 $1.44 (0.97-2.13)$ 0.07 $5-8$ 34.3 $1.35 (0.94-1.94)$ 0.105 $1.39 (0.95-2.03)$ 0.089 29 27.88 Reference $1.35 (0.94-1.94)$ 0.105 $1.39 (0.95-2.03)$ 0.089 29 27.88 Reference $1.44 (1.14-1.83)$ 0.002 $0.99 (0.75-1.33)$ 0.973 29 27.88 Reference $1.44 (1.14-1.83)$ 0.002 $0.99 (0.75-1.33)$ 0.973 29 27.88 Reference $1.44 (1.14-1.83)$ 0.002 $0.99 (0.75-1.33)$ 0.973 20 $20.2123 (0.000)$ $1.73 (1.38-2.18)$ 0.000 $1.53 (1.11-2.1)$ 0.15 20 $22.123 (0.000)$ $1.24 (0.85-1.79)$ 0.031 $1.19 (0.96-1.48)$ 0.105 20 $22.123 (0.000)$ $1.24 (1.4-1.41)$ 0.000 $1.53 (1.11-2.1)$ 0.11 20 $1.99 (0.22)$ $22.123 (0.000)$ $1.24 (0.42-1.41)$ 0.003 1	Educational status of the mother	Illiterate or just able to sign	39.02	41.329 (0.000)	2.65 (1.77–3.96)	0.000	1.62 (1.14–2.12)	0.032
Secondary 23.88 1.3 (0.83-2.03) 0.25 1.11 (0.68-1.83) 0.738 Above secondary 19.44 Reference Reference 1.22 (0.87-1.71) 0.000 1.33 (0.88-2.01) 0.171 Rs. < 2000		Up to primary	34.73		2.2 (1.49–3.27)	0.000	1.59 (0.95–2.65)	0.08
Above secondary19.44ReferenceEconomic statusRs. ≤ 2000 37.4133.33 (0.000)1.98 (1.48–2.64)0.0001.33 (0.88–2.01)0.171Rs. 2001–400026.911.22 (0.87–1.71)0.2491.14 (0.63–1.49)0.746Rs. > 400023.2Reference1.35 (0.94–1.94)0.1051.39 (0.97–2.13)0.07S-a34.31.35 (0.94–1.94)0.1051.39 (0.95–2.03)0.089 ≥ 9 27.88Reference1.35 (0.94–1.94)0.1051.39 (0.95–2.03)0.089Type of houseKutcha38.082.956 (0.000)1.73 (1.38–2.18)0.0020.99 (0.75–1.33)0.973Availability of latrineYes31.052.123 (0.000Reference1.44 (1.14–1.83)0.0021.53 (1.11–2.1)0.11Water sourceNo1.552.123 (0.0011.34 (1.1–1.62)0.0031.53 (1.11–2.1)0.01Water sourceNo1.523.5288.682 (0.003)1.34 (1.1–1.62)0.0031.19 (0.96–1.48)0.01SESLower36.713.0118 (0.001)2.72 (1.76–4.22)0.0031.42 (0.98–2.02)0.048Honder29.111.93 (1.22–3.04)0.0551.42 (0.98–2.02)0.045Liper1459.911.93 (1.22–3.04)0.0551.17 (0.68–2.01)0.57		Secondary	23.88		1.3 (0.83–2.03)	0.25	1.11 (0.68–1.83)	0.738
Economic statusRs. ≤ 2000 37.4133.336 (0.000)1.98 (1.48–2.64)0.0001.33 (0.88–2.01)0.171Rs. 2001–400026.911.22 (0.87–1.71)0.2491.14 (0.63–1.49)0.746Rs. > 400023.2Reference1.24 (0.85–1.79)0.2611.44 (0.97–2.13)0.07Family size ≤ 4 32.342.994 (0.224)1.24 (0.85–1.79)0.2611.44 (0.97–2.13)0.07 ≥ 9 27.8834.31.35 (0.94–1.94)0.1051.39 (0.95–2.03)0.089 ≥ 9 27.88Reference1.24 (1.14–1.83)0.0020.99 (0.75–1.33)0.973 ≥ 9 27.881.44 (1.14–1.83)0.0020.99 (0.75–1.33)0.973 ≥ 9 26.19Reference1.44 (1.14–1.83)0.0020.99 (0.75–1.33)0.973 ~ 100 Pucca26.19Reference1.44 (1.14–1.83)0.0020.99 (0.75–1.33)0.973 ~ 100 Pucca26.19Reference1.86 (1.44–2.41)0.0001.53 (1.11–2.1)0.01 ~ 100 Vater sourceTube well35.288.682 (0.003)1.34 (1.1–1.62)0.0031.19 (0.96–1.48)0.105 ~ 255 Lower36.7130.118 (0.000)2.72 (1.76–4.22)0.0001.42 (0.98–2.02)0.048 ~ 100 Middle29.111.93 (1.22–3.04)0.0051.17 (0.68–2.01)0.575		Above secondary	19.44		Reference			
Rs. 2001-4000 26.91 $1.22 (0.87-1.71)$ 0.249 $1.14 (0.63-1.49)$ 0.746 Ramily size ≤ 4 32.34 $2.994 (0.224)$ $1.24 (0.85-1.79)$ 0.261 $1.44 (0.97-2.13)$ 0.07 ≤ -8 34.3 $1.35 (0.94-1.94)$ 0.105 $1.39 (0.95-2.03)$ 0.089 ≥ 9 27.88 Reference $1.44 (1.4-1.83)$ 0.002 $0.99 (0.75-1.33)$ 0.765 Type of houseKutcha 38.08 $2.956 (0.000)$ $1.73 (1.38-2.18)$ 0.002 $0.99 (0.75-1.33)$ 0.765 $Pucca$ 33.88 $2.956 (0.000)$ $1.44 (1.4-1.83)$ 0.002 $0.99 (0.75-1.33)$ 0.973 $Pucca$ 26.19 $Pucca$ 26.19 $Pucca$ $2123 (0.000)$ $Reference$ $1.9 (0.96-1.48)$ 0.01 Availability of latrineYes 31.55 $2.123 (0.003)$ $1.34 (1.1-6.2)$ 0.003 $1.53 (1.11-2.1)$ 0.11 Water sourceTube well 35.28 $8.682 (0.033)$ $1.34 (1.1-6.2)$ 0.003 $1.9 (0.96-1.48)$ 0.105 SESLower 36.71 $30.118 (0.000$ $2.72 (1.76-4.22)$ 0.000 $1.42 (0.98-2.02)$ 0.048 Middle 29.17 $1.93 (1.22-3.04)$ 0.005 $1.17 (0.68-2.01)$ 0.57	Economic status	Rs. ≤ 2000	37.41	33.336 (0.000)	1.98 (1.48–2.64)	0.000	1.33 (0.88–2.01)	0.171
Rs > 400023.2ReferenceFamily size≤ 432.342.994 (0.22)1.24 (0.85-1.79)0.2611.44 (0.97-2.13)0.075-834.3.135 (0.94-1.94)0.1051.39 (0.95-2.03)0.089≥ 927.88Reference1.23 (1.38-2.18)0.0021.05 (0.78-1.41)0.765Type of houseKutcha38.082.956 (0.000)1.73 (1.38-2.18)0.0020.99 (0.75-1.33)0.973Availability of latrineYes31.052.123 (0.00)ReferenceNo45.651.86 (1.44-2.41)0.0001.53 (1.11-2.1)0.01Vater sourceTube well35.288.682 (0.03)1.34 (1.1-1.62)0.031.19 (0.96-1.48)0.105SESLower36.7130.118 (0.000)2.72 (1.76-4.22)0.0001.42 (0.98-2.02)0.048Iuper1757Beference1.93 (1.22-3.04)0.0051.17 (0.68-2.01)0.575		Rs. 2001–4000	26.91		1.22 (0.87–1.71)	0.249	1.14 (0.63–1.49)	0.746
Family size ≤ 4 32.34 2.994 (0.224) 1.24 (0.85-1.79) 0.261 1.44 (0.97-2.13) 0.07 5-8 34.3 1.35 (0.94-1.94) 0.105 1.39 (0.95-2.03) 0.089 ≥ 9 27.88 Reference 1.73 (1.38-2.18) 0.000 1.05 (0.78-1.41) 0.765 Type of house Kutcha 38.08 22.956 (0.000) 1.73 (1.38-2.18) 0.000 1.05 (0.78-1.41) 0.765 Semi pucca 33.88 1.44 (1.14-1.83) 0.002 0.99 (0.75-1.33) 0.973 Availability of latrine Yes 31.05 22.123 (0.000) Reference 1.53 (1.11-2.1) 0.01 Water source Tube well 35.28 8.682 (0.033) 1.34 (1.1-1.62) 0.003 1.19 (0.96-1.48) 0.105 SES Lower 36.71 30.118 (0.000) 2.72 (1.76-4.22) 0.000 1.42 (0.98-2.02) 0.048 Middle 29.11 1.93 (1.22-3.04) 0.005 1.17 (0.68-2.01) 0.575		Rs. > 4000	23.2		Reference			
5-834.31.35 (0.94-1.94)0.1051.39 (0.95-2.03)0.089≥ 927.88Reference1.73 (1.38-2.18)0.0001.05 (0.78-1.41)0.765Type of houseKutcha38.0822.956 (0.000)1.73 (1.38-2.18)0.0020.99 (0.75-1.33)0.973Pucca26.19Reference1.44 (1.14-1.83)0.0020.99 (0.75-1.33)0.973Pucca26.19Reference1.86 (1.44-2.41)0.0001.53 (1.11-2.1)0.01Water sourceTube well35.288.682 (0.003)1.34 (1.1-1.62)0.0031.19 (0.96-1.48)0.105Deep tube well28.97Reference1.86 (1.44-2.41)0.0001.42 (0.98-2.02)0.048SESLower36.7130.118 (0.000)2.72 (1.76-4.22)0.0001.42 (0.98-2.02)0.048Middle29.111.93 (1.22-3.04)0.0051.17 (0.68-2.01)0.575	Family size	< 4	32.34	2.994 (0.224)	1.24 (0.85–1.79)	0.261	1.44 (0.97–2.13)	0.07
≥ 9 27.88 Reference Type of house Kutcha 38.08 22.956 (0.000) 1.73 (1.38–2.18) 0.000 1.05 (0.78–1.41) 0.765 Semi pucca 33.88 1.44 (1.14–1.83) 0.002 0.99 (0.75–1.33) 0.973 Pucca 26.19 Reference 1.44 (1.14–1.83) 0.000 1.53 (1.11–2.1) 0.01 Availability of latrine Yes 31.05 22.123 (0.000) Reference 1.86 (1.44–2.41) 0.000 1.53 (1.11–2.1) 0.01 Water source Tube well 35.28 8.682 (0.003) 1.34 (1.1–1.62) 0.003 1.19 (0.96–1.48) 0.105 SES Lower 36.71 30.118 (0.000) 2.72 (1.76–4.22) 0.000 1.42 (0.98–2.02) 0.048 Middle 29.11 1.93 (1.22–3.04) 0.005 1.17 (0.68–2.01) 0.575	,	5–8	34.3		1.35 (0.94–1.94)	0.105	1.39 (0.95–2.03)	0.089
Type of house Kutcha 38.08 22.956 (0.000) 1.73 (1.38–2.18) 0.000 1.05 (0.78–1.41) 0.765 Semi pucca 33.88 1.44 (1.14–1.83) 0.002 0.99 (0.75–1.33) 0.973 Pucca 26.19 Reference 1.44 (1.14–1.83) 0.002 0.99 (0.75–1.33) 0.973 Availability of latrine Yes 31.05 22.123 (0.000) Reference 1.86 (1.44–2.41) 0.000 1.53 (1.11–2.1) 0.01 Water source Tube well 35.28 8.682 (0.003) 1.34 (1.1–1.62) 0.003 1.19 (0.96–1.48) 0.105 SES Lower 36.71 30.118 (0.000) 2.72 (1.76–4.22) 0.000 1.42 (0.98–2.02) 0.048 Middle 29.11 1.93 (1.22–3.04) 0.005 1.17 (0.68–2.01) 0.575		≥ 9	27.88		Reference			
Semi pucca 33.88 1.44 (1.14–1.83) 0.002 0.99 (0.75–1.33) 0.973 Pucca 26.19 Reference Reference 1.44 (1.14–1.83) 0.002 0.99 (0.75–1.33) 0.973 Availability of latrine Yes 31.05 22.123 (0.000) Reference 1.86 (1.44–2.41) 0.000 1.53 (1.11–2.1) 0.01 Water source Tube well 35.28 8.682 (0.003) 1.34 (1.1–1.62) 0.003 1.19 (0.96–1.48) 0.105 Deep tube well 28.97 Reference 1.42 (0.98–2.02) 0.048 SES Lower 36.71 30.118 (0.000) 2.72 (1.76–4.22) 0.000 1.42 (0.98–2.02) 0.048 Middle 29.11 1.93 (1.22–3.04) 0.005 1.17 (0.68–2.01) 0.575	Type of house	Kutcha	38.08	22.956 (0.000)	1.73 (1.38–2.18)	0.000	1.05 (0.78–1.41)	0.765
Pucca 26.19 Reference Availability of latrine Yes 31.05 22.123 (0.000) Reference No 45.65 1.86 (1.44–2.41) 0.000 1.53 (1.11–2.1) 0.01 Water source Tube well 35.28 8.682 (0.003) 1.34 (1.1–1.62) 0.003 1.19 (0.96–1.48) 0.105 SES Lower 36.71 30.118 (0.000) 2.72 (1.76–4.22) 0.000 1.42 (0.98–2.02) 0.048 Middle 29.11 1.93 (1.22–3.04) 0.005 1.17 (0.68–2.01) 0.575		Semi pucca	33.88		1.44 (1.14–1.83)	0.002	0.99 (0.75–1.33)	0.973
Availability of latrine Yes 31.05 22.123 (0.000) Reference No 45.65 1.86 (1.44–2.41) 0.000 1.53 (1.11–2.1) 0.01 Water source Tube well 35.28 8.682 (0.03) 1.34 (1.1–1.62) 0.003 1.19 (0.96–1.48) 0.105 Deep tube well 28.97 Reference 1.25 (1.12–2.1) 0.04 0.045 0.048 SES Lower 36.71 30.118 (0.000) 2.72 (1.76–4.22) 0.000 1.42 (0.98–2.02) 0.048 Middle 29.11 1.93 (1.22–3.04) 0.005 1.17 (0.68–2.01) 0.575		Pucca	26.19		Reference			
No 45.65 1.86 (1.44–2.41) 0.000 1.53 (1.11–2.1) 0.01 Water source Tube well 35.28 8.682 (0.003) 1.34 (1.1–1.62) 0.003 1.19 (0.96–1.48) 0.105 Deep tube well 28.97 Reference 555 Lower 36.71 30.118 (0.000) 2.72 (1.76–4.22) 0.000 1.42 (0.98–2.02) 0.048 Middle 29.11 1.93 (1.22–3.04) 0.005 1.17 (0.68–2.01) 0.575	Availability of latrine	Yes	31.05	22.123 (0.000)	Reference			
Water source Tube well 35.28 8.682 (0.003) 1.34 (1.1–1.62) 0.003 1.19 (0.96–1.48) 0.105 Deep tube well 28.97 Reference 1.42 (0.98–2.02) 0.048 SES Lower 36.71 30.118 (0.000) 2.72 (1.76–4.22) 0.005 1.42 (0.98–2.02) 0.048 Middle 29.11 1.93 (1.22–3.04) 0.005 1.17 (0.68–2.01) 0.575	, ,	No	45.65		1.86 (1.44–2.41)	0.000	1.53 (1.11–2.1)	0.01
Deep tube well 28.97 Reference SES Lower 36.71 30.118 (0.000) 2.72 (1.76-4.22) 0.000 1.42 (0.98-2.02) 0.048 Middle 29.11 1.93 (1.22-3.04) 0.005 1.17 (0.68-2.01) 0.575 Lipper 17.57 Reference Reference 1.17 (0.68-2.01) 0.575	Water source	Tube well	35.28	8.682 (0.003)	1.34 (1.1–1.62)	0.003	1.19 (0.96–1.48)	0.105
SES Lower 36.71 30.118 (0.000) 2.72 (1.76-4.22) 0.000 1.42 (0.98-2.02) 0.048 Middle 29.11 1.93 (1.22-3.04) 0.005 1.17 (0.68-2.01) 0.575 Lipper 17.57 Beference Beference 0.005 1.17 (0.68-2.01) 0.575		Deep tube well	28.97		Reference			
Middle 29.11 1.93 (1.22–3.04) 0.005 1.17 (0.68–2.01) 0.575 Upper 17.57 Reference	SES	Lower	36.71	30.118 (0.000)	2.72 (1.76–4.22)	0.000	1.42 (0.98–2.02)	0.048
Unner 1757 Reference		Middle	29.11	(1.93 (1.22–3.04)	0.005	1.17 (0.68–2.01)	0.575
		Upper	17.57		Reference			

Table 5 Factors associated with thinness among children aged 5–10 years

Variables		Thinn	ess				
		%	χ^2 (p value)	COR (95% CI)	<i>p</i> value	AOR (95% CI)	p value
Sex	Male	27.72	0.672 (0.412)	1.08 (0.89–1.32)	0.413	1.1 (0.9–1.36)	0.346
	Female	26.12		Reference			
Age	5	37.13	43.472 (0.000)	Reference			
	6	31.79		0.78 (0.56–1.09)	0.157	0.8 (0.56–1.13)	0.207
	7	21.47		0.42 (0.3–0.6)	0.000	0.52 (0.36–0.75)	0.000
	8	21.88		0.47 (0.34–0.65)	0.000	0.61 (0.43–0.87)	0.006
	9	20.06		0.46 (0.33–0.65)	0.000	0.57 (0.4–0.81)	0.002
	10	31.62		0.79 (0.57–1.08)	0.144	0.86 (0.62-1.2)	0.382
Residence	Rural	27.92	4.883 (0.027)	1.34 (1.03–1.74)	0.03	1.22 (0.93–1.61)	0.156
	Urban	22.45		Reference			
Religion	Hindu	26.02	3.966 (0.046)	Reference			
-	Muslim	31.25		1.29 (1.01–1.66)	0.044	1.17 (0.9–1.54)	0.247
Cast	Lower (SC and ST)	29.12	1.085 (0.298)	1.14 (0.89–1.47)	0.295	0.96 (0.73–1.26)	0.777
	Other	26.44		Reference			
Occupational status of the father	Laborer	35.21	77.474 (0.000)	2.66 (2.08–3.41)	0.000	2.64 (1.74–3.98)	0.000
	Cultivator	32.75		2.39 (1.87-3.05)	0.000	2.41 (1.64–3.56)	0.000
	Business/service	16.94		Reference		(
Educational status of the father	Illiterate or just able to sign	37.59	45.649 (0.000)	3.08 (2.19-4.33)	0.000	1.19 (0.6–1.64)	0.968
	Up to primary	26.5	. ,	1.84 (1.35–2.52)	0.000	1.09 (0.57–1.41)	0.629
	Secondary	26.04		1.84 (1.28–2.62)	0.001	1.22 (0.78-1.89)	0.381
	Above secondary	15.48		Reference			
Occupational status of the mother	Housewife	44.3	37.73 (0.000)	Reference			
· · · · · · · · · · · · · · · · · · ·	Laborer/cultivator	19.05	()	2.38 (1.79–3.16)	0.000	1.62 (1.18–2.22)	0.003
	Business/service	25.03		0.7 (0.4–1.23)	0.217	1.33 (0.71–2.48)	0.377
Educational status of the mother	Illiterate or just able to sign	34.1	52,246 (0.000)	3.36 (2.12–5.32)	0.000	1.7 (0.98-3.06)	0.044
	Up to primary	27.88	(((())))))))))))))	2.51 (1.59–3.95)	0.000	1.92 (1.07-3.44)	0.029
	Secondary	17.61		1.39 (0.83–2.32)	0.209	1.29 (0.73-2.28)	0.389
	Above secondary	13 33		Reference			
Economic status	$R_{\rm S} < 2000$	31.06	35 992 (0 000)	2 31 (1 67-3 19)	0.000	1 27 (0 8–2)	0 304
	Rs 2001-4000	22.1	551572 (01000)	1 45 (0 99–2 11)	0.051	0.97 (0.62–1.51)	0.878
	$R_{s} > 4000$	16 34		Reference	0.001	0.57 (0.02 1.51)	0.07.0
Family size	< 4	24.07	5 843 (0 054)	0.75 (0.52–1.09)	0.128	0.91 (0.61–1.35)	0.626
	 58	28.69	5.015 (0.051)	0.95 (0.66–1.36)	0.791	1.04 (0.71–1.53)	0.83
	> 9	20.05		Reference	0.7 9 1	1.01 (0.71 1.55)	0.05
Type of house	<u> </u>	30.09	30.617 (0.000)	1.82 (1.42-2.34)	0.000	1 (0 72–1 39)	0.996
Type of house	Semi pucca	30.02	50.017 (0.000)	1.82 (1.42 2.34)	0.000	1(0.72 + 1.55) 1.11(0.81 - 1.51)	0.520
	Purca	1911		Reference	0.000	1.11 (0.01 1.51)	0.522
Availability of latrine	Yes	24.58	34 319 (0 000)	Reference			
	No	12 03	51.515 (0.000)	2 22 (1 71_2 80)	0.000	1 58 (1 13_2 10)	0.007
Water source	Tube well	72.05	0.607 (0.436)	1.08 (0.89_1.33)	0.000	1.07 (0.77_1.22)	0.007
	Deen tube well	27.40	0.007 (0.400)	Reference	0.737	1.07 (0.77-1.22)	0.02
SES		2J.7 31 /0	16 700 (0 000)	3 70 (2 23_6 45)	0.000	1.68 (1.12_2.30)	0.006
JLJ	Middle	21.47 21.47	10.7 22 (0.000)	2.7 2 (2.23-0. 4 3)	0.000	1.00 (1.12-2.39)	0.500
	Uppor	∠1. 44 10.01		2.23 (1.29-3.91)	0.004	1.2 (0.04-2.27)	0.571
	ohhei	10.81		neieieiice			

undernutrition in this study. In comparison with children whose mothers worked in other career groups, we discovered that children whose mothers worked in professional jobs had superior nutritional results. When compared to children of better-educated mothers, children of illiterate or less educated mothers were more likely to be undernourished. The recent study also discovered that children whose mothers worked in agriculture had a higher risk of malnutrition. Women working in the agricultural sector in India have lower educational levels and come from impoverished families. Higher educational and occupational status may have an indirect impact on a child's nutritional health by influencing the family's living conditions, child care, knowledge of child-rearing techniques, diet quality, and physical surroundings [13]. Other studies in India [10], Ethiopia [13], Brazil [12], Egypt [15], and Bangladesh [17] found that children from uneducated parents were more likely to be undernourished than children from educated parents. It is claimed that women in professional jobs with higher educational levels are more aware of personal hygiene, have greater access to household resources, and have the ability to make independent decisions that improve children's nutritional status as a result of their exposure to the outside world [10]. Mesfin et al. found that children born to working mothers had a higher risk of malnutrition than children born to housewives [16]. Undernutrition was more common in children from rural regions than in children from urban areas. This was in line with previous research [13, 24]. The disparity could be related to a lack of health knowledge, medical service accessibility, and dietary awareness among rural women. In addition, there are significant disparities in India's healthcare system between rural and urban areas. Children from lower-income families were more likely to be undernourished. According to Tigga et al., the prevalence of child undernutrition was higher in poor families [26]. Lower socio-economic status is linked to poor economic position and low family literacy, which leads to lower purchasing power and food insecurity, all of which contribute to greater rates of undernutrition [28].

In comparison with joint families, children raised in nuclear homes were more likely to be undernourished. In a prior research of teenagers in West Bengal, it was discovered that children raised in nuclear homes were more likely to be undernourished than those raised in united families [10]. Similar findings were also reported by Sapkota and Gurung [29].

Children who drank untreated water had a higher prevalence of undernutrition. Similarly, several studies have found that those who do not have access to clean water are more likely to contract infections and develop chronic diseases, which increases the risk of malnutrition [3, 14, 17]. In this study, inadequate sanitation was found to be a risk factor for child malnutrition. Poor sanitation can have a negative impact on one's health and nutrition, as well as promote the spread of chronic diseases [30]. Unsanitary conditions and practices, such as unsanitary latrines, excrement on premises, open drainage surrounding or near the house, and drinking unprotected water, can raise the risk of infectious disease, which can lead to malnutrition. The current study did not look at the prevalence of parasite infestations, diarrhea episodes, or other chronic disorders. Our research location is known to be a cholera- and malaria-endemic area, and other particular illnesses, such as chronic parasite infestations linked to malnutrition, were common [31]. Because of the filthy surroundings, it was likely that the rural population was more susceptible to infections. Rural folks wash their dishes and clothes in contaminated pond water, making them more prone to parasitic and chronic diseases, potentially leading to a higher frequency of malnutrition [8, 10, 32].

Conclusions

Stunting, underweight, and thinness among children in this community are still a serious public health concern, according to the findings of this study. Multiple risk factors for child malnutrition were discovered in the current investigation. Undernutrition was caused by illiteracy, untreated drinking water, and poor sanitation, all of which were independent risk factors. Stunting was linked to advanced age, poor economy, a nuclear family, drinking untreated water, maternal occupation, and poorer socio-economic level. Male gender, advanced age, rural habitation, mother illiteracy, parental occupation, and toilet availability were all linked to being underweight. Thinness was associated with mother illiteracy, parental profession, poorer socio-economic level, and the availability of a latrine. As a result, access to clean and sufficient drinking water, as well as sanitation and hygiene standards, should be taken into account.

Study limitations

This study has some drawbacks, despite its efficient sampling design, huge sample size, and robust analysis. Different predictors affecting child nutrition were investigated in this study, but some important confounding variables such as physical activity, parasitic infection, child's history of illness, daily intake, and household food insecurity were overlooked. The use of cross-sectional data has drawbacks, as the cross-sectional nature of the study design makes it impossible to establish proper causal links between predictors and outcome variables. A cohort research, rather than a cross-sectional study, is more appropriate for understanding the potential temporal connection of predictors and child undernutrition. Monthly income and socio-demographic characteristics may be subject to desirability bias. As a result, the relationship between the predictors and the outcome variables may be overestimated. However, by paying attention to the parent's occupation, we can lessen this likely prejudice. In addition, we only employed anthropometric indices to assess undernutrition, with no biochemical measures included.

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Authors' contributions

Conceived and designed the experiments: Amitava Pal and Prakash C. Dhara. Analyzed the data: Amitava Pal, Sourav Manna, Rishna Dalui, and Rupanjan Mukhopadhyay. Wrote the paper: Amitava Pal. Carried out the literature review: Amitava Pal, Sourav Manna, Rishna Dalui, and Rupanjan Mukhopadhyay. Reviewed and approved the final version of the manuscript: Amitava Pal, Sourav Manna, Rishna Dalui, Rupanjan Mukhopadhyay, and Prakash C. Dhara. The author(s) read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The Vidyasagar University Ethics Review Committee provided ethical approval and permission prior to the start of this investigation (Ethical No.: VU/R/ Ethical/3-(ii)/2012; dated: 22 March 2012). During visits to the homes of those who agreed to participate in the study, written informed consent was collected from the guardians (left thumb impression for illiterate guardians in the presence of two literate witnesses). This study was performed in accordance with the ethical standards of the committee and with the Helsinki Declaration.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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