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Influence of Household Food Insecurity on Nutritional Status of Scheduled Castes Children in Rural Areas of Barabanki District, Uttar Pradesh, India

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Abstract

This study investigates the influence of household food insecurity on nutritional status of Scheduled Castes (SC) children in the rural area of Barabanki district, Uttar Pradesh by analysing the relationship between Household Food Insecurity Access Scale (HFIAS) and the nutritional status of children based the survey of 585 children from 300 SC households in the rural areas of Barabanki district of Uttar, India. The study finds a statistically significant association between child nutrition and household food insecurity.

Background

Food is essential for every individual. Household food security influences health and wellbeing of household members. The concept of food security includes availability, accessibility, fair use, and utilisation by household members throughout the year. Any dysfunction in the household food security system can lead to hunger and malnutrition - under or over nutrition (Behrman et al, 2004; Weingärtner, 2009) Household food insecurity and poverty are primary factors of poor nutritional status (Babatunde and Qaim, 2010). However, household food security cannot always yield a guarantee of good nutritional status and sometimes it shows plodding progress (Pheley et al, 2002; Stuff et al, 2004; Castetbon et al, 2009; Hossain et al, 2016). The household food insecurity is highly influential in deciding the nutritional status of women and children as a balanced diet, access to health care services and physical activities are the leading contributing factors of a healthy life (Kennedy et al, 2004; Badiane et al, 2018; Casey et al, 2005; Rose and Bodor, 2006; Spring, 2020; Tarasuk, 2001; Hyder et al, 2005).

The quality and quantity of food consumed depends on the availability, accessibility, and affordability of food (Gwatkin et al, 2005; Friesen, 2018). Existing

evidence reveals that household food insecurity, poverty, and nutritional status are mutually and closely associated (Ramachandran, 2007; Antony and Laxmaiah, 2008). Factors that contribute to insufficient food intake include irregular public distribution system, social status, individual behaviour, cultural barriers, poverty, low mobility. Individuals having insufficient food intake are more likely to be under nourished than individuals having sufficient food intake in terms of quantity and quality (Varadharajan et al, 2013; Kumar and Kalita, 2017). Food insecurity remains a key issue because of its implications for individual health (Johnson et al, 2018). Food insecurity contributes to poor nutritional status which, in turn, affects individual work capacity leading to substantial loss in productivity (Upadhyay and Palanivel, 2011). It is well-known that the nutritional status of the population is the most important factor in public health and well-being (Sachs, 2012).

In India, the nutritional status of an individual is seriously influenced by her or his social class. The Scheduled Castes and Scheduled Tribes, as identified in the Indian Constitution, are the most deprived sub-groups of the population. National Family Health Survey 2015-16 (NFHS-4) shows that the nutritional status of Scheduled Castes children in the rural areas of the country is very poor (Government of India, 2017). More than half of the Scheduled Castes children are under nourished, and this proportion is higher than children of Other Castes (Jungari and Chauhan, 2017; Gupta and Coffey, 2020; Government of India, 2017).

The present paper analyses the influence of household food insecurity on the nutritional status of Scheduled Castes children in the rural areas of district Barabanki of Uttar Pradesh, India. It is based on primary data collected from 300 Scheduled Castes households. The NFHS-4 suggests that more than 51 per cent of children below 5 years of age in district Barabanki are stunted while more than 40 per cent are underweight. Because of very high prevalence of stunting, the proportion of children who are wasted is only around 12 per cent (Government of India, 2019). There is, however, no knowledge about the prevalence of child under nutrition in the rural areas of the district and that too in Scheduled Castes children. This paper explores the influence of household food insecurity on the nutritional status of Scheduled Castes children in the rural areas of the district.

Methods

The paper is based on the data available through a field study carried out in the rural areas of district Barabanki of Uttar Pradesh, India. A multi-stage sampling design was adopted to select the sample for the study. At the first stage, sub-districts were selected; at the second stage, villages were selected, and, at the last stage, households were selected using the systematic sampling procedure. The sample size of the study was 300 Scheduled Castes households in which 585 children below 15 years of age were identified. Height and weight of these children were measured following the standard measurement protocol. Based on the height and weight the nutritional

status of the child was decided in terms of weight-for-age, height-for-age, and weight-for-height. In addition, child thinness was also calculated (World Health Organization, 2006; 2009) On the other hand, household food security was measured using the Household Food Insecurity Access Scale (HFIAS) (Coates et al, 2007).

Bivariate and multivariate techniques have been used to analyse the collected data. SPSS 20 and Stata 12 software packages were used for the analysis. The bivariate analysis is confined to the cross tabulation of the collected data by selected individual and household characteristics of the children while bivariate logistic regression analysis has been carried out to measure the influence of household food insecurity on the nutritional status of children. The bivariate logistic regression analysis leads to a logit model that derives the relative likelihood of the occurrence of the event of interest (Retherford and Choe, 2011). The dependent variable used in the study is a dichotomous variable having value 1 if the child was under nourished and value 0 if the child was not under nourished. The nutritional status was measured in terms of height-for-age (stunting), weight-for-height (wasting), and weight-for-age (underweight). The child was classified as under nourished if the z-score with respect to either height-for-age or weight-for-height or weight-for-age was less than -2 (World Health Organization, 2006; 2009). The independent variables used in the regression analysis include place of residence, type of house, household food insecurity, caste, living status of the household as revealed through the ration card, agriculture land size, livestock, age, and education of the mother of the child, gender of the child, and child education.

Results

Figure 1 depicts the distribution of the households surveyed by the food security status. Only 22 per cent households were found to be food secure households in the study population whereas almost a similar proportion was found to be severely food insecure. Moreover, around 26 per cent households were mildly food insecure while around 30 per cent households were moderately food insecure.

Table 1 shows variation in the household food security status by background characteristics of the households. The proportion of food insecure households is found to be the highest in that area where the proportion of Scheduled Castes (SC) households was high. Among different subcastes, household food insecurity has been found to be high in *Chamar* compared to *Pasi* and *Kori* communities. Similarly, household food insecurity has been found to be high in households below the poverty line as reflected through the ration card that the household had. More generally, the proportion of food insecure household has been found to decrease with the improvement in the standard of living of the household as reflected through the household wealth index - the higher the household wealth index the lower the proportion of food insecure households. Scheduled Castes constitute the deprived population group in the Indian society which is strongly stratified on the caste basis. Table 1 suggests that within this group there is wide variation in the household food security status.

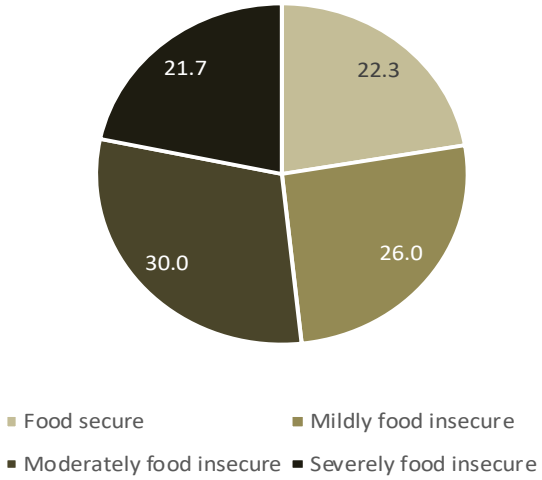

Figure 1: Distribution of households surveyed by food security status
Source: Authors

Table 1: Relationship in household's food security and selected household's covariates.

Background Characteristics	Household food security status				N
	Secure	Mildly insecure	Moderately insecure	Severely insecure	
Residence area (SC%)					
Low SC area	24.0	26.0	31.0	19.0	100
Medium SC area	23.0	28.0	28.0	21.0	100
High SC area	20.0	24.0	31.0	25.0	100
Type of house					
Kachha	(16.7)	(37.7)	(20.8)	(25.0)	24
Semi-*Pucca*	23.4	24.1	31.4	21.1	261
Pucca	(13.3)	(40.0)	(20.0)	(26.7)	15
Caste					
Pasi	17.6	28.2	29.4	24.7	85
Chamar	24.9	23.8	31.2	20.1	189
Kori	(19.2)	(34.6)	(23.1)	(23.1)	26
Type of Ration Card					
Above Poverty Line	32.8	36.2	13.8	17.2	116
Below Poverty Line	15.8	19.6	40.2	24.5	184
Wealth index					
Low	17.0	29.0	29.0	25.0	100
Medium	22.0	33.0	24.0	21.0	100
High	28.0	25.0	20.0	17.0	100

Background Characteristics	Household food security status				N
	Secure	Mildly insecure	Moderately insecure	Severely insecure	
Landholding size					
Below 0.5 Acre	(9.1)	(9.1)	(40.9)	(40.9)	18
0.5 - 1.0 Acre	23.0	24.8	30.0	22.2	220
More than 1.0 Acre	25.0	39.6	25.0	10.4	48
Irrigation facility					
Full irrigation	22.7	24.3	30.8	22.3	247
Partial irrigation	25.6	30.8	23.1	20.5	39
No irrigation	(7.1)	(35.7)	(42.9)	(14.3)	14
Type of crop produced					
Rice	23.2	26.1	29.6	21.1	280
Wheat	(10.0)	(25.0)	(35.0)	(30.0)	20
Livestock					
Yes	52.0	22.6	32.1	20.2	216
No	21.3	27.3	29.2	22.2	84
Number of Cow/buffalos					
No cow	23.7	22.3	33.1	20.9	139
1-2	19.1	31.3	26.7	22.9	131
3 and above	30.0	20.0	30.0	20.0	30
Number of Goats					
No goat	22.9	25.3	29.5	22.3	166
1-3	14.8	31.5	27.8	25.9	54
4-5	26.4	24.5	35.8	13.2	53
6 and above	(29.9)	(22.2)	(25.9)	(25.9)	27
Total	22.3	26.0	30.0	21.7	300

Remarks: Figures in brackets are based on less than 30 observations.
Source: Authors' calculations.

The prevalence of under nutrition in children of the surveyed population has been found to be quite high. The prevalence of stunting was 50.3 per cent; the prevalence of wasting was 22.6 per cent while the prevalence of underweight was 65.8 per cent (Figure 2). One reason for relatively low prevalence of wasting may be very high prevalence of stunting in children. Figure 2 also shows that the prevalence of child under nutrition in the surveyed households is higher in boys compared to girls in all dimensions of child nutrition: height-for-age (stunting), weight-for-height (wasting), weight-for-age (underweight) and thinness.

Table 2 shows that the prevalence of child under nutrition by household-, mother-, and child-specific factors. The prevalence of stunting and wasting is higher in boys than girls but the prevalence of wasting and thinness is higher in girls relative to boys. The prevalence of stunting is higher in children below 6 years of age but the prevalence of underweight and thinness is higher in children more than 6 years of age. There appears no specific association between child nutrition and school enrolment.

The prevalence of stunting has been found to be higher in children living in high SC residential area, although the prevalence of underweight was the highest in medium SC area whereas the prevalence of thinness was the highest in low SC residential area. The prevalence of stunting, wasting and thinness was low in children living in *Pucca* houses compared to *Kachha* and Semi-*Pucca* houses. Among different communities, child under nutrition is relatively high in *Kori* community compared to *Chamar* and *Pasi* communities. The prevalence of child under nutrition is the highest among the households having the lowest household wealth index but the lowest in households with the highest household wealth index. Similarly, the size of the land possessed by the household is found to be associated with the nutritional status of children. Household food security status plays a key role in shaping children's health (Mahadevan and Hoang, 2016). The prevalence of child stunting is found to be low in food secure households compared to food insecure households. The same pattern may be seen in case of the prevalence of child underweight. However, the prevalence of wasting and the prevalence of thinness is found to be low in food insecure households as compared to food secure households. Table 2 also reveals that mother-specific factors such as age of the mother and her educational status have been found to be key influencing factors as regards the for nutritional status of children.

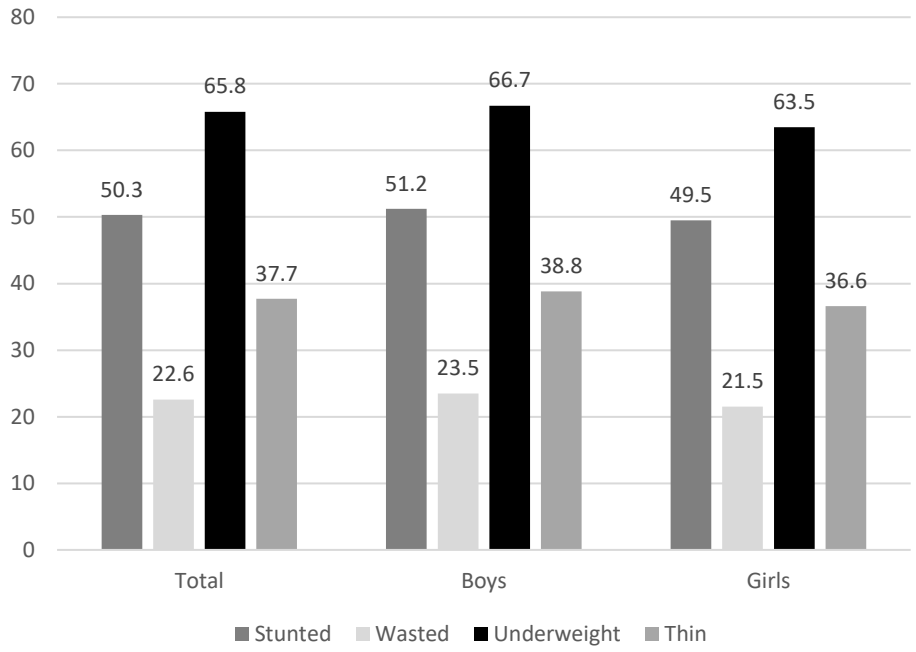

Figure 2: Prevalence of nutritional status in children (per cent).
Source: Authors.

Table 2: Nutritional status of children under 14 years' children by selected background characteristics.

Background characteristics	Stunted	Wasted	Underweight	Thin
Children Level Factors				
Age group (in years)				
Under 6 years	56.0	26.4	62.2	30.7
6-8	52.9	22.9	70.0	70.0
9-10	42.9	26.7	68.2	32.4
11-12	46.2	16.5	NA	0.0
13-14	44.6	10.7	NA	0.0
Sex				
Girl	51.2	23.5	63.5	38.8
Boy	49.5	21.5	67.8	36.6
Level of education				
Never enrolled	54.0	24.5	64.3	52.9
1st Standard	59.0	12.9	68.6	59.7
2nd Standard	52.3	22.7	67.9	43.2
3rd Standard	40.4	27.7	74.1	42.6
4th Standard	47.7	25.0	60.0	22.7
5th Standard	40.0	23.6	63.6	12.7
6th & above	41.0	13.1	57.0	06.6
Household Level Factors				
Agriculture land				
Below 0.5 Acre	36.4	13.6	71.4	50.0
0.5 - 1.0 Acre	51.7	24.4	65.3	36.9
More than 1.0 Acre	48.4	22.2	66.3	38.1
Household food security scale				
Food secure	46.3	31.3	60.7	41.5
Mildly food insecure access	52.6	18.1	63.7	37.7
Moderately food insecure access	48.6	22.7	64.6	36.7
Severely food insecure access	55.4	24.6	71.4	38.5
Livestock				
Yes	46.4	21.0	81.4	35.7
No	50.9	32.1	63.8	38.1
Number of cow/buffalos				
No cow	56.7	25.7	69.4	38.4
1-2	49.8	20.4	57.9	36.4
3 and above	50.0	23.3	42.9	47.8
Number of goats				
No goat	50.2	23.3	61.8	39.2
1-3	47.2	23.9	67.6	33.6
4-5	52.1	20.0	52.8	40.4
6 and above	59.3	22.2	71.4	35.0

Background characteristics	Stunted	Wasted	Underweight	Thin
Residence area				
Low SC area	48.3	20.2	62.8	40.4
Medium SC area	51.9	23.5	71.5	39.6
High SC area	50.8	23.9	63.2	33.7
Type of house				
Kachha	45.8	20.8	88.9	27.3
Semi-*Pucca*	49.8	22.7	64.9	38.8
Pucca	37.3	20.0	83.3	23.1
Caste				
Pasi	48.8	23.3	68.1	36.2
Chamar	50.4	21.7	63.4	36.8
Kori	57.4	30.8	83.3	59.1
Type of ration card				
Above poverty line	49.7	23.4	64.2	37.7
Below poverty line	51.2	21.1	66.7	37.8
Wealth status				
Poor	51.4	23.4	67.7	42.0
Medium	54.0	24.2	70.9	32.1
Rich	56.8	21.4	60.8	35.0
Mother Level Factors				
Mother's age (years)				
15-24	51.1	21.1	62.5	37.6
25-34	49.4	21.1	65.1	34.5
35-44	48.9	25.3	67.8	41.5
45-49	63.0	25.9	73.7	45.0
Mother's education				
No education	50.5	23.3	64.9	37.8
1-5 years	51.7	24.1	76.5	37.5
6-8 years	52.3	17.6	75.0	33.3
More than 8 years	50.0	12.5	71.4	35.7
Total	50.3	22.6	65.8	37.7

Source: Authors' calculations

The prevalence of child under nutrition by household food insecurity is shown in table 3. The proportion of stunted children was higher in those households without food to eat during the one month prior to the survey. Similarly, more than 50 per cent of the stunted children belonged to those households which had the inability to eat preferred food or had to eat a limited variety of food or had to eat fewer meals and had to sleep without food in the last one month. Likewise, a higher percentage of wasted children belonged to those households who had experiences of no food to eat during the last one month. However, prevalence of wasting, underweight and thinness has not been found to be influenced by such categories of household food insecurity such as limited variety of food, sleeping without food, and no food whole day and night.

Table 3: Percentage distribution of frequency of household's food insecurity by children nutritional status.

Food insecurity experience in one month	Stunted	Wasted	Underweight	Thin
Worry about insufficient food	48.8	22.1	66.1	37.9
Inability to eat preferred food	50.9	23.1	65.1	40.1
Had to eat a limited variety of food	58.6	21.4	67.4	33.3
Had to eat certain food items without choice	50.1	22.7	70.7	39.1
Had to eat smaller meals	45.8	22.9	64.3	36.6
Had to eat fewer meals	55.3	27.7	69.2	36.6
Had no food to eat	63.6	30.3	75.0	37.1
Had to sleep without food	53.8	19.2	81.2	40.9
Had to go day and night without eating any food	33.3	16.7	54.5	41.7
Total	50.3	22.6	65.8	37.7

Source: Authors' calculations

Table 4 shows results of the binary logistic regression analysis of the nutritional status of the child (stunted, wasted and thin) on the household food security status after controlling selected child-specific, household-specific, and mother-specific variables. The table confirms that household food security status has an influence on the nutritional status of children as measured in terms of stunting. The likelihood of a child to be stunted is higher in food insecure households compared to food secure households even after controlling a range of child-specific, household and mother related variables. In severely food insecure households, the probability of a child being stunted is found to be more than 2 time higher than in food secure households, although the likelihood of a child being stunted in mildly food insecure households has not been found to be statistically significantly different from the likelihood of a child being stunted in food secure households.

The relationship of child wasting with household food security status has, however, not been found to be strong. The likelihood of a child being stunted in severely food insecure households has not been found to be different from the likelihood of a child being wasted in food secure households. One reason is that the child wasting is influenced by child stunting. In stunted children, wasting may be low because of poor linear growth so that even if the weight of the child is low-for-age, the ratio of weight for height may be high and children may be classified as 'not wasted.' In case of mildly food insecure and moderately food insecure households, however, the likelihood of wasting in children is found to be statistically significantly higher than the likelihood of wasting in food secure households. On the other hand, the likelihood of a child being thin is found to be statistically significantly higher in severely food insecure households compared to the food secure households but the likelihood of a child being thin in mildly and moderately food insecure households is not found to be statistically significantly higher than the likelihood in food secure households.

Table 4: Results of binary logistic regression of child undernutrition on household food security.

Background characteristics	Dependent variables		
	Stunted	Wasted	Thin
Explanatory variable			
Household food security			
Food secure®	1.0	1.0	1.0
Mildly food insecure	1.210	1.201*	1.110
	(0.584-2.301)	(0.235-2.301)	(0.954-2.351)
Moderately food insecure	1.331*	1.320**	0.957
	(1.501-3.251)	(1.024-2.321)	(0.975-3.021)
Severely food insecure	2.213**	1.024	1.231*
	(2.351-5.320)	(0.954-8.301)	(1.024-3.214)
Confounding variables			
Age of the child			
Under 6 years®	1.0	1.0	1.0
6-8 years	0.804**	0.929**	1.240
	(0.471-0.753)	(1.094-1.748)	(0.580-2.352)
9-10 years	0.624*	0.859	1.187**
	(0.326-0.915)	(0.393-1.879)	(1.720-2.310)
11-12 years	0.757	0.723	2.301
	(0.366-1.565)	(0.146-0.947)	(0.201-5.320)
13-14 years	0.645	0.632**	2.370
	(0.281-1.483)	(0.079-0.873)	(3.210-14.320)
Sex of the child			
Girl®	1.0	1.0	1.0
Boy	0.964**	0.914*	0.938
	(1.063-1.861)	(0.026-0.881)	(0.545-1.615)
School enrolment			
Never enrolled®	1.0	1.0	1.0
1st Standard	1.535*	0.425	1.235*
	(0.792-0.975)	(0.173-1.045)	(0.143-0.890)
2nd Standard	1.216	1.003**	0.816
	(0.576-2.570)	(0.404-0.892)	(0.307-2.167)
3rd Standard	0.634	1.440	1.210
	(0.303-1.325)	(0.620-3.344)	(0.451-3.244)
4th Standard	1.020**	0.811***	1.899**
	(1.04-2.336)	(1.662-3.590)	(3.518-6.595)
5th Standard	0.748	0.834*	0.710
	(0.340-1.644)	(0.530-3.615)	(0.202-2.522)
6th & above	0.839	1.141	1.336
	(0.366-1.924)	(0.369-3.526)	(0.242-7.374)

Background characteristics	Dependent variables		
	Stunted	Wasted	Thin
Household agriculture land			
Below 0.5 Acre®	1.0	1.0	1.0
0.5 - 1.0 Acre	0.683*	2.223	0.619
	(0.644-0.983)	(0.584-0.862)	(0.058-1.764)
More than 1.0 Acre	0.505	0.820	0.572**
	(0.521-4.349)	(0.594-10.675)	(2.331-11.573)
Household livestock ownership			
Yes®	1.0	1.0	1.0
No	1.496	0.763**	1.578
	(0.646-3.484)	(0.138-0.723)	(0.345-7.214)
Number of cows in the household			
No cow®	1.0	1.0	1.0
1-2	0.797	0.933	0.385
	(0.415-1.533)	(0.417-2.089)	(0.121-1.222)
3 and more	0.911	1.244*	0.905*
	(0.359-2.316)	(1.417-3.709)	(1.196-4.179)
Number of goats in the household			
No goat®	1.0	1.0	1.0
1-3	0.811	1.425	0.417
	(0.409-1.607)	(0.641-3.188)	(0.120-1.445)
4-5	0.980*	0.822	0.453
	(1.477-2.015)	(0.330-2.047)	(0.141-1.457)
6 and more	1.164	1.293	0.364
	(0.434-3.120)	(0.408-4.099)	(0.071-1.865)
Location of the household			
Low SC area®	1.0	1.0	1.0
Medium SC area	0.853	1.076	0.507
	(0.361-1.571)	(0.417-2.283)	(0.129-1.996)
High SC area	1.125*	1.193	0.632
	(1.341-1.782)	(0.286-1.677)	(0.164-2.432)
Type of house			
Kachha®	1.0	1.0	1.0
Semi-*Pucca*	0.715	1.513*	0.870*
	(0.409-2.520)	(0.091-0.909)	(0.006-0.316)
Pucca	0.911*	0.833	0.470
	(1.858-7.824)	(0.267-2.595)	(0.002-1.413)

Background characteristics	Dependent variables		
	Stunted	Wasted	Thin
Sub-caste of the household			
Pasi®	1.0	1.0	1.0
Chamar	1.781	0.1.039	3.554*
	(0.879-3.610)	(0.457-2.360)	(1.030-12.262)
Kori	1.903	1.448	1.694
	(0.721-5.022)	(0.491-4.270)	(2.819-12.396)
Type of ration card			
Above poverty line®	1.0	1.0	1.0
Below poverty line	1.185**	0.981**	1.174**
	(0.751-0.964)	(0.573-0.806)	(1.541-2.546)
Household wealth status			
Poor®	1.0	1.0	1.0
Medium	1.109	1.226*	0.548**
	(0.637-1.930)	(0.624-0.895)	(1.002-1.861)
Rich	0.849**	0.815**	0.236
	(0.824-0.985)	(1.501-2.010)	(0.086-0.641)
Mother's age			
15-24 years®	1.0	1.0	1.0
25-34 years	1.057*	0.648**	1.776*
	(1.053-2.108)	(1.021-1.495)	(1.521-6.056)
35-44 years	0.831*	1.082	1.880**
	(0.418-0.652)	(0.487-2.404)	(0.195-0.708)
45-49 years	1.514	1.989*	4.114
	(0.569-4.024)	(1.323-1.828)	(0.698-2.247)
Mother's education			
No education®	1.0	1.0	1.0
1-5 years	1.049	0.942	0.915*
	(0.466-2.364)	(0.359-2.417)	(0.258-0.742)
6-8 years	1.365	0.464	1.924
	(0.954-3.935)	(0.115-1.870)	(421-8.798)
More than 8 years	0.955***	0.433***	2.833***
	(2.012-2.737)	(0.051-0.930)	(2.763-4.585)

Source: Authors' calculations

Discussions and Conclusions

This study has examined the influence of household food security on the nutritional status of children in Scheduled Castes households living in the rural areas. The study shows that the nutritional status of children of these households is directly related to the food security status of the household. Another important finding of the presented analysis is that there is variation in the prevalence of child under nutrition by sub-castes within the Scheduled Castes households. Scheduled Castes are popularly

termed as 'untouchables' in the Indian society and, therefore, they are highly deprived and vulnerable population group which is reflected in terms of a high degree of household food insecurity. The present study shows that the deprivation and vulnerability of Scheduled Castes household as reflected through household food security has a strong influence on the nutritional status of Scheduled Castes children. Findings of the present study support the findings of previous research (Hallal et al, 2006; Coates et al, 2007; Bouchard et al, 2012). Poverty, food insecurity and malnutrition are the major barrier to achieve the Sustainable Development Goals (Branca et al, 2020; Weinreb et al, 2002).

The findings of the present study suggest that efforts should specifically be directed towards improving the household food security of Scheduled Castes households to address the high prevalence of child under nutrition in these households. There is a need to explore the reasons behind a high prevalence of food insecurity in Scheduled Castes households. In this context, it would also be useful to analyse the appropriateness, adequacy, efficiency, and effectiveness of the target public distribution system (PDS) of the country which is specifically directed towards improving the food availability at the household level. It may, however, be emphasised that the household food security is not the only factor that determines the nutritional status of children. There are a number of other factors also. However, the present study shows that even if these factors are controlled, the household food security has a strong impact on the nutritional status of children of Scheduled Castes households. This means that improving the household food security in Scheduled Castes households can contribute substantially towards accelerating the reduction in the prevalence of child under nutrition in Scheduled Castes.

References

Antony GM, Laxmaiah A (2008) Human development, poverty, health & nutrition situation in India. *Indian Journal of Medical Research* 128(2):198-205.

Babatunde RO, Qaim M (2010) Impact of off-farm income on food security and nutrition in Nigeria. *Food Policy* 35(4): 303-11.

Badiane O, Collins J, Dimaranan B, Ulimwengu J (2018) *An Assessment of the New Alliance for Food Security and Nutrition*. *Addis Ababa, African Union*.

Behrman JR, Alderman H, Hoddinott J (2004) Hunger and malnutrition. B Lomborg (ed) *Global Crises*, *Global Solutions*. Cambridge, Cambridge University Press: 363-420.

Bouchard C, Blair SN, Haskell WL (2012) *Physical Activity and Health*. Champaign, IL, Human Kinetics.

Branca F, Demaio A, Udomkesmalee E, Baker P, Aguayo VM, Barquera S, Dain K, Keir L, Lartey A, Mugambi G, Oenema S (2020) A new nutrition manifesto for a new nutrition reality. *The Lancet* 395(10217): 8-10.

Casey PH, Szeto KL, Robbins JM, Stuff JE, Connell C, Gossett JM, Simpson PM (2005) Child health-related quality of life and household food security. *Archives of Pediatrics & Adolescent Medicine* 159(1): 51-56.

Castetbon K, Vernay M, Malon A, Salanave B, Deschamps V, Roudier C, Oleko A, Szego E, Hercberg S (2009) Dietary intake, physical activity and nutritional status in adults: the French nutrition and health survey (ENNS, 2006–2007). *British Journal of Nutrition* 102(5):733-43.

Coates J, Swindale A, Bilinsky P (2007) *Household Food Insecurity Access Scale for Measurement of Household Food Access: Indicator Guide*. Washington DC, Food and Nutrition Technical Assistance Project.

Friesen RA (2018) Food Security. CeDEP, SOAS, University of London: P541 Dissertation.

Government of India (2017) *National Family Health Survey (NFHS-4), 2015–16.* Mumbai, International Institute for Population Sciences.

Government of India (2019) *National Family Health Survey (NFHS-4), 2015–16 – Uttar Pradesh.* Mumbai, International Institute for Population Sciences.

Gupta A, Coffey D (2020) Caste, religion, and mental health in India. *Population Research and Policy Review* 20:1-23.

Gwatkin DR, Wagstaff A, Yazbeck A (2005) *Reaching the Poor with Health, Nutrition, and Population Services: What Works, What doesn't, and Why*. Washington DC, World Bank.

Hallal PC, Victora CG, Azevedo MR, Wells JC (2006) Adolescent physical activity and health. *Sports Medicine* 36(12):1019-30.

Hossain M, Naher F, Shahabuddin Q (2005) Food security and nutrition in Bangladesh: progress and determinants. *eJADE: electronic Journal of Agricultural and Development Economics* 2(2):103-32.

Hyder AA, Maman S, Nyoni JE, Khasiani SA, Teoh N, Premji Z, Sohani S (2005) The pervasive triad of food security, gender inequity and women's health: exploratory research from sub-Saharan Africa. *African Health Sciences* 5(4): 328-34.

Johnson CM, Sharkey JR, Lackey MJ, Adair LS, Aiello AE, Bowen SK, Fang W, Flax VL, Ammerman AS (2018) Relationship of food insecurity to women's dietary outcomes: a systematic review. *Nutrition Reviews* 76(12): 910-28.

Jungari S, Chauhan BG (2017) Caste, wealth and regional inequalities in health status of women and children in India. *Contemporary Voice of Dalit* 9(1): 87-100.

Kennedy G, Nantel G, Shetty P (2004) Globalization of food systems in developing countries: impact on food security and nutrition. Rome, Food and Agriculture Organization. Food and Agriculture Paper 83.

Kumar D and Kalita P (2017) Reducing postharvest losses during storage of grain crops to strengthen food security in developing countries. *Foods* 6(1):8.

Mahadevan R and Hoang V (2016) Is there a link between poverty and food security? *Social Indicators Research* 128(1):179-99.

Pheley AM, Holben DH, Graham AS, Simpson C (2002) Food security and perceptions of health status: a preliminary study in rural Appalachia. *The Journal of Rural Health* 8(3): 447-53.

Ramachandran P (2007) Poverty nutrition linkages. *Indian Journal of Medical Research* 126(4): 249-261.

Retherford RD, Choe MK (2011) *Statistical Models for Causal Analysis*. New York, John Wiley & Sons.

Rose D, Bodor JN (2006) Household food insecurity and overweight status in young school children: results from the Early Childhood Longitudinal Study. *Pediatrics* 117(2): 464-73.

Sachs JD (2012) From millennium development goals to sustainable development goals. *The Lancet* 9;379(9832): 2206-11.

Spring A (2000) *Women Farmers and Commercial Ventures: Increasing Food Security in Developing Countries*. Lynne, Rienner Publishers

Stuff JE, Casey PH, Szeto KL, Gossett JM, Robbins JM, Simpson PM, Connell C, Bogle ML (2004) Household food insecurity is associated with adult health status. *The Journal of Nutrition* 134(9): 2330-5.

Tarasuk VS (2001) Household food insecurity with hunger is associated with women's food intakes, health and household circumstances. *The Journal of Nutrition* 131(10): 2670-6.

Upadhyay RP, Palanivel C (2011) Challenges in achieving food security in India. *Iranian Journal of Public Health* 40(4): 31-36.

Varadharajan KS, Thomas T, Kurpad AV (2013) Poverty and the state of nutrition in India. *Asia Pacific Journal of Clinical Nutrition* 22(3): 326-339.

Weingärtner L (2009) The concept of food and nutrition security. *Achieving Food and Nutrition Security* 3:21-52.

Weinreb L, Wehler C, Perloff J, Scott R, Hosmer D, Sagor L, Gundersen C (2002) Hunger: its impact on children's health and mental health. *Pediatrics* 110(4): e41.

World Health Organization (2006) *WHO Child Growth Standards: Length/Height-for-age, Weight-for-Age, Weight-for-Length, Weigh-for-Height and Body Mass Index-for-Age. Methods and Development.* Geneva, World Health Organization.

World Health Organization (2009) *AnthroPlus for Personal Computers Manual. Software for Assessing Growth of the World's Children and Adolescents.* Geneva, World Health Organization.