Household food insecurity and nutritional status of children and women in Nepal

Abhishek Singh, Ashish Singh, and Faujdar Ram

Abstract

Background. *Information on the association between household food insecurity and nutritional status of children and women based on a nationally representative sample is not available from Nepal.*

Objective. *To examine the association between food insecurity and nutritional status of children and married women in Nepal using data from the 2011 Nepal Demographic and Health Survey.*

Methods. *The Household Food Insecurity Access Scale was used to assess food insecurity in the 2011 Nepal Demographic and Health Survey. We used body mass index (BMI) to assess the nutritional status of married women, and stunting, wasting, and underweight to assess the nutritional status of children under 5 years of age. Binary logistic regression and multinomial logistic regression were performed to examine the associations.*

Results. *In severely food-insecure households, 51% of children were stunted and 40% were underweight; 27% of married women had a BMI below 18.5 kg/m^2; children were 1.50 (95% CI, 1.15 to 1.97) and 1.40 (95% CI, 1.05 to 1.85) times as likely as children in food-secure households to be stunted and underweight, respectively; and married women were 1.5 (95% CI, 1.17 to 1.92) times as likely as married women in food-secure households to have a BMI below 18.5 kg/m^2. No association was found between household food insecurity and wasting among children.*

Conclusions. *There is a significant association between food insecurity and malnutrition among children in Nepal. Among women, food insecurity is associated with underweight (BMI < 18.5 kg/m^2) but not with overweight (BMI ≥ 25.0 kg/m^2).*

Key words: Body mass index, food insecurity, Nepal, stunting, underweight, wasting

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Introduction

The rate of malnutrition among children in Nepal is one of the highest in the world. Recent data from the 2011 Nepal Demographic and Health Survey (NDHS 2011) [1] indicate that 41% of children under 5 years of age were stunted, 11% were wasted, and 29% were underweight. The rate of malnutrition among children varies according to urban or rural residence and ecological zone. The prevalence rates of stunting and underweight in the mountain region were 53% and 36%, respectively [1]. Malnutrition among women is also a serious concern in Nepal. NDHS 2011 found that 18% of women of reproductive age (15 to 49 years) were malnourished, and a total of 35% were anemic (29% mildly anemic, and 6% moderately anemic) [1].

Along with malnutrition among children and women, food insecurity remains an alarming problem in Nepal. According to the Global Hunger Index 2012, Nepal ranked 60th out of 79 countries [2]. NDHS 2011 found that 51% of households in Nepal were food insecure: 12% mildly, 23% moderately, and 16% severely food insecure [1]. There is considerable variation in the rate of household food insecurity according to urban or rural residence and ecological zone. Given the high levels of household food insecurity in the country, Nepal recognized food security as a fundamental human right for all citizens in its interim constitution (2006/07). Nepal aims to reduce the proportion of the population living below a minimum level of dietary energy consumption to 25% by 2015 [3].

Given that household food insecurity can negatively affect food consumption in terms of both quantity and quality, leading to malnutrition, particularly among

children and women, a few studies have examined the association between household food insecurity and malnutrition among children and women. Some studies have reported a positive association between household food insecurity and weight gain during childhood [4, 5], but others have found no relationship [6–11]. A few studies have found a negative association between household food insecurity and malnutrition among children [12–15]. Among adults, a few studies have found a significant association between household food insecurity and malnutrition [9, 16, 17]. Interestingly, most of these studies were conducted in developed countries.

A literature search yielded only one small-scale study that examined the relationship between household food insecurity and nutritional status of children in Nepal by Osei et al. [6]. This study found no association between household food insecurity and malnutrition among children in Kailali District of Nepal. We found no study in Nepal that analyzed the association between household food insecurity and malnutrition among women. Hence, this paper explores the relationship between household food insecurity and nutritional status of children and married women in Nepal using data from NDHS 2011.

Methods

Data

The data used for the analysis are from the recently released 2011 Nepal Demographic and Health Survey (NDHS 2011). The primary objective of NHDS 2011 was to provide estimates of key population and health indicators, including fertility and mortality rates, for the country as a whole and for urban and rural areas separately. Interviews were conducted with 12,674 women aged 15 to 49 years residing in 10,826 sampled households. The response rates for household and women interviews were 99% and 98%, respectively.

NDHS 2011 adopted a two-stage sampling design to select households for interview. The enumeration areas were selected in the first stage using probability-proportional-to-size strategy. In the second stage, 35 households in each selected urban enumeration area and 40 households in each selected rural enumeration area were randomly selected for interview. Because the households were selected with a two-stage sampling design, sampling weights are required to ensure the actual representativeness of the sample at the national level as well as at the domain levels. The details of the sampling weights are given in the NDHS 2011 report [1].

The analysis of data from children is restricted to 2,335 children below 5 years of age for whom anthropometric information was available in NDHS 2011. The analysis of data from married women is restricted to 4,581 currently married women aged 15 to 49 years for whom information on body mass index was available in NDHS 2011.

No ethical approval or informed consent was required for the current study because the study is based on a publicly available anonymous secondary dataset. This dataset can be obtained free of cost from MEASURE DHS on request. The details of accessing data from MEASURE DHS are available on their website (http://www.measuredhs.com/data/Access-Instructions.cfm).

Variables

The dependent variables included in the analysis are stunting, wasting, and underweight for children and body mass index for currently married women. Children whose height-for-age z-score is < –2 SD from the median of the World Health Organization (WHO) reference population are considered short for their age (stunted) or chronically malnourished. Height-for-age, therefore, represents the long-term effects of malnutrition in a population and is not sensitive to recent, short-term changes in dietary intake. Children whose weight-for-height z-score is < –2 SD from the median of the WHO reference population are considered thin (wasted). Wasting is sensitive to recent, short-term changes in dietary intake [1]. Weight-for-age is a composite index that accounts for both chronic and acute malnutrition. Children whose weight-for-age is < –2 SD from the median of the WHO reference population are classified as underweight. All three anthropometric measures were calculated using new growth standards published by WHO in 2006 [18]. Stunting, wasting, and underweight were coded into two categories: 1 if stunted, wasted, or underweight; 0 otherwise.

Body mass index (BMI) is the ratio of the weight in kilograms to the square of the height in meters (kg/m^2). A BMI below 18.5 kg/m^2 indicates thinness or acute malnutrition, and a BMI of 25.0 kg/m^2 or above indicates overweight or obesity. We coded BMI into three categories: 1 if BMI < 18.5 kg/m^2, 2 if BMI ≥ 25.0 kg/m^2, 0 if neither underweight nor overweight or obese.

The main independent variable is a measure of household food insecurity. This variable was created using a series of questions on household food insecurity included in NHDS 2011. The questions on food insecurity included in NDHS 2011 were adopted from the Household Food Insecurity Access Scale (HFIAS). Of the nine generic questions constituting HFIAS, seven were included in NDHS 2011, and the reference period for assessment was extended to 12 months from 1 month to allow for seasonal variations [1]. The questions used were as follows:

» In the past 12 months, how frequently did you worry

that your household would not have enough food?
» In the past 12 months, how often were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?
» In the past 12 months, how often did you or any household member have to eat a limited variety of foods due to lack of resources?
» In the past 12 months, how often did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
» In the past 12 months, how often did you or any household member eat fewer meals in a day because of lack of resources to get food?
» In the past 12 months, how often was there no food to eat of any kind in your household because of lack of resources to get food?
» In the past 12 months, how often did you or any household member go to sleep at night hungry because there was not enough food?

Each question had four response options: never, rarely, sometimes, or often. The households that reported that they "never" or "rarely" worried that their households would not have enough food were coded as "food secure." Households that reported that they worried about not having enough food (sometimes or often), and/or were unable to eat preferred foods, and/or ate a more monotonous diet than desired, but only rarely, were coded as "mildly food insecure." Households that reported that they ate a more monotonous diet than desired sometimes or often, and/or had started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes, were coded as "moderately food insecure." Households that reported that they often cut back on meal size or number of meals , and/or ran out of food or went to bed hungry, even as infrequently as rarely, were coded as "severely food insecure." These categories of household food insecurity are adapted from Coates et al. [19]. Therefore, the household food insecurity variable has four categories: food secure (coded as 0), mildly food insecure (coded as 1), moderately food insecure (coded as 2), and severely food insecure (coded as 3).

Besides household food insecurity, other socioeconomic and demographic variables have been shown to have a significant impact on malnutrition among children and women. Accordingly, in the analysis of data from children, we also included age of the mother at birth of the index child (< 20 years, 20 to 29 years, ≥30 years), mother's schooling (no schooling, up to primary school, secondary or above), mother's work status (not working, working), mother's autonomy (no autonomy, partial autonomy, full autonomy), mother's exposure to media (no exposure, some exposure), wealth status of the household (bottom one-third, middle one-third, top one-third), region of residence (mountain, hill, terai [low-lying land at the foot of the Himalayas]) place of residence (urban, rural), sex of child, age of child, birth order of child (first, second or higher), and size of child at birth (larger than average, average, smaller than average).

The variables that were included in the analysis of data from married women were woman's current age (15 to 24, 25 to 34, or 35 to 49 years), woman's schooling, woman's work status, woman's autonomy, woman's exposure to media, wealth status of the household, region of residence, and place of residence.

Woman's autonomy was estimated from her responses to four questions about the extent of her decision-making power in her household:
» Who usually decides how your (partner's/husband's) earnings will be used: you, your (partner/husband), or you and your (partner/husband) jointly?
» Who usually makes decisions about healthcare for yourself: you, your (partner/husband), you and your (partner/husband) jointly, or someone else?
» Who usually makes decisions about making major household purchases?
» Who usually makes decisions about visits to your family or relatives?

Women who reported no decision-making for all four questions were coded as having "no autonomy." Women who reported decision-making (either alone or jointly with her partner/husband) for all four questions were coded as having "full autonomy." The rest were coded as having "partial autonomy." Similarly, media exposure was estimated using woman's responses to three questions about television, radio, and newspaper use. Women who had no exposure to any of the three media were coded into the "no exposure" category and those having exposure to one or more sources of media were coded into the "some exposure" category. Wealth status of the household was created by dividing the wealth index (already given in NDHS 2011) into three equal parts. The wealth index in NDHS 2011 was constructed using household assets data via a principal components analysis [1]. In the absence of data on income or expenditures in large-scale surveys, the wealth index serves as a good proxy of level of wealth that is consistent with expenditure and income measures [20].

Statistical analysis

We used bivariate analysis to examine the unadjusted association between food insecurity and the dependent variables, binary logistic regression to examine the adjusted association between food insecurity and stunting and underweight, and multinomial logistic regression to examine the association between food insecurity and BMI. The first-order interaction terms were used to evaluate for potential interaction effects between household food insecurity, maternal schooling, and household wealth status. Interactions were not

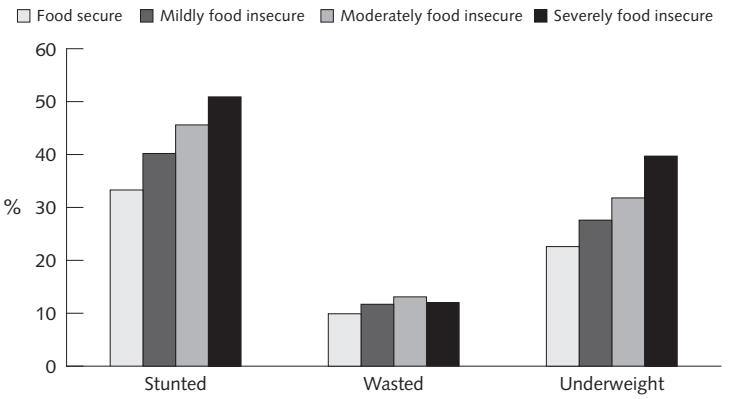

FIG. 1. Percentage of children stunted, wasted, and underweight according to household food insecurity, Nepal, 2011

significant in the statistical models and hence were not included in the final models. All of the analyses presented in this paper were performed with STATA 10.0. All estimates presented here are weighted.

Results

Table 1 shows the distribution of independent variables for the samples of children and married women. Fifty-seven percent of the sampled children and 50% of the sampled women were from food-insecure households. The distribution of women's schooling, wealth status of household, and region of residence was similar in the samples of children and women. Mothers of the children included in the children sample were less likely to be working, have autonomy, have exposure to media, or reside in urban areas than women included in the sample of women.

Figure 1 shows the unadjusted bivariate association between household food insecurity and malnutrition (stunting, wasting, and underweight) among children under 5 years of age. Stunting and underweight were significantly associated with household food insecurity ($p < .05$). Fifty-one percent of children from severely food-insecure households were stunted, compared with only 33% of children from food-secure households. The proportion of underweight children was higher in severely food-insecure households than in food-secure households: 40% and 23%, respectively. Although the rate of malnutrition was higher among children from food-insecure households than among children from food-secure households, the rate of malnutrition among children from food-secure households was also high. The association between household food insecurity and wasting was not significant.

Acute malnutrition (BMI < 18.5 kg/m^2) among women was more often reported in severely food-insecure households than in food-secure households (**fig. 2**). Twenty-seven percent of women from severely food-insecure households had a BMI below 18.5 kg/m^2, compared with only 13% of women from food-secure households. The percentage of overweight women was significantly ($p < .05$) lower in food-insecure households (6.7%) than in food-secure households (19.5%).

The adjusted odds ratios from binary logistic regression for stunting and underweight among children under 5 years of age are shown in **table 2**. The findings indicate that food insecurity was significantly associated with both stunting and underweight. Children from severely food-insecure households were 1.50 (95% CI, 1.15 to 1.97) times as likely as children from food-secure households to be stunted. Children from moderately food-insecure households were 1.40 (95% CI, 1.08 to 1.80) times as likely as children from food-secure households to be stunted. Likewise, children from severely food-insecure households were significantly more likely to be underweight than children from food-secure households (odds ratio, 1.40; 95% CI, 1.05 to 1.85). The association between food insecurity and malnutrition among children was independent of

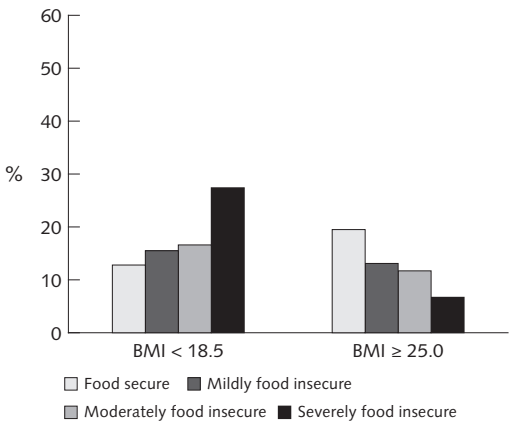

FIG. 2. Percentage of married women of reproductive age with body mass index (BMI) < 18.5 kg/m^2 and ≥ 25.0 kg/m^2 according to household food insecurity, Nepal, 2011

TABLE 1. Distribution of independent variables, Nepal, 2011[a]

	Children		Married women	
Covariate and category	%	*N*	%	*N*
Food insecurity				
Food secure	43.1	1,007	50.2	2,299
Mildly food insecure	12.3	287	13.4	616
Moderately food insecure	23.3	543	20.7	947
Severely food insecure	21.3	498	15.7	719
Woman's current age (yr)				
15–24			27.6	1,263
25–34			35.9	1,647
35–49			36.5	1,671
Age of mother at childbirth (yr)				
< 20	20.7	483		
20–29	61.3	1,431		
≥ 30	18.0	421		
Woman's schooling				
None	47.4	1,107	47.6	2,182
Up to primary	19.7	461	19.0	871
Secondary or higher	32.9	767	33.4	1,528
Woman's work status				
Not working	43.4	1,014	37.8	1,731
Working	56.6	1,321	62.2	2,850
Woman's autonomy				
None	27.4	630	20.0	911
Partial	41.5	956	41.4	1,880
Full	31.1	716	38.6	1,755
Woman's exposure to media				
None	45.5	1,061	36.6	1,676
Some	54.5	1,274	63.4	2,905
Wealth status of household				
Bottom one-third	33.3	778	34.2	1,565
Middle one-third	33.4	780	34.8	1,593
Top one-third	33.3	777	31.0	1,422
Region of residence				
Mountain	7.9	185	6.7	306
Hill	39.5	922	39.6	1,814
Terai[b]	52.6	1,228	53.7	2,461
Place of residence				
Urban	8.9	207	12.6	575
Rural	91.1	2,128	87.4	4,006
Sex of child				
Male	50.7	1,185		
Female	49.3	1,150		
Birth order of child				
1st	35.1	819		
2nd or higher	64.9	1,516		
Size of baby at birth				
Larger than average	17.8	416		
Average	64.3	1,502		
Smaller than average	17.9	417		
Total	100.0	2,335	100.0	4,581

*a. N*s are weighted
b. Terai is low-lying land at the foot of the Himalayas.

TABLE 2. Adjusted odds ratios (95% confidence intervals) from binary logistic regression models for stunting and underweight among children, Nepal, 2011

Covariate and category	Stunting	Underweight
Food insecurity		
Food secure (reference)		
Mildly food insecure	1.03 (0.77, 1.37)	0.87 (0.63, 1.20)
Moderately food insecure	1.40 (1.08, 1.80)*	1.23 (0.94, 1.61)
Severely food insecure	1.50 (1.15, 1.97)*	1.40 (1.05, 1.85)*
Age of mother at childbirth (yr)		
< 20 (reference)		
20–29	0.81 (0.63, 1.03)	0.81 (0.62, 1.06)
≥ 30	0.79 (0.56, 1.11)	0.73 (0.51, 1.04)
Mother's schooling		
None (reference)		
Up to primary	1.00 (0.78, 1.29)	0.70 (0.54, 0.91)*
Secondary or higher	0.77 (0.59, 0.99)*	0.54 (0.40, 0.72)*
Mother's work status		
Not working (reference)		
Working	0.85 (0.68, 1.05)	0.95 (0.76, 1.20)
Mother's autonomy		
None (reference)		
Partial	1.12 (0.89, 1.40)	0.99 (0.78, 1.26)
Full	1.08 (0.85, 1.38)	1.11 (0.86, 1.44)
Mother's exposure to media		
None (reference)		
Some	0.94 (0.76, 1.15)	0.86 (0.69, 1.07)
Wealth status of household		
Bottom one-third (reference)		
Middle one-third	0.73 (0.58, 0.93)*	0.83 (0.64, 1.07)
Top one-third	0.52 (0.38, 0.72)*	0.64 (0.45, 0.91)*
Region of residence		
Mountain (reference)		
Hill	0.76 (0.60, 0.98)*	0.80 (0.62, 1.04)
Terai[a]	0.67 (0.51, 0.89)*	0.92 (0.69, 1.24)
Place of residence		
Urban (reference)		
Rural	1.39 (1.07, 1.80)*	1.25 (0.93, 1.67)
Age of child (continuous)	1.03 (1.02, 1.03)*	1.01 (1.00, 1.02)*
Sex of child		
Male (reference)		
Female	0.93 (0.78, 1.11)	0.88 (0.73, 1.06)
Birth order of child		
1st (reference)		
2nd or higher	1.18 (0.94, 1.48)	1.44 (1.12, 1.85)*
Size of baby at birth		
Larger than average (reference)		
Average	1.37 (1.08, 1.73)*	1.76 (1.34, 2.32)*
Smaller than average	2.02 (1.5, 2.69)*	3.48 (2.53, 4.78)*

*$p < .05$.

a. Terai is low-lying land at the foot of the Himalayas.

household wealth. Age of the child, size of the child at birth, wealth status of the household, region of residence, and urban vs. rural residence were also significantly associated with stunting. The variables that were significantly associated with underweight were age of the child, birth order, size of the child at birth, and mother's schooling.

The adjusted relative risk ratios for BMI are shown in **table 3**. The results adjusted for selected variables indicate that food insecurity was significantly associated with acute malnutrition but not with overweight among married women of reproductive age. Women from severely food-insecure households were 1.50 (95% CI, 1.17 to 1.92) times as likely as women from food-secure households to have a BMI below 18.5 kg/m^2. Similarly, women from moderately food-insecure households were 1.35 (95% CI, 1.07 to 1.71) times as likely as women from food-secure households to have a BMI below 18.5 kg/m^2.

Discussion

Our study is perhaps the first to investigate the association between household food insecurity and malnutrition among children and women using a large-scale, population-based dataset in Nepal. The results, adjusted for other socioeconomic and demographic variables, indicate a significant association between household food insecurity and malnutrition among children and women. Children from severely food-insecure households were significantly more likely to be stunted or underweight than children from food-secure households. The finding of our study is in contrast to an earlier small-scale study that found no significant association between household food insecurity and malnutrition among children using similar measures, stunting and underweight [6]. Some of the differences in the findings could be attributed to the difference in age of the children included in the two studies. The study by Osei et al. included children aged 6 to 23 months [6], whereas our study includes children below 5 years of age. Another difference between the earlier study and our study is the way in which the household food insecurity variable was estimated. The study by Osei et al. used only five questions to estimate household food insecurity [6]. Furthermore, in the study by Osei et al., the estimated household food insecurity variable was coded into two categories only: food insecure (all those who reported "rarely," "sometimes," or "often") and food secure (all those who reported "never"). In contrast, NHDS 2011 used seven questions to estimate household food insecurity. Moreover, the estimated household food insecurity variable in our study was coded into four categories: severely food insecure, moderately food insecure, mildly food insecure, and food secure. A food-insecurity variable with these four categories is likely to provide a more robust association with malnutrition among children and women than a variable with only two categories. In the study of Osei et al., any household responding "rarely" or "sometimes" to the five questions on household food insecurity was also coded as "food insecure," thus making "food-insecure" and "food-secure" households very similar. The findings of our study clearly reveal that the association between household food insecurity and malnutrition among children and women might be affected by the type of variable used to measure household food insecurity.

Women from severely food-insecure households were significantly more likely than women from food-secure households to have a BMI less than 18.5 kg/m^2. Our findings are consistent with earlier studies that have also found a significant association between household food insecurity and low BMI among adults [16, 17]. Our study does not confirm the findings of earlier studies, mostly conducted in developed countries, that have shown a positive association between food insecurity and overweight among women [21–23]. Interestingly, 51% of households in Nepal reported some type of food insecurity, and 39% of households reported moderate to severe food insecurity [1]. A study by Romer identified over 9 million Nepalese as vulnerable to food insecurity [24]. Improving household food security is one of the policy options that Nepal could pursue to improve nutrition among children and women.

Another finding of the study that deserves attention is the high prevalence rates of stunting, wasting, and underweight in food-secure households. NHDS 2011 found that 33%, 10%, and 23% of children from food-secure households were stunted, wasted, and underweight, respectively. It is clear that improving food security is necessary but not sufficient to improve the nutritional status of children in Nepal. These findings indicate that along with improving household food security, policy makers in Nepal must also look at other policy options, such as improving maternal education, improving childhood feeding practices, improving sanitation and hygiene, and controlling childhood infections to reduce malnutrition among children.

The limitations of our study must also be noted. First, the use of cross-sectional data did not allow us to examine the causal link between household food insecurity and malnutrition among children and women. Second, there is a possibility of recall bias, as the reference period for the household food insecurity questions was extended from 1 month to 12 months in NHDS 2011. Despite these limitations, our study provides additional and conclusive evidence on the relationship between household food insecurity and malnutrition among children and women in a developing-country setting.

Our findings are not only relevant for Nepal, but

TABLE 3. Adjusted relative risk ratios from multinomial logistic regression model for body mass index (BMI) of currently married women of reproductive age, Nepal, 2011

Covariate and category	BMI < 18.5 kg/m^2	BMI ≥ 25.0 kg/m^2
Food insecurity		
Food secure (reference)		
Mildly food insecure	1.23 (0.94, 1.61)	1.08 (0.82, 1.42)
Moderately food insecure	1.35 (1.07, 1.71)*	1.16 (0.90, 1.51)
Severely food insecure	1.50 (1.17, 1.92)*	0.81 (0.57, 1.16)
Age of woman (yr)		
15–24 (reference)		
25–34	1.10 (0.88, 1.38)	2.57 (1.93, 3.40)*
35–49	0.96 (0.74, 1.23)	4.02 (2.99, 5.41)*
Woman's schooling		
None (reference)		
Up to primary	0.65 (0.50, 0.84)*	1.26 (0.97, 1.63)
Secondary or higher	0.74 (0.58, 0.96)*	1.24 (0.97, 1.58)
Woman's work status		
Not working (reference)		
Working	0.99 (0.82, 1.21)	0.80 (0.66, 0.97)*
Woman's autonomy		
None (reference)		
Partial	0.87 (0.70, 1.09)	1.26 (0.93, 1.72)
Full	0.69 (0.54, 0.88)*	1.79 (1.32, 2.44)*
Woman's exposure to media		
None (reference)		
Some	0.74 (0.61, 0.90)*	1.11 (0.87, 1.41)
Wealth status of household		
Bottom one-third (reference)		
Middle one-third	1.05 (0.84, 1.31)	1.95 (1.44, 2.64)*
Top one-third	0.73 (0.54, 0.99)*	6.18 (4.42, 8.63)*
Region of residence		
Mountain (reference)		
Hill	1.11 (0.85, 1.45)	0.68 (0.51, 0.92)*
Terai[a]	1.96 (1.49, 2.58)*	0.63 (0.46, 0.86)*
Place of residence		
Urban (reference)		
Rural	1.02 (0.81, 1.30)	0.68 (0.56, 0.83)*

*p< .05.
a. Terai is low-lying land at the foot of the Himalayas.

also hold significance for the neighboring country of India. The National Family Health Survey 3 conducted in India in 2005/06 found that almost half of children under 5 years of age were stunted, 43% were underweight, and 20% were wasted. Similarly, more than one-third (36%) of women had a BMI below 18.5 kg/m^2 and 55% were anemic [25]. Given the high level of malnutrition among children, women, and men, the Government of India is debating adopting a National Food Security Bill (NFSB) that envisages providing legal entitlement to subsidized food grains to at least 75% of the country's population: 90% in rural areas and 50% in urban areas (http://eac.gov.in/reports/rep_NFSB.pdf) [26]. However, there are no population-based studies in India that might provide support to NFSB. The unavailability of studies is due simply to the nonavailability of information on household food insecurity in large-scale population-based datasets like the National Family Health Survey or District Level Household Survey. In the absence of relevant data, the findings of our study, along with findings from Bangladesh [14], might provide empirical evidence in

favor of governmental initiatives not only in India but also in other countries where food insecurity is still a major concern.

In order to have a better understanding of the association between household food insecurity and malnutrition of children and women, not only at the national level but also at the regional and state levels, there has to be regular monitoring and analysis of food insecurity and malnutrition of children and women. This would require collection, compilation, and generation of data at regular intervals at the national and state levels. Furthermore, more research is required on issues related to measurement of household food insecurity.

Authors' contributions

Abhishek Singh conceptualized the paper and analyzed the data. Ashish Singh helped in preparation of the first draft of the paper. Faujdar Ram supervised the statistical analysis and helped in the finalization of the manuscript.

References

1. Ministry of Health and Population, New ERA, ICF International, Nepal. Demographic and Health Survey 2011. Kathmandu and Calverton, Md, USA: Ministry of Health and Population, New ERA, and ICF International, 2011.
2. International Food Policy Research Institute. 2012 Global Hunger Index. Washington, DC: IFPRI, 2012.
3. Nepal Planning Commission. Nepal Millennium Development Goals progress report 2010. Kathmandu: NPC, 2010.
4. Dubois L, Farmer A, Girard M, Porcherie M. Family food insufficiency is related to overweight among preschoolers. Soc Sci Med 2006;6:1503–16.
5. Casey PH, Simpson PM, Gossett JM, Bogle ML, Champagne CM, Connell C, Harsha D, McCabe-Sellers B, Robbins JM, Stuff JE, Weber J. The association of child and household food insecurity with childhood overweight status. Pediatrics 2006;118:e1406–13.
6. Osei A, Pandey P, Spiro D, Nielson J, Shrestha R, Talukdar Z, Quinn V, Haselow N. Household food insecurity and nutritional status of children aged 6 to 23 months in Kailali District of Nepal. Food Nutr Bull 2010;31:483–94.
7. Alaimo K, Olson C, Frongillo E, Briefel R. Food insufficiency, family income, and health in US preschool and school-aged children. Am J Public Health 2001;91:781–6.
8. Kaiser LL, Melgar-Quinonez HR, Lamp CL, Johns MC, Sutherlin JM, Harwood JO. Food security and nutritional outcomes of preschool-age Mexican-American children. J Am Diet Assoc 2002;102:924–9.
9. Bhattacharya J, Currie J, Haider S. Poverty, food insecurity, and nutritional outcomes in children and adults. J Health Econ 2004;23:839–62.
10. Cook JT, Frank DA, Berkowitz C, Black MM, Casey PH, Cutts DB, Meyers AF, Zaldivar N, Stalicky A, Levenson S, Heeren T, Nord M. Food insecurity is associated with adverse health outcomes among human infants and toddlers. J Nutr 2004;134:1432–8.
11. Kac G, Schlussel MM, Perez-Escamilla R, Velasquez-Melendez G, da Silva AAM. Household food insecurity is not associated with BMI for age or weight for height among Brazilian children aged 0–60 months. PLoS One 2012;9:e45747.
12. Rose D, Bodor J. Household food insecurity and overweight status in young school children: results from the Early Childhood Longitudinal Study. Pediatrics 2006;117:464–73.
13. Matheson DM, Varady J, Varady A, Killen JD. Household food security and nutritional status of Hispanic children in the fifth grade. Am J Clin Nutr 2002;76:210–7.
14. Saha KK, Frongillo EA, Alam DS, Arifeen SE, Persson LA, Rasmussen KM. Household food security is associated with growth of infants and young children in rural Bangladesh. Public Health Nutr 2009;12:1556–62.
15. Hackett M, Melgar-Quinonez H, Alvarez MC. Household food insecurity associated with stunting and underweight among preschool children in Antioquia, Colombia. Rev Panam Salud Publica 2009;25:506–10.
16. Isanaka S, Mora-Plazas M, Lopez-Arana S, Baylin A, Villamor E. Food insecurity is highly prevalent and predicts underweight but not overweight in adults and school children from Bogota, Colombia. J Nutr 2007;137:2747–55.
17. Gulliford MC, Mahabir D, Rocke B. Food insecurity, food choices, and body mass index in adults: nutrition transition in Trinidad and Tobago. Int J Epidemiol 2003;32:508–16.
18. World Health Organization. WHO Child Growth Standards: length/height-for-age, weight-for length, weight-for-height and body mass index-for-age: methods and development. Geneva: WHO, 2006.
19. Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for measurement of household food access: indicator guide (v. 3). Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development, 2007.
20. Rutstein SO. Wealth versus expenditure: comparison between the DHS wealth index and household expenditures in four departments of Guatemala. Calverton, Md, USA: ORC Macro, 1999.
21. Dietz WH. Does hunger cause obesity? Pediatrics 1995;95:766–7.
22. Olson CM. Nutrition and health outcomes associated with food insecurity and hunger. J Nutr 1999;129:521S–4S.
23. Townsend MS, Peerson J, Love B, Achterberg C, Murphy SP. Food insecurity is positively related to overweight in women. J Nutr 2001;131:1738–45.
24. Romer C. Food insecurity and vulnerability in Nepal: profiles of seven vulnerable groups. ESA Working Paper No. 04-10. Rome: Food and Agriculture Organization, 2004.
25. International Institute for Population Sciences and Macro International. National Family Health Survey (NFHS-3), 2005–2006: India: Volume I. Mumbai: IIPS, 2007.
26. National Advisory Council (NAC) of the Government of India. National Food Security Bill 2011. New Delhi: NAC, 2011. Available at: nac.nic.in/pdf/nfsb_final.pdf.