Association Between Wasting and Food Insecurity Among Children Under Five Years: Findings from Nepal Demographic Health Survey 2016

CURRENT STATUS: UNDER REVISION

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DOI:
10.21203/rs.3.rs-15554/v1

SUBJECT AREAS
Health Economics & Outcomes Research  Health Policy

KEYWORDS
association, children, food insecurity, intervention, socio-demographic, wasting
Abstract

Background: Wasting is a consequence of food insecurity, poor access to appropriate, inadequate caring and feeding practices. The present study assessed association between wasting and household food insecurity among under five years children, along with other socio-demographics characteristics.

Methods: This study is a secondary analysis of Nepal Demographic and Health Survey 2016. The participants were children under five years of age and total children analyzed were 2414. Logistic regression was carried out to identify the risk factors of wasting using odds ratio and 95 percent confidence interval.

Results: The prevalence of wasting increased with the level of food insecurity from mild (9.4%) to moderate (10.8%) and to severe (11.3%). The highest proportions of wasted children were in Province 2 (14.3%), from rural areas (10.1%), born to mothers with no education (12.4%) and from a richer wealth quintile (11.3%). Children belonging to severe food insecure households had 1.36 (95% CI 0.72-2.57) adjusted odds of being wasted and 1.38 (95% CI 0.80-2.38) crude odds of being wasted. Children born to mothers without any education had 1.84 (95% CI 1.08-3.12) crude odds of being wasted than those born to mothers with higher education in the crude analysis; however, no association was seen in the adjusted analysis with adjusted odds of 1.35 (95% CI 0.71-2.59). For children living in Province 1, the crude odds was 2.18 (95% CI 1.06-4.51); however on adjusting for other variables, the odds decreased to 2.06 (95% CI 1.01-4.19). Those for Province 2, the crude odds was 2.74 (95% CI 1.46-5.14) and the adjusted odds was 2.45 (95% CI 1.22-4.95).

Conclusion: Considering the increment in childhood wasting as per level of food insecurity, an integrated intervention should be developed that addresses improving knowledge and behavior of community people on diet and nutrition as well as reducing the problem of food insecurity through agricultural interventions.
Background

Wasting is a severe phenomenon of losing weight and is often associated with acute starvation and severe disease [1]. Wasting, which is defined as the percentage of children aged 0 to 59 months, whose weight for height is below minus two standard deviations (moderate) and minus three standard deviations (severe wasting) from the median of the World Health Organization Child Growth Standards [1] affects 7.5 percent or 50.5 million children of under five years worldwide, of which 16 million are severely wasted [2]. More than half of all wasted children lived in South Asia in 2018 demanding a serious need of help with appropriate and adequate interventions [3]. In addition to this, wasting contributes to 4.7 percent of all deaths among children aged under 5 years globally and severe wasting is associated with 2 million deaths in a year since severely wasted children are 11 times more likely to die compare to healthy children [4]. The mortality rate elevates when a child is both stunted and wasted [4]. The Nepal Demographic Health Survey (NDHS) reported prevalence of wasting among children under five years in 2016 at 10 percent [5], which was reduced by one percent in five years from 11 percent in 2011 [6].

Wasting is a consequences of food insecurity, poor access to appropriate, inadequate caring and feeding practices such as exclusive breastfeeding or low quantity and quality of complementary food, unaffordable health care, lack of a sanitary environment including access to safe water, sanitation and hygiene services [7]. Children suffering from wasting are susceptible to long term developmental delays, vulnerable to several infections and face an increased risk of death, particularly when wasting is severe [2].

Household food insecurity is one of the underlying causes of wasting as suggested by the United Nations Children Fund conceptual framework of undernutrition [8], which this study has focused on. In Nepal, 51 percent of households are suffering from food insecurity and
do not have adequate access to food throughout the year [5]. In addition, nearly all households belonging to the poor economic status are victims of food insecurity [5]. Food insecurity positively correlates with undernutrition, as the threat of undernutrition increases with the level of food insecurity [9]. Less researches have been done in Nepal investigating the relationship between wasting and food insecurity and no definite evidences are available for recognizing the risk factors of childhood wasting and understanding the extent to which the risk factors contributes to wasting. In this respect, the objective of this study was to present the distribution of wasting according to various levels of food insecurity and socio-demographic characteristics and to measure the risk of wasting as determined by those circumstances to help policy makers and program planners to develop the health intervention adequately and appropriately as per the scientific evidence provided.

Methods

The data from Nepal Demographic and Health Survey (NDHS) 2016 was used for this study and secondary analysis was conducted with study population as children under five years. NDHS is a nationally representative cross sectional survey conducted every five years [10]. The sampling frame used for the NDHS 2016 is an updated version of the frame from the 2011 National Population and Housing Census, conducted by the Central Bureau of Statistics. The NDHS 2016 sample was stratified and selected in two stages in rural areas and three stages in urban areas. The detail of sampling is provided elsewhere [11]. The total number of children under five years analyzed in this study was 2414.

Variables

The outcome variable was wasting, and the main explanatory variable was food insecurity. The questionnaire for food insecurity was adopted from the United States Agency for International Development's Food and Nutrition Technical Assistance project [11]. The
questions were arranged in order of severity and frequency of occurrence, captured household perceptions of food vulnerability or stress and behavioral responses to food insecurity. Based on the responses, four food insecurity categories were created; i) food secure households, ii) mildly food insecure households, iii) moderately food insecure households, and iv) severely food insecure households. Other independent variables were based on the literature review and they were wealth quintiles, place of residence, mother's education, province and sex of child. Wealth quintile was recorded as (i) poorest (ii) poorer (iii) medium (iv) richer and (v) richest. The wealth quintile was based on household’s ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation [12]. Place of residence was categorized into (i) rural and (ii) urban. Mother’s education level was categorized into (i) no education (ii) primary (iii) secondary (iv) higher. Child sex was recorded as male and female and province was categorized as per the seven provinces of Nepal.

Statistical analysis

The 23rd version of Statistical Package for Social Science (SPSS) (IBM USA) was used for data analysis. Descriptive statistics was carried out to identify the frequency of wasting. Logistic regression was performed to identify the risk factors of wasting using odds ratio and 95 percent confidence interval (CI). P value < 0.05 was considered statistically significant for the association between wasting and explanatory variables. The sample-weighted data was taken into consideration during analysis. Complex sample analysis method was used to account for the study design and sample weight [13].

Ethics

Nepal Health Research Council and human research ethics committee in ICF Macro International approved NDHS 2016 [11]. Approval was taken from Independent Review Boards of New Era and ICF Macro International for all the data collection tools and
procedures for NDHS. The dataset was requested for access from DHS program website [11].

Results

Distribution of Wasted Children Under Five Years by Household Food Insecurity and Socio-demographic Characteristics

Table 1 shows the frequency and percentage of wasted and normal children below five years of age by household food insecurity, wealth quintiles, sex of child, mother’s education, place of residence and provinces. The prevalence of wasting in children below five years of age increased with the level of food insecurity from mild (9.4%) to moderate (10.8%) and to severe food insecurity (11.3%). Out of urban children, 9.2 percent were wasted in urban and 10.1 percent were wasted in rural areas. The highest proportions of wasted children were in Province 2 (14.3%), born to a mother with no education (12.4%) and were from a richer wealth quintile (11.3%). Additionally, chi-square tests showed significant associations between wasting and mother’s education ($P = 0.014$) and province ($P < 0.001$) respectively.
Table 1
Frequency and Percentage for Children Under Five Years by Household Food Insecurity and Socio-demographic Characteristics (n = 2414)

| Characteristics                      | Wasted (< -2 SD) | Normal (≥ -2 SD) |
|--------------------------------------|------------------|------------------|
|                                      | n                | %                | n                | %                |
| Household food insecurity (P = 0.496) |                  |                  |                  |                  |
| Secure                               | 88               | 8.9              | 900              | 91.1             |
| Mild                                 | 76               | 9.4              | 733              | 90.6             |
| Moderate                              | 41               | 10.8             | 339              | 89.2             |
| Severe                                | 27               | 11.3             | 211              | 88.7             |
| Wealth quintiles (P = 0.296)         |                  |                  |                  |                  |
| Poorest                              | 43               | 8.7              | 449              | 91.3             |
| Poorer                               | 48               | 9.1              | 478              | 90.9             |
| Middle                               | 58               | 10.6             | 491              | 89.4             |
| Richer                                | 59               | 11.3             | 465              | 88.7             |
| Richest                               | 23               | 7.2              | 298              | 92.8             |
| Sex of child (P = 0.837)             |                  |                  |                  |                  |
| Male                                 | 119              | 9.5              | 1134             | 90.5             |
| Female                               | 113              | 9.7              | 1048             | 90.3             |
| Mother’s education (P = 0.014)       |                  |                  |                  |                  |
| No education                         | 102              | 12.4             | 723              | 87.6             |
| Primary                              | 42               | 8.9              | 429              | 91.1             |
| Secondary                            | 64               | 8.6              | 684              | 91.4             |
| Higher                                | 23               | 7.3              | 293              | 92.7             |
| Place of residence (P = 0.408)       |                  |                  |                  |                  |
| Urban                                | 117              | 9.2              | 1161             | 90.8             |
| Rural                                | 115              | 10.1             | 1021             | 89.9             |
| Province (P < 0.001)                 |                  |                  |                  |                  |
| Province 1                           | 46               | 11.8             | 344              | 88.2             |
| Province 2                           | 95               | 14.3             | 570              | 85.7             |
| Province 3                           | 15               | 4.2              | 339              | 95.8             |
| Province 4                           | 11               | 5.9              | 176              | 94.1             |
| Province 5                           | 34               | 7.5              | 418              | 92.5             |
| Province 6                           | 11               | 7.1              | 144              | 92.9             |
| Province 7                           | 20               | 9.5              | 191              | 90.5             |

Children who slept in the household the night before the survey were selected for analysis. Data weighted according to DHS recommendations [13].

P value <0.05 was considered statistically significant for chi square test between wasting and explanatory variables.

Association Between Wasting and Household Food Insecurity and Socio-demographic Characteristics

Table 2 shows the crude odds ratio (COR) and adjusted odds ratio (AOR) with 95 percent CI for wasting and its relationship with household food insecurity, wealth quintiles, sex of child, mother’s education, place of residence and provinces. Children belonging to severe food insecure households had 1.36 (95% CI 0.72–2.56) adjusted odds of being wasted and 1.38 (95% CI 0.80–2.38) crude odds of being wasted than to those belonging to food secure households. Children born to mothers without any education had 1.84 (95% CI
1.08-3.12) crude odds of being wasted than those born to mothers with higher education in the crude analysis; however, no association was seen in the adjusted analysis with adjusted odds of 1.35 (95% CI 0.71-2.59). Children living in the rural areas were associated with increased odds of wasting compared to their urban counterparts in both crude and adjusted analysis. Similarly, in both the crude and adjusted analysis, children belonging to Province 1 and 2 had higher odds of wasting relative to children belonging to Province 7. For children living in Province 1, the crude odds was 2.18 (95% CI 1.06-4.51); however on adjusting for other variables, the odds decreased to 2.06 (95% CI 1.01-4.19). Those for Province 2, the crude odds was 2.74 (95% CI 1.46-5.14) and the adjusted odds was 2.45 (95% CI 1.22-4.95).

Table 2
COR and AOR with 95% CI between Wasting and Household Food Insecurity and Socio-demographic Characteristics (n = 2414)

| Variables               | COR  | 95% CI | AOR  | 95% CI |
|-------------------------|------|--------|------|--------|
|                         | Lower|        | Upper|        |
| Household food Insecurity |     |        |      |        |
| Secure                  | 1    |        | 1    |        |
| Mild                    | 1.08 | 0.75   | 1.54 | 0.98   |
| Moderate                | 1.24 | 0.75   | 2.06 | 1.13   |
| Severe                  | 1.38 | 0.80   | 2.38 | 1.36   |
| Wealth quintile         |      |        |      |        |
| Poorest                 | 1.225| 0.68   | 2.22 | 1.00   |
| Poorer                  | 1.316| 0.72   | 2.40 | 0.87   |
| Middle                  | 1.513| 0.88   | 2.60 | 0.86   |
| Richer                  | 1.625| 0.89   | 2.95 | 1.15   |
| Richest                 | 1    |        | 1    |        |
| Sex of child            |      |        |      |        |
| Female                  | 1.03 | 0.75   | 1.42 | 1.05   |
| Male                    | 1    |        | 1    |        |
| Mother's education      |      |        |      |        |
| No education            | 1.84 | 1.08   | 3.12 | 1.35   |
| Primary                 | 1.27 | 0.68   | 2.37 | 1.04   |
| Secondary               | 1.21 | 0.68   | 2.16 | 1.07   |
| Higher                  | 1    |        | 1    |        |
| Place of residence      |      |        |      |        |
| Rural                   | 1.13 | 0.82   | 1.56 | .99    |
| Urban                   | 1    |        | 1    |        |
| Province                |      |        |      |        |
| Province 1              | 2.18 | 1.06   | 4.50 | 2.06   |
| Province 2              | 2.74 | 1.46   | 5.14 | 2.45   |
| Province 3              | 0.70 | 0.30   | 1.64 | 0.64   |
| Province 4              | 1.34 | 0.67   | 2.69 | 1.24   |
| Province 5              | 1.32 | 0.63   | 2.76 | 1.15   |
| Province 6              | 1.66 | 0.82   | 3.37 | 1.54   |
| Province 7              | 1    |        | 1    |        |

Children who slept in the household the night before the survey were selected for analysis. Data weighted according to DHS recommendations [13]. Complex sample analysis method was used to account for the study design and sample weight.
Discussion

The objective of this study was to present the distribution of wasting according to socio-demographic circumstances with a focus on household food insecurity and to measure the risk of wasting as determined by those risk. In this study, the prevalence rate of wasting among assessed children was noted higher among children from food insecure than among children from food secure households since 60 percent of the children under five years of age belonged to food insecure households. Of that 60 percent, mildly food insecure household covered one-third (33.5%), moderately and severely covered 15.7 and 10 percent respectively. Additionally, the prevalence of wasting among children under five years increased with levels of food insecurity as the adjusted odds ratio (as well as prevalence) increased from 0.98 (95% CI 0.64–1.50) to 1.14 (95% CI 0.65–1.98) and to 1.36 (95% CI 0.71–2.57) from mild (prevalence 9.4%) to moderate (prevalence 10.8%) and severe (prevalence 11.3%) food insecurity respectively, which is in accordance with the study of John et al. reporting a dose-response relation between severity of food insecurity and children’s nutritional health [14]. In addition to this, moderate and severe food insecurities were also significantly associated with wasting in low and middle income countries such as Bangladesh and Vietnam in the adjusted analysis [15]. However, no significant association was found in the present study although the prevalence increased incrementally with food insecurity. This was surprising given the already established association of food insecurity and children nutritional status by UNICEF conceptual framework of undernutrition. This might have been due to the small intersection sample size of wasted children and children belonging to food insecure households. A larger study is recommended to further understand this relationship in Nepal.

The thematic report on food security and nutrition had shown greater prevalence of wasting in female (36.1%) than male children (33.8%), which contradicts the findings of
the present study showing similar prevalence of wasting among male (9.5%) and female (9.7%) children. Harding et al., however, reported that sex was not significantly associated with wasting in Nepal aligning with the present study [16]. They also noted that the association was noted significant in data of other low income countries such as Afghanistan, India, Bangladesh, and Pakistan [16].

Less variation was noted in the prevalence of wasting among the wealth quintiles in 2016. The maximum prevalence was noted in richest quintile (7.2%) and minimum prevalence was noted in richer quintile (11.3%) compare to the variation of 7.4 percent (in richest quintile) as maximum to 12.8 percent (in middle quintile) as minimum in 2011. Similarly, while the under five years children belonging to the poorest quintile had prevalence of 8.7 percent, which is unexpectedly close to the prevalence of wasting among children belonging to the highest (richest) wealth quintile (7.2%) and also represents the second most lowest prevalence rate among the wealth quintiles. In 2011 NDHS reported the prevalence of wasting among children under five peaked at middle (12.8%) and then at the poorest (12.5%) wealth quintiles [6]. The lowest prevalence shifted from middle quintile in 2011 to the richer quintile in 2016. This might be due to a shift of overall population belonging to the poorest and poorer wealth quintile towards middle and richer wealth quintile as a part of a rise in economic condition as characterized by data on Gross Domestic Product from The World Bank [17]. The Gross Domestic Product has risen from 18.9 to 21.2 to 28.8 from 2011 to 2016 and to 2018 respectively [17]. Also, no significant relationship was found between wasting and wealth quintiles in this study as in other previous studies [18–23], which could have been affected by the above mentioned statement on less variation in prevalence and shift of wasting pattern in terms of wealth quintiles. This finding is supported by a study on trends in stunting with four NDHSs, which has also shown reduction from 25.7 to 20.5 percent (from 2011 to 2016) in
proportion of stunted children under five years age among those belonging to a poorer wealth quintile whereas an increment was observed among those belonging to a richer wealth quintile from 16.9 to 21.7 percent from 2011 to 2016, [21] similar to the present study. However, a multinational cohort study conducted in Ethiopia, India, Peru and Vietnam found children belonging to the lowest wealth quintile households had significantly increased probabilities of being wasted in all four countries in comparison to children belonging to the highest wealth quintile households [24]. This is not consistent with the result of the present study having noted higher prevalence of wasting among middle and richer wealth quintiles children.

The highest prevalence of wasting was also noted among Province 2, which might be due to large volume of underprivileged people suffering from lack of basic facilities such as education and health [25]. Additionally, Nepal Multidimensional Poverty Index 2018 reports more than 47.9 percent of people living in Province 2 (second highest populated province holding 18.4%) are multidimensionally poor, which is greater by almost 20 percent than that of the national average (28.6%) [26].

Additionally, the Demographic and Health Surveys of 15 sub-Saharan African countries showed that urban-rural differentials are considerable in all countries, that they have narrowed in most countries primarily due to an increase in urban undernutrition [27]. An another study done in Nepal mentioned that a significantly higher prevalence of wasting was noted in rural areas as compared to urban areas [28]. Aligning with these studies, the prevalence of wasting in the present study was slightly higher among children living in rural (10.1%) than those living in urban (9.2%) and the highest proportion of wasted children were born to a mother without education (12.4%), which is similar to the finding of a thematic report on nutrition and food security stating the highest proportion (43.3%) of the undernourished children born to a mother without education [28].
Asfaw and team in Southern region of Ethiopia shows a significant association between mother's education and all three indicators of undernutrition (stunting, wasting and underweight) [29] again in agreement with the present study. A significant relationship was also found between wasting and provinces in the present study. A higher prevalence was found in Province 1 and 2. The odds ratio after the adjustment fell from COR 2.18 (95% CI 1.06–4.50) to AOR 2.06 (95% CI 1.01–4.19); however, it remained significant.

Due to cross-sectional nature of the study, the causal inference between wasting and study variables could not be estimated. However, this study has given provincial level information on wasting, which is not available in other studies of Nepal and is highly beneficial for formulating provincial level policies. The provincial level information on wasting would bring the focus on the current need of each province and this information would support the design of intervention within various provinces. The study warrant a high precision of the findings due to large sample size representing national population. Reliable and comparable standardized tools were used.

Conclusion

The prevalence of wasting increased with the level of food insecurity from mild to moderate and to severe. Considering this increment, the intervention addressing wasting should also consider addressing the problem of food insecurity rather than keeping the focus on improving the knowledge and behavior of community people on diet and nutrition. The governmental and non-governmental interventions should target the food insecure households to improve the child wasting. Besides, socio-economic dimensions of wasting should be incorporated into the nutritional interventions to bring those vulnerable out of suffering. Lastly, policies that promote availability, access, and consumption of diverse nutrient rich foods need to be encouraged, especially for those vulnerable groups where such foods have the potential to reduce the impacts of food insecurity.
List Of Abbreviations
AOR Adjusted Odds Ratio
CI Confidence Interval
COR Crude Odds Ratio
DHS Demographic Health Survey
EA Enumeration Areas
GDP Gross Domestic Product
NDHS Nepal Demographic Health Survey
PSU Primary Sampling Unit
UNICEF United Nations Children Fund
USAID United States Agency for International Development
WHO World Health Organization

Declarations
Ethics approval and consent to participate
Nepal Health Research Council and human research ethics committee in ICF Macro International approved NDHS. Approval was taken from Independent Review Boards of New Era and ICF Macro International for all the data collection tools and procedures for NDHSs. The dataset was requested for access to DHS program website. Informed consent was taken from participants before interviewing them. Mothers or care takers provided consent incase of children. The details are mentioned in the NDHS 2016 report.
Consent for publication
Not Applicable
Availability of data and material
The data that support the findings of this study are available from the DHS website but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available upon
reasonable request.

Competing interests
The authors declare that they have no competing interests.

Funding
No funding was available for this study

Authors' contributions
SN designed the study, performed the statistical analysis, interpreted the findings and discussion and wrote the first draft of the manuscript. ID and PS contributed in statistical analyses, interpretation of findings and contributed in manuscript writing. All the authors contributed in revision and have agreed on the final version of the manuscript.

Acknowledgements
Firstly, we would like to thank the Measure DHS program for providing access to DHS datasets. Secondly, we are sincerely grateful to all the mothers and children who were interviewed during the surveys.

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