A Community-based Survey of Household Food Insecurity and Associated Factors Among 2-6 Years Old Children in the Southeast of Iran

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Abstract

Background:

To investigate the status of household food security and factors affecting it among 2-6 years old children in an urban area in the southeast of Iran.

Methods:

A community-based survey was conducted from September to January 2018 on 450 children aged 2-6 years who were selected using stratified cluster random sampling. They lived in six different areas in an urban area in the southeast of Iran. Data was collected using the U.S. Department of Agriculture Food Security questionnaire and anthropometric measurements.

Results:

The prevalence of food insecurity among children was 81.7% consisting of 2.6% without hunger, 9.2% with moderate hunger and 96.9% with severe hunger. The weight gains of those children who were in the insecurity group without hunger was 2.63 times lower than those children in the food security group. Also, chances of weight gain in the insecurity group without hunger and in the insecurity group with moderate hunger were less as 1.91 and 1.41 times, respectively.

Conclusions:

Food insecurity in children aged 2-6 years was influenced by various socio-demographic factors. Therefore, policy-makers should plan for improving the quality of life and health of the children through improving their food security.

Introduction

Food insecurity as a global challenge can lead to humanitarian catastrophes worldwide. The Food and Agriculture Organization of the United Nations (FAO) has stated that “for the first time since 1970, more than one billion people, about 100 million more than the last year and around one-sixth of all of humanity, are esurient and malnourished worldwide” (1). Food insecurity is associated with starvation and destitution and is considered a global universal public health problem with long-time negative consequences for children’s health(2). Also, it is a risk factor for child’s growth, because appropriate nutrition and adequate meal affect child’s well-being, physical, mental and social development and his/her future health and welfare (3). In the study of Victora et al. (2008), those children who suffered from food insecurity were more likely to experience life issues during adulthood in terms of poor education outcomes and lower economic status. It is believed that nutritious foods are required for proper growth and development. Sufficient calcium intake increases bone density, helps teenagers’ grow and reduces the venture of hip fracture in later adulthood (4). Therefore, the health, and growth and development of children are top priorities of in all societies(5). Concerns about food insecurity at the household level consist of an obvious association between food insecurity and poor health, insufficient food consumption, cognitive and academic decline and psychosocial problems in children (6, 7).

Background in Iran

While significant progress has been made in the reduction of the proportion of malnourished children over the past three decades, malnutrition remains a major public health issue in developing and transitional countries(8). In addition, household food insecurity is recognized as a major factor influencing malnutrition. Therefore, food insecurity is a major indicator of the nutritional status in low-income societies(9). A recent report by Shahraki et al. (2016) has showed that chronic malnutrition measured by stunting affected 32.5% of children in Iran. According to the National Survey of Iranian Children, there is significant nutritional diversity in all parts of Iran, and the poorest indices have been reported in the southeast of Iran(10). It has been estimated that 20-60% of households in Iran suffer from food insecurity. Similarly, an inappropriate child food security status is more common in poor provinces such as in the southeast part of Iran(11). However, a few studies have been conducted on food insecurity in this urban area and no study has been conducted to investigate food insecurity and its associated factors in order to help the use of scarce resources where it can have the greatest impact on food security(12). Assessment of the state of food insecurity among households and the investigation of factors affecting childhood stunting is of paramount importance to design improvement nutrition strategies(13). Therefore, this study aimed to investigate the household food security and identify factors affecting it among 2-6 years old children in an urban area in the southeast of Iran.

Methods

Study design

A community-based cross-sectional survey was conducted from September to January 2018. This research was conducted in an urban area in the southeast of Iran with the highest rate of children malnutrition among Iranian households(5).

Participants

Children aged 2-6 years and children's mothers or their primary caretakers of both genders were recruited. Given the role of mothers and the children's primary caregivers for feeding them, they were included to this research. On the other hand, unwillingness to take part in the study and metabolic, and congenital or chronic diseases in children led to their exclusion.

Data collection

Sampling

A multi-stage cluster sampling method was used to recruit the participants. Given a confidence level of 95% and a maximum linear estimate of 0.04%, the sample size was estimated 450 people. Therefore, data from 450 children aged 2-6 years from 6 different areas of the city were collected by three members of the research team who were trained in workshops for 2 days and were asked to participate in a field experiment before starting actual data collection. The performance of the data collectors was supervised and evaluated by the principal investigator to ensure the quality and reliability of collected data.

Instruments

Data about the socio-demographic characteristics of the participants including child's gender and age, parent's education level, parent's occupation, access to water and water closet (WC), disease history, birth weight, birth height, arm circumference and also food security among household were collected through face-to-face interviews with the children's mothers.

Food insecurity in the last 12 month was assessed using the 18-item U.S. Department of Agriculture (USDA) Core Food Security Module questionnaire(14, 15). It consists of food insecurity constructs of 'quantity of food', 'quality of food', 'food acceptability' and 'certainty of getting food' (16). It has been translated to Farsi and validated in the Iranian context (17). The children's mothers were requested to fill out the questionnaire and the food security status of each household was estimated based on the participants' responses. Each response was coded as 'affirmative' or 'negative' using a two-choice scale of 'yes' or 'no'. For those questions with more than two responses, 'often' and 'sometimes' was affirmative (value= 1), and 'never' was considered negative (value= 0). The coded responses were used to calculate an ordinal score in which 0 corresponded the most food-security households and 18 corresponded the most food-insecurity households. Finally, households were categorized into four groups using cutoff points proposed by Bickel et al. (2000) as follows: 'food secure households' (0–2 affirmative responses); 'food insecure without hunger households' (3–7 affirmative responses); 'food insecure with moderate hunger households' (8–12 affirmative responses); and 'food insecure with severe hunger households' (13–18 affirmative responses).

Five questions specifically referred to the children's experiences for constructing a measure of children's food insecurity across households. Three or more affirmative responses in the five child-specific questions indicated a household with child food insecurity. The cutoff point was selected, because it represented a reduction in the quality and quantity of food that was directly available to children and identified a more serious form of food insecurity than household-based ones(14, 18).

The height of the children standing without shoes was measured using a precision of 0.1 cm using a tape measure mounted on a wall. Their weight with minimum clothing and without any shoes was measured using a calibrated scale (Seca®, Germany) with a precision of 0.1 kg. After collecting anthropometric data, the WHO Anthro software was used to assess the children's growth indices. The Z-scores of weight-for-age, height-for-age, and weight-for-height were calculated to determine the severity and prevalence of children's underweight, stunting and weight loss. The weight for age (underweight) index was divided into five categories: severe underweight ($z < -3$); underweight ($-2 < z < -1$); normal ($-1 < z < +1$); overweight ($z > +2$); and obese ($z > +3$). The height for age (stunting) index was divided into four categories: severe stunting ($z < -3$); stunting ($-3 \leq z \leq -2$); normal ($-2 \leq z \leq +3$); and tall stature ($z > 3$). The weight for height (wasting) index was divided into six groups: severe wasting ($z < -3$); wasting ($-3 < z < -2$); normal ($-2 < z < +1$); overweight ($+1 < z < +2$); obese ($+2 < z < +3$); and severe obese ($z > +3$).

Data analysis

Descriptive data analysis consisted of frequencies and proportions. Bivariate analysis estimated the crude effects of each covariate on the food security status. The chi-squared test was used to examine the correlation between variables. If a variable showed a significant

association in the bivariate model, it was considered a candidate variable for the multivariable model. The adjusted strength of each variable was examined using the multivariate ordinal logistic analysis. The odds ratio was calculated using the ordinal logistic regression model. The anthropometric and the logistic regression results were presented as proportions and adjusted odds ratios (AORs), respectively using 95% confidence intervals (CIs). All data analysis was performed using the SPSS software v.18 (IBM SPSS Inc., Chicago, IL, USA). $P < 0.05$ was considered statistically significant.

Results

Given unreliable and missing data, four questionnaires were excluded from the data analysis. Therefore, the data analysis was performed on data collected from 421 people.

Demographic characteristics

The mean age of the children was 3.37 ± 1.07 years. The majority of them (54.1%) were male and in the age group of three years (35.4%). Also, 61.52%, 35.86% and 2.7% of the children had normal weight, and were underweight and overweight, respectively (Table 1).

Food security status and weight for age

The distribution of the children's food security status by weight for age in the groups was reported in table 1. Accordingly, 18.3% were in food security, 2.6% in the insecure without hunger, 9.2% in the insecure with moderate hunger, and 69.9% in the insecure with severe hunger.

Statistically significant relationships were observed between maternal education, access to drinking water and birth weight ($p < 0.01$). Regarding weight, 76.6% of the children in the food security group, 90% in the insecure group without hunger, 69.2% in the insecure with moderate hunger group and 55.4% in the insecure with severe hunger group had normal weight ($p < 0.01$). Also, it was found that 53.7% of the children with literate mothers, 63.6% with mothers who had under diploma education, and 71.8% with mothers who had diploma or higher education had normal weight for age. In addition, 63.1% of the children who had access to drinking water had a normal weight. On the other hand, 64.2% of the children who had birth weight more than 2,500 grams had normal weight and 54% of those with birth weight less than 2,500 grams were underweight.

Food security status and height for age

Furthermore, maternal education, access to WC and birth weight were significantly associated with height for age ($P < 0.01$). Height for age was normal in 76.6% of the children in the food security group. Also, 63.6% of the children in the insecure without hunger group, 69.2% in the insecure with moderate hunger group, and 55.1% in the insecure with severe hunger group had normal height ($p < 0.01$) (Table 2). Moreover, 53% of the children with literate mothers, 63% with under diploma education level and 69% with diplomas and higher education level had normal height for age. It was found that 64% of the children who had access to sanitation as water closet (WC) were in the normal weight range, while 55% of the children who did not have any access to WC were stunting. While 64% of the children who had birth weight more than 2,500 grams were in the normal height range, 55.7% of those who had birth weight less than 2,500 grams were stunting ($p < 0.01$).

Food security status and weight for height

There was a statistically significant relationship between access to WC, birth height and arm circumference with weight for height ($p < 0.01$). In the children with food security, 74% had normal weight for height. All children in the insecure group without hunger had normal weight for height. Also, 69.2% of the insecure children in the moderate hunger group and 70.4% of the insecure children in the severe hunger group were classified as normal weight for height (Table 3). Moreover, 71.1% of the children who had access to WC and 74% of the children without it had normal weight for height. It was reported that 71.7% of the children with birth height more than 45 cm and 72% with birth height less than 45 cm had a normal weight for height. Overall, 72% of the children with arm circumference greater than 11.5 cm had normal weight, but 50% of the children with arm circumference less than 11.5 cm were wasted.

The logistic regression model of food security

The model of ordinal logistic regression showed statistically significant relationships between the children's food security and weight for age in the presence of confounding variables. The weight gain was 2.63 times lower in the children in the food insecurity group than in those without food security (95% confidence: -1.41, -4.952). There was no statistically significant relationship between the children in the insecure group with moderate hunger and the insecure group with severe hunger with regard to weight for age (Table 4).

Converting the children's food security status from food insecurity to insecurity without hunger and insecurity with moderate hunger showed that the chances of height rise were less as 1.91 times (95% confidence interval: -1.01, -3.66) and 1.41 times (95% confidence interval: 0.69, -3.45), respectively. Also, no statistically significant relationship was reported between the children in the insecure group with severe hunger and height for age (Table 5).

In addition, there was no statistically significant relationship between the children's food security status and weight for height in any of the food security groups (Table 6).

Discussion

This study was conducted to investigate the status of household food security and factors affecting it among 2-6 years old children in an urban area in the southeast of Iran.

In this study, associations between household demographic characteristics and household food insecurity were reported. Also, there were relationships between household food insecurity and underweight, stunting and weight loss. A study in Colombia showed that children with food insecurity households were three times more likely to lose weight, but stuttering had no association with food insecurity in the family (19). In contrast, a study in South Korea showed a significant relationship between insecurity and overweight (7). These controversial findings appear to be partly due to differences in the module used to assess the families' food security status, age group of samples, reference used to determine the children's nutritional status, and sample size. According to the WHO's malnutrition classification, stunting, underweight, and weight loss are considered very serious or critical, high or serious in communities with the percentages of 30–39.9%, 20–29.9% and 10–14.9%, respectively(20, 21). Accordingly, the prevalence of malnutrition in terms of underweight and stunting was in the very high range and weight loss was in the critical range.

We found that the prevalence of mild, moderate and severe household food insecurity were 2.8%, 9.1%, and 69.7%, respectively. According to previous studies, the rates of moderate and severe household food insecurity in Nepal, Haromaya District, Ethiopia, Kailali District of Nepal and Tabriz city in Iran were 23.2% , 19.0 % , 39.7 % , 69% and 30%, respectively(22-25). Those were less than the rate in our study. However, such a difference should be interpreted with caution, because these studies have not used the same module to measure food insecurity. Also, other studies in different provinces of Iran have reported various degrees of food insecurity depending on development conditions. A study in Isfahan city showed the prevalence of food insecurity among households with children aged 14-17 years was 36.6% (26). The results of the food security study in Yazd city indicated that 32.9% of households with children aged 6-12 years had food insecurity (27) .

Our study results showed that those children who began supplemental feeding earlier and before 6 months were 2.41 times more at the risk of stunting than those children who began supplemental feeding befittingly at 6–8 months. According to the WHO, children should start supplement feeding at the age of 6-8 months (28). A study in West Gojam showed that children with delayed supplemental feeding were at the higher risk of stunting (22).

In our study, food insecurity was the same in boys and girls, which was consistent with the Burkina Faso's finding(29). Also, food insecurity was prevalent and was associated with socio-demographic factors among households with pre-school children in southeastern Iran and Ethiopia (30, 31). In contrast, studies in Southwest Ethiopia showed that the mean score of food security was higher in females (32, 33) . In developing countries, differences have been found in the allocation of household resources by location within the household. Therefore, women are mostly found to be disadvantaged due to the culture of less valuing them than men(34). Gender bias may also have been reflected in the allocation of resources for children. For example, boys benefit from the allocation of food resources in Philippines and Nepal(15). In the present study, a negative association between the mother's occupation status and the food security status was found as households with unemployed mothers had higher food security. However, no such an association was observed between the father's occupation status and the food security status. Conversely, a significant relationship has been found between the father job status and food insecurity(15, 35). A study in Nepal reported that households with working mothers usually had a greater food expenditure and a higher degree of food security, because of their contribution to total household income (36) . The influence of food security in the nutritional status of children is mediated by the mother's knowledge of child nutrition and health, maternal nutritional status, intra-household food allocation and utilization, access to health services and healthy environmental conditions. For instance, the distribution of food within the family is associated with the hierarchical position in which the head of the family is given a higher priority, while mothers and children receive less share of family's food compared to what they need (15, 37).

Since data was collected using self-report questionnaires, non-response bias could be a limitation of our study. In addition, cause-and-effect relationships could not be found using data collected from this cross-sectional survey. However, our study can provide valuable data

on food security among households with children aged 2-6 years in the southeast of Iran and have implications for future research and policy making.

Conclusion

This study showed that food insecurity was prevalent in households with children aged 2-6 years living in southeast of Iran. Since early childhood is the most important developmental phase in the human's life, designing and implementing strategies to improve access to food and enhance maternal nutritional knowledge should be considered by policy-makers to enhance food security and quality of life among children aged 2-6 years.

List Of Abbreviations

WC: Water closet

USDA: U.S. Department of Agriculture

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

The ethical approval was obtained from the Ethics and Research committee affiliate with the University of Medical Sciences in which the corresponding author (MS) worked under the code of IR.IRSHUMS.REC.1394.7.

Consent for publication

The parents and caregivers of the children were ensured of anonymity and confidentiality of data. Therefore, they gave consent for the publication of our findings.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

The authors of this article have met the following criteria: Substantial contributions to the development of study concept and design (S.A., M.S.), acquisition of data and analysis (S.A., M.S., F.D. and M.J.), interpretation of data and drafting the article or revising it critically for important intellectual content (S.A., M.S., F.D., M.J. and M.V.), approval of the final version to be published (S.A., M.S., F.D., M.J. and M.V.).

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References

1. FAO. The state of food insecurity in the world: Economic crises-impacts and lessons learned. FAO Roma; 2009.

2. Haque MA, Farzana FD, Sultana S, Raihan MJ, Rahman AS, Waid JL, et al. Factors associated with child hunger among food insecure households in Bangladesh. *BMC Public Health*. 2017;17(1):205.
3. Nord M. Food Insecurity in Households with Children: Prevalence, Severity, and Household Characteristics. *Economic Information Bulletin Number 56*. US Department of Agriculture. 2009.
4. Kalkwarf HJ, Khoury JC, Lanphear BP. Milk intake during childhood and adolescence, adult bone density, and osteoporotic fractures in US women. *Am J Clin Nutr*. 2003;77(1):257–65.
5. Moridi G, Fathi M. The prevalence of malnutrition and associated factors in children under 5 years age in Iran. *J Nurse Midwifery*. 2009;19:47–53.
6. Kaiser LL, LAMP CL, JOHNS MC, SUTHERLIN JM, HARWOOD JO, MELGAR-QUIÑONEZ HR. Food security and nutritional outcomes of preschool-age Mexican-American children. *J Am Diet Assoc*. 2002;102(7):924–9.
7. Oh S-Y, Hong M. Food insecurity is associated with dietary intake and body size of Korean children from low-income families in urban areas. *Eur J Clin Nutr*. 2003;57(12):1598–604.
8. De Onis M, Blössner M, Borghi E, Frongillo EA, Morris R. Estimates of global prevalence of childhood underweight in 1990 and 2015. *Jama*. 2004;291(21):2600–6.
9. Ali Naser I, Jalil R, Wan Muda WM, Nik W, Suriati W, Mohd Shariff Z, et al. Association between household food insecurity and nutritional outcomes among children in Northeastern of Peninsular Malaysia. *Nutrition research practice*. 2014;8(3):304–11.
10. Sheykhi M, EFTEKHARI NM, HADIPOUR M, ESMAILLADEH A. Prevalence of stunting, underweight and wasting according to national center for health statistics criteria in rural children aged under six years in Zahedan, Iran, in 2010. 2013.
11. Alimoradi Z, Kazemi F, Estaki T, Mirmiran P. Household food security in Iran: systematic review of Iranian articles. *Advances in Nursing Midwifery*. 2015;25(87):63–76.
12. Barrett CB. Measuring food insecurity. *Science*. 2010;327(5967):825–8.
13. Berhanu G, Mekonnen S, Sisay M. Prevalence of stunting and associated factors among preschool children: a community based comparative cross sectional study in Ethiopia. *BMC Nutrition*. 2018;4(1):28.
14. Bickel GNM, Price C, Hamilton W, Cook J. Guide to measuring household food security(PDF). USDA Food and Nutrition Service. 2000.
15. Shahraki SH, Amirkhizi F, Amirkhizi B, Hamed S. Household food insecurity is associated with nutritional status among Iranian children. *Ecology of food nutrition*. 2016;55(5):473–90.
16. Hamilton WLCJ, Thompson WL, Buron LF, Frongillo EA, Olson CM, Wehler CA. Household Food Security in the United States in 1995 Technical report of the food security measurement project. Washington DC, United States Department of Agriculture. 1997.
17. Rafiei M, Nord M, Sadeghizadeh A, Entezari MH. Assessing the internal validity of a household survey-based food security measure adapted for use in Iran. *Nutr J*. 2009;8:28.
18. Nord M, Bickel W, States G. U. Measuring children's food security in U.S. households, 1995–19992002.
19. 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(12):2747–55.
20. De Onis M, Blössner M, World Health Organization. Programme of N. WHO global database on child growth and malnutrition / compiled by Mercedis de Onis and Monika Blössner. Geneva: World Health Organization; 1997.
21. WHO Global Database on Child Growth and Malnutrition
Organization WH. WHO Global Database on Child Growth and Malnutrition 1997 [Available from:
https://apps.who.int/iris/bitstream/handle/10665/63750/WHO_NUT_97.4.pdf;jsessionid=3CCD881673193D0A3CFB4DF6C754751C?sequence=1.
22. Sreeramareddy CT, Ramakrishnareddy N, Subramaniam M. Association between household food access insecurity and nutritional status indicators among children aged < 5 years in Nepal: results from a national, cross-sectional household survey. *Public Health Nutr*. 2015;18(16):2906–14.
23. Abdurahman AA, Mirzaei K, Dorosty AR, Rahimiforushani A, Kedir H. Household Food Insecurity May Predict Underweightand Wasting among Children Aged 24–59 Months. *Ecology of food nutrition*. 2016;55(5):456–72.
24. Osei A, Pandey P, Spiro D, Nielson J, Shrestha R, Talukder Z, et al. Household food insecurity and nutritional status of children aged 6 to 23 months in Kailali District of Nepal. *FoodNutr Bull*. 2010;31(4):483–94.
25. Alipour B, Abbasalizad Farhangi M, Asghari S, Amirkhizi F, Dahri M, Abedimanesh N, et al. Child-specific food insecurity and its sociodemographic and nutritional determinants among Iranian schoolchildren. *Ecol Food Nutr*. 2016;55(3):231–40.

26. Rafiei M, Rastegari HA, Ghiasi M, Shahsanaie V. Household food security in Isfahan based on current population survey adapted questionnaire. *International journal of preventive medicine*. 2013;4(12):1421.
27. Karam SZ, DOROSTI MA, Eshraghian M, Siasi F. JAZAYERI AA. Obesity and food security in Yazd primary school students. 2007.
28. Organization WH. Infant and young child feeding 2020 [Available from: <https://www.who.int/news-room/fact-sheets/detail/infant-and-young-child-feeding>].
29. Haddad L, Reardon T. Gender bias in the allocation of resources within households in Burkina Faso: a disaggregated outlay equivalent analysis. *J Dev Stud*. 1993;29(2):260–76.
30. Hamed Shahrahi S, Amirkhizi F, Amirkhizi B, Hamed S. Household Food Insecurity Is Associated with Nutritional Status among Iranian Children 2016. 1–18 p.
31. Hadley C, Lindstrom D, Tessema F, Belachew T. Gender bias in the food insecurity experience of Ethiopian adolescents. *Soc Sci Med*. 2008;66(2):427–38.
32. Belachew T, Hadley C, Lindstrom D, Gebremariam A, Michael KW, Getachew Y, et al. Gender differences in food insecurity and morbidity among adolescents in southwest Ethiopia. *Pediatrics*. 2011;127(2):e398–405.
33. Belachew T, Lindstrom D, Hadley C, Gebremariam A, Kasahun W, Kolsteren P. Food insecurity and linear growth of adolescents in Jimma Zone, Southwest Ethiopia. *Nutr J*. 2013;12:55.
34. DeRose LF, Das M, Millman SR. Does Female Disadvantage Mean Lower Access to Food? *Popul Dev Rev*. 2000;26(3):517–47.
35. Mohammadzadeh A, Dorosty A, Eshraghian M. Household food security status and associated factors among high-school students in Esfahan. *Iran Public health nutrition*. 2010;13(10):1609–13.
36. Mohd Shariff Z, Khor GL. Indicators and Nutritional Outcomes of Household Food Insecurity among a Sample of Rural Malaysian Women 2004.
37. Motbainor A, Worku A, Kumie A. Stunting Is Associated with Food Diversity while Wasting with Food Insecurity among Underfive Children in East and West Gojjam Zones of Amhara Region, Ethiopia. *PloS one*. 2015;10(8):e0133542-e.

Tables

Table 1. The participants’ socioeconomic and demographic characteristics by weight for age

Variable	N (%)	Weight for age			P value*
		Underweight	Normal	Overweight	
		N (%)	N (%)	N (%)	
Gender					
Female	193(45.9)	70(36.3)	121(62.7)	2(1.0)	0.17
Male	228(54.1)	81(35.5)	138(60.5)	9(4.0)	
Father's education level					
Illiterate	120(285)	51(42.5)	67(55.8)	2(1.7)	0.23
Under diploma	200(45.5)	72(36.0)	122(61.0)	6(3.0)	
Diploma/university	101(24.0)	28(27.7)	70(69.3)	3(3.0)	
Maternal education					
Illiterate	149(35.4)	66(44.3)	80(53.7)	3(2.0)	<0.01
Under diploma	187(44.4)	66(35.3)	118(63.1)	3(1.6)	
Diploma/academic	85(20.2)	19(22.4)	61(71.8)	5(5.9)	
Access to water					
Yes	363(86.2)	128(35.3)	229(63.1)	6(1.7)	<0.01
No	58(13.8)	23(39.7)	30(51.7)	5(8.6)	
Access to W.C					
Yes	339(80.5)	118(34.8)	214(63.1)	7(2.1)	0.19
No	82(19.5)	33(40.2)	45(54.9)	4(4.9)	
Background disease					
Yes	61(14.5)	28(45.9)	33(54.1)	0(0.0)	0.10
No	360(85.5)	123(34.2)	226(62.8)	11(3.1)	
Birth weight					
>2500	358(85.0)	117(32.7)	230(64.2)	11(3.1)	<0.01
<2500	63(15.0)	34(54.0)	29(46.0)	0(0.0)	
Household food security status					
Food security	77(18.3)	14(18.2)	59(76.6)	4(5.2)	<0.01
Insecure without hunger	11(2.6)	1(9.1)	10(90.9)	0(0.0)	
Insecure with moderate hunger	39(9.2)	9(23.1)	27(69.2)	3(7.7)	
Insecure with severe hunger	294(69.9)	127(43.2)	163(55.4)	4(1.4)	

Table 2. The participants' socioeconomic and demographic characteristics by height for age

Variable	N (%)	Height for age			P value*
		Stunting	Normal	Tall	
		N (%)	N (%)	N (%)	
Gender					
Female	193(45.9)	69(35.8)	123(63.7)	1(5.0)	0.28
Male	228(54.1)	92(40.4)	132(57.9)	4(1.8)	
Father's education					
Illiterate	120(28.5)	55(45.8)	64(53.3)	1(0.8)	0.06
Under diploma	200(45.5)	76(38.0)	120(60.0)	4(2.0)	
Diploma/university	101(24.0)	30(29.7)	71(70.3)	0(0.0)	
Maternal education					
Illiterate	149(35.4)	69(46.3)	79(53.0)	1(0.7)	0.01
Under diploma	187(44.4)	69(36.9)	117(62.9)	1(0.5)	
Diploma/academic	85(20.2)	23(27.1)	59(69.4)	3(3.5)	
Access to water					
Yes	363(86.2)	134(36.9)	224(61.7)	5(1.4)	0.27
No	58(13.8)	27(46.6)	31(53.4)	0(0.0)	
Access to WC					
Yes	339(80.5)	116(34.2)	218(64.3)	5(1.5)	<0.01
No	82(19.5)	45(54.9)	37(45.1)	0(0.0)	
Background disease					
No	360(85.5)	135(37.5)	220(61.1)	5(1.4)	0.51
Yes	61(14.5)	26(42.6)	35(57.4)	0(0.0)	
Birth weight					
≥2500gram	358(85.0)	124(34.6)	229(64.0)	5(1.4)	<0.01
<2500gram	63(15.0)	37(58.7)	26(41.3)	0(0.0)	
Birth height					
≥45cm	392(93.1)	145(37.0)	242(61.7)	5(1.3)	0.13
<45cm	29(6.89)	16(55.2)	13(44.8)	0(0.0)	
Household food security status					
Food security	77(18.3)	16(20.8)	59(76.6)	2(2.6)	0.01
Insecure without hunger	11(2.6)	4(36.4)	7(63.6)	0(0.0)	
Insecure with moderate hunger	39(9.2)	12(30.8)	27(69.2)	0(0.0)	
Insecure with severe hunger	294(69.9)	129(43.9)	162(55.1)	3(1.0)	

Table 3. The participants' socioeconomic and demographic characteristics by weight for height

Variable	N (%)	Weight for height				P value*
		Wasting N (%)	Normal N (%)	Overweight N (%)	Obese N (%)	
Gender						
Female	193(45.9)	40(20.7)	143(74.1)	8(4.1)	2(1.0)	0.77
Male	228(54.1)	57(25.0)	159(69.7)	10(4.4)	2(0.9)	
Father's education						
Illiterate	120(28.5)	21(17.5)	92(76.7)	6(5.0)	1(0.8)	0.71
Under diploma	200(45.5)	53(26.5)	138(69.0)	7(3.5)	2(1.0)	
Diploma/academic	101(24.0)	23(22.8)	72(71.3)	5(5.0)	1(1.0)	
Maternal education						
Illiterate	149(35.4)	34(22.8)	107(71.8)	7(4.7)	1(0.7)	0.68
Under diploma	187(44.4)	46(24.6)	131(70.1)	9(4.8)	1(0.5)	
Diploma/university	85(20.2)	17(20.0)	64(75.3)	2(2.4)	2(2.4)	
Access to water						
Yes	363(86.2)	83(22.9)	264(72.7)	13(3.6)	3(0.8)	0.28
No	58(13.8)	14(24.1)	38(65.5)	5(8.6)	1(1.7)	
Access to WC						
Yes	339(80.5)	85(25.1)	241(71.1)	12(3.5)	1(0.3)	<0.01
No	82(19.5)	12(14.6)	61(74.4)	6(7.3)	3(3.7)	
Background disease						
No	360(85.5)	79(21.9)	260(72.2)	17(4.7)	4(1.1)	0.36
Yes	61(14.5)	18(29.5)	42(68.9)	1(1.6)	0(0.0)	
Birth weight						
≥2500gram	358(85.0)	84(23.5)	254(70.9)	17(4.7)	3(0.8)	0.58
<2500gram	63(15.0)	13(20.6)	48(76.2)	1(1.6)	1(1.6)	
Birth height						
≥45cm	392(93.11)	93(23.7)	281(71.7)	16(4.1)	2(0.5)	<0.01
<45cm	29(6.89)	4(13.8)	21(72.4)	2(6.9)	2(6.9)	
Arm circumference						
≥11.5cm	415(98.6)	94(22.7)	301(72.5)	18(4.3)	2(0.5)	<0.01
<11.5	6(1.4)	3(50.0)	1(16.7)	0(0.0)	2(33.3)	
Household food security status						
Food security	77(18.3)	17(22.1)	57(74.0)	2(2.6)	1(1.3)	0.04
Insecure without hunger	11(2.6)	0(0.0)	11(100.0)	0(0.0)	0(0.0)	
Insecure with moderate hunger	39(9.2)	8(20.5)	27(69.2)	3(7.7)	1(2.6)	
Insecure with severe hunger	294(69.9)	72(24.5)	207(70.4)	13(4.4)	2(0.7)	

Table 4. Odds ratios for weight for age based on the ordinal logistic regression model

Variables	N	Adjusted Odds Ratio*	95% confidence interval	P value
Household food security status				
Food security	77	1	-	
Insecure without hunger	11	-2.63	-4.95, -1.41	<0.01
Insecure with moderate hunger	39	-1.10	-2.74, 224	0.58
Insecure with severe hunger	294	1.47	-2.97, 6.48	0.60
Maternal Education				
Illiterate	149	1	-	
Under diploma	187	-2.09	-3.93, -1.09	0.02
Diploma/academic	85	-1.76	-3.12, -1.06	0.08
Birth weight				
≥2500gram	358	1	-	
<2500gram	63	-1.20	-3.89, -1.24	<0.01
Access to water				
Yes	363	1	-	
No	58	-1.15	-2.09, 1.55	0.62

Table 5. Odds ratios of stunting based on the ordinal logistic regression model

Variables	N	Adjusted Odds Ratio*	95% confidence interval	P value
Household food security status				
Food security	77	1	-	
Insecure without hunger	11	-1.91	-3.66, -1.01	0.04
Insecure with moderate hunger	39	-1.41	-3.45, 0.69	0.02
Insecure with severe hunger	294	-1.46	-5.52, 2.58	0.57
Father's education level				
Illiterate	120	1	-	
Under diploma	200	1.00	-1.89, 1.82	0.98
Diploma/academic	101	1.12	-1.52, 1.89	0.65
Maternal education				
Illiterate	149	1	-	
Under diploma	187	1.93	-3.78, 1.00	0.05
Diploma/academic	85	1.55	-2.85, 1.18	0.15
Birth weight				
≥2500gram	358	1	-	
>2500gram	63	-2.31	-4.17, -1.29	<0.01
Arm circumference				
≥11.5cm	415			
<11.5	6	-2.41	-4.65, 0.45	0.44
Access to W.C				
Yes	339	1	-	
No	82	-1.97	-3.32, -1.17	<0.01

The odds ratios were adjusted for father education, maternal education, birth height, arm circumference and access to Water closet (WC)

Table 6. Odds ratios of weight for height based on the ordinal logistic regression model

Variables	N	Adjusted Odds Ratio*	95% confidence interval	P-value
Household food security status				
Food security	77	1	-	
Insecure without hunger	11	1.25	-1.39, 2.20	0.42
Insecure with moderate hunger	39	2.27	-1.82, 9.48	0.25
Insecure with severe hunger	294	1.64	-1.30, 3.56	0.20
Birth height				
≥2500gram	392	1	-	
>2500gram	29	1.05	-1.73, -1.91	0.87
Arm circumference				
≥11.5cm	415	1	-	
<11.5	6	1.08	-2.43, 5.58	0.92
Access to W.C				
Yes	339	1	-	
No	82	2.38	1.30, 4.30	<0.01