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The Relationship Between Food Insecurity and Anthropometric Measures at Birth in Low Income Households

Asieh Ahmadihoseini [1], Nasrin Omidvar [2, *], Mohsen Nematy [1], Mohammad Safarian [1] and Maryam Salehi [3]

[1] Department of Nutrition, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
[2] Department of Community Nutrition, National Nutrition and Food Technology Research Institute, Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[3] Department of Community Medicine, Mashhad University of Medical Sciences Mashhad, Iran

[*] *Corresponding author*: Department of Community Nutrition, National Nutrition and Food Technology Research Institute, Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences, No. 46, West Hafezi St., Farahzadi Blvd. Shahrak-E-Qods, 1981619573, Tehran, Iran. Email: omidvar.nasrin@gmail.com

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Abstract

Background: Food security is one of the important factors that influence health and well-being throughout the life cycle.
Objectives: This study aimed to determine the relationship between household (HH) food security status and anthropometric indices at birth and before 6-years-of age among children in a low income community in Mashhad city.
Methods: In this cross-sectional study, 240 Iranian HHs which had at least one under 6-year old child were selected through systematic cluster sampling. Height and weight of children were measured. Also, their length and weight at birth were collected from their vaccination certificate. Anthropometric status (based on z-scores) of children were evaluated by WHO Anthro-Plus software.
Results: Severe, moderate, and mild food insecurity was observed in 7.1, 20, and 34.2% of the HHs, respectively. A significant association was observed between HH food insecurity and average height of their under 6-year-old children. There was no association between HH food insecurity and children's measurements at birth ($P > 0.05$). Comparison of anthropometric status at birth and between 1 to 6 years of age in food secure and insecure groups based on Wilcoxon test, showed a significant difference between z-scores of weight for age (WAZ) and body mass index (BMI) for age (BAZ) in children from food insecure HHs.
Conclusions: The results suggest that children in food insecure HHs do not necessarily have abnormal weight and length at birth, but growing up in a food insecure HH may lead to abnormal anthropometric status. Proper strategies to ensure food security in low income HHs may help to prevent child undernutrition.

Keywords: Children, Food Security, Anthropometric Status, Undernutrition

1. Background

Food security and adequate nutrition are among the most important factors determining individual's health from conception into elder years (1). Food insecurity meaning "limited or uncertain availability of notorious, adequate and safe foods for normal growth in socially acceptable ways to conduct an active life" (2) is often associated with poverty and low income, and should be considered as an important associate of health and nutrition outcomes especially in mothers and their infants (3, 4).

It has been shown that maternal nutrition has an important role in prenatal and neonatal periods. Few studies have specifically addressed the importance of food security in this period of life and its association with low birth weight (LBW) deliveries (5). LBW (birth weight less than 2500 g) and preterm birth, are major public health problems and strongest single risk factors which are defined as neonatal mortality and morbidity that contribute to larger health cost (6, 7). It is estimated that 15% to 20% of all births worldwide are LBW, indicating more than 20 million births a year with more than 95% of LBW infants being born in developing countries (6, 8). Evidence shows that low birth weight and restricted neonatal growth is associated with poor growth in childhood and an increased risk of chronic diseases, including diabetes, hypertension, heart disease and obesity later in life (6, 9). Fetal growth is directly affected by mother's diet during pregnancy. Mothers in deprived socio-economic conditions and food insecure families are at higher risk of having low birth weight infants, primarily due to poor nutrition and health over a long period of time, including before and during pregnancy (10). Mother's poor nutritional status which may

lead to pre-eclampsia, anemia, early cesarean section, multiple pregnancies, infections and chronic conditions such as diabetes also can increase the incidence of LBW (8, 11).

In Iran, numerous studies have investigated household (HH) food insecurity; however, they are scattered in different cities. Based on the result of a recent systematic review on food security in Iran, the prevalence of food insecurity was 49% among Iranian HH, 67% in children, 61% in mothers, 49% in adolescents and 65% in the elderly (12). According to sub-groups analysis in another review, food insecurity without and with hunger was estimated 29.6% and 19.2%, respectively (12). Also, prevalence of food insecurity in HH with children aged 6 - 11 years in Yazd have been reported, 30.5% (13). Food insecurity affects health status of all HH members in different ways, although preschool children are more prone to poverty and food insecurity as they are in growing age and poor nutrition can lead to continual complications later in life. Food insecurity may result in reduced learning and productivity and may also affect children's anthropometric status, including weight and height (14, 15). Food insecurity in childhood is also shown as a predictor of chronic diseases, mental health, depression and suicidal ideation during late adolescence (15-17).

2. Objectives

The present study aimed to determine the relationship between food insecurity and anthropometric status of children at birth and up to age 6 years in a low income district in Mashhad city.

3. Methods

This cross-sectional study was performed from June to November 2014 in Golshahr, a low income district in Mashad city. Golshahr with a population of about 34,650 is located in the northeastern part of Mashad. It is considered a low income district where different ethnic groups of Iranian, as well as Afghani immigrants/refugees are settled. The present study was conducted parallel to a larger study on HH food security status of Afghan immigrants in Golshahr to compare Iranian and Afghans living in the same district in terms of HHs food security and evaluate the effect of different social and cultural status on HH food security.

The sample in the present study included 240 Iranian HHs who had at least one under 6 years old child and were living in Golshahr district. The sample was selected through systematic cluster sampling method from 3 health centers and 7 sub centers in the district. Sample size in each health center was defined based on the population size under its coverage and selection was done using a table of random numbers. Data were collected through face-to-face interview with mothers by two trained nutritionists after they signed a letter of informed consent.

3.1. Anthropometric Measurement

weight of the child was measured based on standard protocols (18) by a Seca scale (Hamburg, Germany) to the nearest 0.1 kg and their height was measured using a measuring tape (Seca, Hamburg,Germany) to the nearest 0.1 cm. Child anthropometric status was reported as z-scores of weight for age (WAZ), height-for-age (HAZ) and BMI for age (BMIZ), by WHO Anthro Plus software. Short stature was defined as HAZ-score $<$ -1 and underweight as WAZ-score $<$ -1, while Z-scores between -1 $\leq$ to $\leq$ 1 were defined as normal range, Z-score $\geq$ 1 was defined as tall/overweight.

3.2. Food Insecurity Measurement

HH food security status over the last 12 months was measured by the US Department of Agriculture (USDA) Food Security Module. The scale is consisted of an 18-item questionnaire with 4 frequency response options that classifies HHs into "food secure", "food insecure without hunger", "food insecure with moderate hunger" and "food insecure with severe hunger". Food security score of each HH was calculated according to the number of positive responses on each item of the questionnaire (19). The internal validity of the adapted USDA module in measuring adult and child food insecurity in Iranian population has been evaluated and confirmed in a study in Esfahan (20). In addition, the USDA module was adapted in a study among households in Shiraz by Ramesh et al. (21).

3.3. Statistical Analysis

Data were analyzed using the statistical package for social sciences statistical software package, version 16 (SPSS). The χ^2 test and Wilcoxon test were used, significance level was defined at $P < 0.05$.

4. Results

4.1. Demographic Characteristics

A total of 240 HHs and their under 6-year-old children were studied. Of the studied children, 55% were boys. Table 1, depicts mean and standard error of demographic characteristics in the studied HHs.

Table 1. Mean ± SE of Demographic Characteristics of Iranian HHs in Golshahr, Mashhad, 2014

Variable	Minimum	Maximum	Mean ± SE
HH characteristics			
Age of head, y	20.0	65.0	33.63 ± 7.06
Age of spouse, y	18.0	54.0	30.03 ± 6.31
Family size, No.	3.0	8.0	3.96 ± 0.95
Number of children	1.0	6.0	1.94 ± 0.93
Number of children under 6 years of age	1.0	3.0	1.12 ± 0.35
Income, Rials/mo	1300000	30000000	8808021 ± 4877611
Child characteristics			
Age, mo	9.0	80.0	39.45 ± 19.14
Weight, kg	7.7	31.2	13.93 ± 3.90
Height, cm	70.0	127.0	96.14 ± 13.59

Abbreviation: HH, household.

4.2. Household Food Security and Child Anthropometrics

Child anthropometric status, including z-scores of WAZ, HAZ, and body mass index (BMI) for age (BAZ) by HH food security status are presented in Table 2. Among the studied HHs, 61% were food insecure, Figure 1 depicts food insecurity status in studied HH.

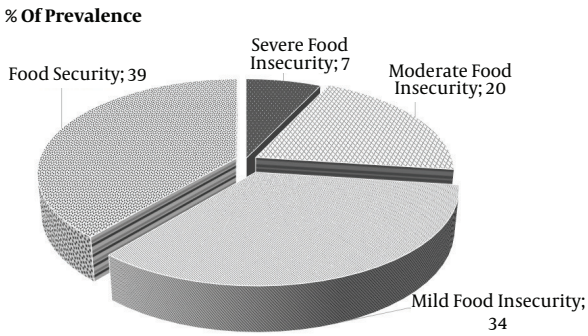

Figure 1. Prevalence of food insecurity and its levels in the studied households in Mashhad, Golshahr, 2014

A significant association was observed between HH food insecurity and average height of the studied children. There was no significant association between HH food insecurity and child's birth measurements ($P > 0.05$), as well as child sex (Table 2).

Comparison of anthropometric status at birth with 1 - 6 years of age in food secure and insecure groups based on Wilcoxon test, are presented in Table 3. There was a significant difference in WAZ-score and BMI for BAZ-score in children from food insecure HH at birth and before the age of 6 years. As the children grew older, the number of underweights, as well as overweights increased and normal weights decreased. No significant difference was observed in anthropometric indices of children in food secure group.

5. Discussion

To the best of our knowledge, this is the first study evaluating the relationship between anthropometric measurements of children at birth and before the age of 6 years with their HH food security status in Iran. Most food insecurity studies in the country are focused on prevalence of food insecurity and its impact on weight and height of children during childhood and adolescence, but not at birth. The results indicate a high prevalence of food insecurity among the studied HHs (61.2%). The extent of food insecurity observed in this study is higher than in those reported by Saraei et al. in Tabriz (44.9%) (22), as well as Chowdhury et al. in Bangladesh (35.7%) (23). This difference may be due to lower socioeconomic status of the studied HHs in Golshahr and/or as a result of using different questionnaires to assess food security status.

Also, a significant association was observed between anthropometric indices (WAZ and BAZ) of the studied children at birth and before age of 6 years in the children from food insecure households, while birth length was not associated with HH food security status. This finding shows that children in food insecure HH necessarily do not have abnormal weight and length at birth, but growing up in a food insecure HH may lead to abnormal anthropometric status later in life. Saraei et al. in Tabriz, have reported similar results (22). Grilo et al. in New York also reported a non-significant effect of food insecurity on birth weight

Table 2. Anthropometric Status of Children at Birth and Before 6 Years Old in Golshahr, Mashhad by HH Food Security Status, 2014[a]

Anthropometric Indices	HH Food Security Status			P Value
	Food Secure	Insecure Without Hunger	Insecure with Hunger	
Weight status based on BAZ				
At birth				0.83
Underweight	27 (38.6)	22 (31.4)	21 (30.0)	
Normal weight	49 (38)	48 (37.2)	32 (24.8)	
Overweight	17 (41.5)	12 (29.3)	12 (29.3)	
Before 6 years old				0.8
Underweight	27 (38.6)	22 (31.4)	21 (30)	
Normal weight	49 (38)	48 (37.2)	32 (24.8)	
Over weight	17 (41.5)	12 (29.3)	12 (29.3)	
Height status based on HAZ				
At birth				0.35
Stunt	12 (31.6)	18 (47.4)	8 (21.1)	
Normal stature	66 (41)	52 (32.3)	43 (26.7)	
Tall	15 (36.6)	12 (29.3)	14 (34.1)	
Before 6 years old	12 (31.6)	18 (47.4)	8 (21.1)	0.3
Stunt				
Normal stature	66 (41)	52 (32.3)	43 (26.7)	
Tall	15 (36.6)	12 (29.3)	14 (34.1)	
Weight status based on WAZ				
At birth				0.4
Underweight	14 (35)	17 (42.5)	9 (22.5)	
Normal weight	71 (40.8)	53 (30.5)	50 (28.7)	
Overweight	8 (30.8)	12 (46.2)	6 (23.1)	
Before 6 years old				0.4
Underweight	14 (35)	17 (42.5)	9 (22.5)	
Normal weight	71 (40.8)	53 (30.5)	50 (28.7)	
Overweight	8 (30.8)	12 (46.2)	6 (23.1)	

Abbreviations: BMI, body mass index; BAZ, BMI-for-age Z-score; HAZ, height-for-age Z-score; HH, household; WAZ, weight-for-age Z-score.
[a]Values are expressed as No. (%).

(24). However, Chowdhury et al. in Bangladesh found that mothers from food-insecure HHs were 37% more likely to give birth to small infants compared to food-secure ones (23). Mozayeni et al. in Tehran also found that 82.1% of pregnant mothers in food insecure condition had LBW infants (25). This discrepancy may be due to the lack of data on food security status during pregnancy. Also, even in the food insecure HHs, mothers do their best endeavor to supply their nutritional needs during pregnancy to give birth to normal babies, especially in the first pregnancies.

On the other hand, it is well documented that HH food security is strongly associated with child nutritional status. A study conducted in Kenya among 6858 urban poor children found that the risk of stunting increased by 12% among food-insecure children (26). Also, a cohort study conducted in rural Bangladesh among 1343 children found that HH food security was associated with greater subsequent weight and length gain, and proportions of underweight and stunting were significantly lower among those in food-secure HHs (27).

Based on the World Health Organization report, girls are more prone to low birth weight (28). However, in the present study, no significant relationship was observed between anthropometric status and children's sex.

Table 3. Comparison of Anthropometric Status of Children at Birth and Before Age of 6 Years in Golshahr, Mashhad by HH Food Security Status 2014[a]

Anthropometric Status	Food Secure			Food Insecure		
	At Birth	Under 6 Years Old	P Value	At Birth	Under 6 Years Old	P Value
WAZ						0.02
Underweight	14 (15.1)	27 (29.0)	0.06	26 (17.7)	45 (30.6)	
Normal weight	71 (76.3)	59 (63.4)		103 (70.1)	85 (57.8)	
Overweight	8 (8.6)	7 (7.5)		18 (12.2)	17 (11.6)	
HAZ						0.1
Short stature	12 (12.9)	20 (21.5)	0.9	26 (17.7)	33 (22.4)	
Normal stature	66 (71.0)	50 (53.8)		95 (64.6)	81 (55.1)	
Tall stature	15 (16.1)	23 (24.7)		26 (17.7)	33 (22.4)	
BAZ						0.02
Underweight	27 (29.0)	42 (45.2)	0.08	43 (29.3)	60 (40.8)	
Normal weight	49 (52.7)	45 (48.4)		80 (54.4)	72 (49.0)	
Overweight	17 (18.3)	6 (6.5)		24 (16.3)	15 (10.2)	

Abbreviations: BMI, body mass index; BAZ, BMI-for-age Z-score; HAZ, height-for-age Z-score; HH, household; WAZ, weight-for-age Z-score.
[a]Values are expressed as No. (%).

Bryant Borders et al. in a study on 294 pregnant women with the aim to estimate factors influencing the weight of neonates in low-income women have shown that demographic factors such as maternal age, multiple psychosocial factors (e.g. depression) and food insecurity are among the most important contributors to low birth weight of neonates (29). However, in the present study, food insecurity was not a predictor of low birth weight.

This study has some limitations that should be considered in evaluating its findings. Although conducting our project in a district of a large city in Iran, limits the generalizability of the findings, it allows us to gain important insight into the association between food insecurity and birth outcomes among a population at high risk for food insecurity and adverse birth outcomes. Also, anthropometric status of pregnant mother, the amount of weight gain during pregnancy and stress level are all influencing factors on birth weight (30), data of which were not available in the present study.

Finally, start of this study was aligned with the initiation of cash transfer program by the government, which may have affected some participant's response regarding their income, as higher income could result in discontinuing of their subsidies.

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Footnotes

Authors' Contribution: Study supervision and administrative, technical, and material support: Mohsen Nematy. Study concept and design: Nasrin Omidvar and Mohsen Nematy. Analysis and interpretation of data: Nasrin Omidvar and Asieh Ahmadihoseini. Drafting of the manuscript: Asieh Ahmadihoseini and Nasrin Omidvar. Critical revision of the manuscript for important intellectual content: Nasrin Omidvar and Mohsen Nematy and Mohammad Safarian. Statistical analysis: Maryam Salehi and Mohammad Safarian.

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