

Association Among Food Insecurity, Academic Performance, and Weight Status in Primary Schoolchildren in Tehran, Iran: A Cross-sectional Study

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ABSTRACT

Objective: To examine the associations among household food insecurity (FI), academic performance, and weight status in urban primary schoolchildren.

Design: Cross-sectional study.

Setting: Primary schools in Tehran, Iran.

Participants: A total of 803 students (419 boys and 384 girls), aged 10–12 years, were recruited from 43 primary schools.

Main Outcome Measures: Levels of FI were measured using a locally validated, 18-item household food security survey module. Academic performance was assessed by 152 teachers through a specifically designed, 20-scale questionnaire. Standard anthropometric measurements were also taken.

Analysis: Linear and multinomial regressions were conducted.

Results: At the household level, FI was associated with poorer grades in all subjects studied (except for social science in FI without hunger) ($P < .05$). At the child level, a significant association was observed between low food security and poorer grades in all subjects studied, whereas for very low food security, this relationship was significant only for mathematics, reading, and science ($P < .05$). Food insecurity without hunger (odds ratio = 2.56; 95% confidence interval, 1.05–6.23) and low food security (odds ratio = 4.41; 95% confidence interval, 1.58–12.23) were associated with overweight only in girls.

Conclusions and Implications: The findings confirm the need for policies and programs to improve students' dietary quality and food security to improve their health as well as educational attainment. Future research is needed to explore further the association between food security and academic performance.

Key Words: food insecurity, body weight, academic performance, primary schoolchildren (*J Nutr Educ Behav.* 2017; ■:1-9.)

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INTRODUCTION

Food insecurity (FI) refers to “limited or uncertain availability of nutritionally adequate and safe foods or limited

or uncertain ability to obtain food in socially acceptable ways.”¹ Food insecurity is a multidimensional phenomenon associated with developmental adverse outcomes and a persistent

public health concern in both developed and developing countries.² The relatively high prevalence of different FI levels in Iran has made its alleviation a priority of national development programs.³ Based on a recent study, about 49% of Iranian households experience some degree of FI.⁴

Children need consistent access to an adequate quantity of high-quality food for optimal physical, social, and cognitive growth; therefore, they are considered a group vulnerable to FI. Based on epidemiologic studies, FI in children is associated with poor academic achievement and school engagement, grade repetition, absenteeism, tardiness, anxiety, aggression, psychosocial dysfunction, and difficulty in getting along with peers.⁵⁻⁸ In addition, children in food-insecure households are more

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at risk of being neglected by their parents in providing adequate health and nutritional and emotional care.^{9,10} Findings on the association between FI and poorer academic performance were different based on the severity of FI and academic subjects (mathematics, reading, etc). In 1 study, this association was observed only in marginal but not severe FI,¹¹ whereas a longitudinal study showed that FI was associated with poor scores in reading but such an association was not observed in mathematics.¹² On the other hand, a possible paradoxical association between FI and childhood obesity was suggested.¹³ Plausible mechanisms to explain this association include changes in food choices and consumption patterns in food-insecure children.¹⁴ As a coping strategy, food-insecure children tend to consume less expensive, energy-dense foods; overeat when foods are available; and have low physical activity.¹⁵ Most studies conducted to examine the association between FI and obesity were carried out in the US. Results of these studies were inconsistent: some showed a positive association,^{12,15-17} others showed no association,¹⁸⁻²¹ and yet others reported an inverse association between obesity and FI in children.^{22,23}

In Iran, child obesity is a growing public health problem. According to the Childhood and Adolescence Surveillance and Prevention of Adult Noncommunicable Disease survey,^{24,25} in 2010, overweight/obesity in 10- to 18-year-old children was 18.2% and increased to 21.5% in 2012. The authors undertook the current study to explore the association between FI at the household and child levels with academic performance and weight status in fifth- and sixth-grade students in the city of Tehran, the capital of Iran.

METHODS

Sampling and Data Collection

This cross-sectional study was carried out in fifth- and sixth-grade primary schoolchildren in the city of Tehran. A total of 186,761 children were eligible to participate, 803 of whom took part in the study (419 boys and 384 girls). Data were collected from October, 2015 to March, 2016. The researchers applied multistage systematic cluster sampling in 3 stages to

select districts, schools, classes, and children. The general office of education in Tehran classifies its 19 educational districts into 3 socioeconomic levels: affluent, semiaffluent, and deprived. In the first stage of the study, 9 districts (3 from each of the 3 socioeconomic areas) were selected by weighting districts according to their students' population density. Then the researchers selected public and private schools from these 9 districts by weighting them according to the number of students in the schools. In the third stage, fifth- and sixth-grade students were randomly selected from each school.

A team of 7 trained nutritionists collected data. A supervisor ensured consistency during the data collection process. The participant and their parents received a full verbal and written explanation of the purpose of the study and a consent form to sign. All data were collected in the schools. Parents were invited to complete food security (FS), socioeconomic, and demographic questionnaires through face-to-face interviews. In some cases in which parents were unable to attend in schools (because of child care needs, illness, work constraints, etc), telephone interviews were employed. The ethical committee of the National Nutrition and Food Technology Research Institute approved the study protocol.

Measurements

Household FS status. The researchers measured household FS status using a locally validated,²⁶ 18-item US Department of Agriculture Household Food Security Survey Module, which was designed to capture experiences associated with inadequate quality and quantity of the household food supply within the past 12 months.¹ Based on the scale, households were categorized as FS (raw score of 0–2), FI without hunger (raw score of 3–7), FI with moderate hunger (raw score of 8–12), and FI with severe hunger (raw score of 13–18). Because of the prevalence of each category, the categories of FI with moderate and severe hunger were grouped together.

Child-level FS status. The last 8 items of the US Department of Agriculture Household Food Security Survey Mod-

ule referred to FI in households with children. The items were applied to all children in the household. The categories of children's FS based on the scale were: high or marginal FS (raw score of 0–1); low FS (LFS) (raw score of 2–4); and very low FS (VLFS) (raw score of 5–8).²⁷ Mothers were asked child-level questions with regard only to the child who was included in the study, not all children within the household.

Children weight status. For each child, standing height (in centimeters) and weight (in kilograms) were measured twice. Two digital scales (model number 63200, Soehnle, Backnang, Germany) were used to measure weight to the nearest 0.1 kg. The scales were placed on a metal platform. Each day before starting weight measurements, scales were calibrated using a predefined weight; this was repeated after every 20 samples. A tape measure was used to measure standing height to the nearest 0.1 cm. The tape measure was set vertically against the wall, 50 cm above the floor. A big, flat, set square was used to make a right angle with the wall to ensure that height was measured accurately. Children were asked to remove shoes and bulky clothes before measurements. Body mass index (BMI) was calculated as weight (in kilograms) divided by the square of height (in meters). The BMI Z-score for age and sex was calculated based on World Health Organization Child Growth Standards software (AnthroPlus, World Health Organization, Geneva, Switzerland, 2007). Children's weight status was reported in 4 categories: thin (Z-score: <2 SD), normal (Z-score: ≥ -2 SD and ≤ 1 SD), overweight (Z-score: >1 SD and ≤ 2 SD), and obese (Z-score: >2 SD). Girls were asked whether they had reached menarche; weight status was reported as pre-menarche or post-menarche.

Academic performance. The researchers collected data on academic performance with an author-designed questionnaire that was completed by the student's teacher. Because children's final grades were not available at the time, this pretested, self-administered questionnaire was developed and used based on teachers' assessments of children's performance in class and with

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