Association of Individual and Neighborhood Factors with Home Food Availability: Evidence from the National Health and Nutrition Examination Survey

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ABSTRACT

Background Accumulating evidence suggests the important role of the home food environment in an individual's dietary intake.

Objective This study examined the associations of individual and neighborhood-level factors with the availability of healthy and unhealthy foods in the home using a nationally representative sample from the 2007 to 2008 and 2009 to 2010 National Health and Nutrition Examination Surveys (NHANES).

Design A cross-sectional study design was used with NHANES merged with the 2000 census data. Food availability was measured through self-report questionnaire regarding the frequency of foods or drinks available in the home.

Participants The analysis included 8,975 participants aged 19 to 65 years.

Statistical analyses performed Associations of individual and neighborhood factors with home food availability (always or most of the time available) were assessed using logistic regression modeling accounting for NHANES' complex survey design and weights. Individual-level and neighborhood-level factors were simultaneously included in the analysis.

Results Family income-to-needs ratio was positively associated with the availability of dark green vegetables (odds ratio [OR]=1.07; 95% CI=1.00 to 1.13), fat-free or low-fat milk (OR=1.16; 95% CI=1.07 to 1.25), and salty snacks (OR=1.12; 95% CI=1.04 to 1.20) in the home. College graduates were more likely to have fruits (OR=1.96, 95% CI=1.48 to 2.60), vegetables (OR=1.48; 95% CI=1.16 to 1.88), and fat-free or low-fat milk (OR=1.81; 95% CI=1.55 to 2.12) and less likely to have salty snacks (OR=0.77; 95% CI=0.63 to 0.95) and sugary drinks (OR=0.46, 95% CI=0.37 to 0.57) available compared with non-college graduates. Tract socioeconomic status (SES) scores were positively associated with fruit (OR=1.15; 95% CI=1.02 to 1.29), vegetable (OR=1.14; 95% CI=1.03 to 1.26), and fat-free or low-fat milk (OR=1.25; 95% CI=1.10 to 1.42) availability. Urban residents were associated with greater availability of fruits (OR=1.47; 95% CI=1.05 to 2.08) and fat-free or low-fat milk (OR=1.33; 95% CI=1.02 to 1.73) in the home compared with rural residents. Food desert status was not associated with home food availability.

Conclusions The results show that SES at both individual (education, income) and neighborhood level was linked to home food availability, suggesting a need to improve the home food environment for socioeconomically disadvantaged individuals and neighborhoods.
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THE PREVALENCE OF OBESITY REMAINS HIGH IN THE United States with approximately 35% of men and 40% of women being obese in 2013 to 2014.[1] Although evidence links poor diet quality to obesity and risk of chronic diseases,[2-4] to date many individuals across the country do not meet dietary recommendations, with fewer than one in three adults consuming the recommended amount of vegetables each day.[5] The home food environment such as the availability of healthy or unhealthy foods in the home can be one of the important moderators of a person's dietary intake.[6-8] Previous work showed the overall home availability

of obesogenic unhealthy foods was significantly associated with energy intake of both adults and their adolescent children.[6] Grant and colleagues reported that home food inventory scores were associated, positively or inversely, with saturated fat, sugar, and other nutrient intake among participants aged 50 years old.[8] In addition, Emery and colleagues demonstrated that homes of obese individuals had less healthy foods available than homes of nonobese individuals.[9]

Various factors may influence the home food environment and dietary habits. An individual's socioeconomic status (SES) can be considered as one of the main contributors.[10-12] Masters and colleagues reported high-income homes had the highest prevalence of fruits and fat-free or low-fat milk always available in a nationally representative sample.[11] Individuals with low income were reported to consume fewer fruits and vegetables, and a high proportion of their dietary energy intake was from fat and empty calorie foods relative to their high-income counterparts.[13] However, there are various SES indicators including both monetary- and nonmonetary-related factors. Literature suggests that using different SES measures are important for capturing the effects of social inequalities in home food availability.[12] For example, Wilson and colleagues reported that although both higher household income and education level were individually associated with higher fruit and vegetable availability scores, higher education but not income level was also independently associated with decreased availability of sweetened beverages in the home.[12]

Beyond individual-level factors, a growing body of evidence suggests that neighborhood deprivation, neighborhood minority composition, and rural neighborhood are linked to poor dietary patterns and obesity.[14-16] These neighborhoods are most often affected by poor access to supermarkets and healthy foods.[15,17,18] It has been suggested that neighborhood residents who have better access to supermarkets and limited access to convenience stores tend to have healthier diets and lower obesity rates,[17,19] because affordable, high-quality foods are more likely to be found in supermarkets than in convenience stores.[20] However, a recent study found that nutrition profiles of foods and beverages household purchased did not differ according to whether people shopped at large supermarkets, mass merchandisers, or a combination of supermarkets and small convenience stores.[21] Although more research is needed to investigate neighborhood effects on energy balance and obesity, no study to date has explored how various neighborhood factors such as neighborhood SES, area population density (rural-urban status), and food dessert status may contribute to the home food environment, which likely serves as a mediator or moderator for the link between neighborhood and health outcomes.

The ecological framework emphasizes the multiple influences on a person's health behaviors and outcomes.[22] The underlying etiology for an obesogenic home food environment is complex, involving contributing factors at different levels. Given the importance of the home food environment in an individual's dietary intake and in turn the development or prevention of obesity, the current study examined the associations of individual- and neighborhood-level factors with the availability of healthy (fruits, dark green vegetables, and fat-free or low-fat milk) and unhealthy foods (salty snacks and sugary drinks) in the home among adults aged 19 to 65 years using a nationally representative sample from 2007 to 2008 and 2009 to 2010 National Health and Nutrition Examination Surveys (NHANES).

METHODS

Sample

Individual-level data used in this study were from the 2007 to 2008 and 2009 to 2010 waves of the continuous NHANES merged with the 2000 census data using the geographic information system techniques. NHANES is a program of studies designed to assess the health and nutritional status of adults and children in the United States. Since 1999, the survey has examined a nationally representative sample of about 5,000 people each year. NHANES uses a complex, multistage, probability sampling design to select participants who are representative of the civilian, noninstitutionalized US population.[23] The 2007 to 2008 and 2009 to 2010 data were used because questions regarding home food availability were only available in 2007 to 2008 and 2009 to 2010 NHANES surveys. The 2000 census data (instead of the most recent 2010 census data) was used because the 2000 census information was obtained prior to the collection of the outcome data, which would allow a temporal sequence from the hypothesized predictors to the outcome variables (home food availability) because the reverse hypothesis—for example, the effect of home food environment on neighborhood characteristics (eg, tract-level SES, urban-rural status, food desert status)—seems less likely.

The present study focused on 8,975 adults aged 19 to 65 years. The 2007 to 2008 and 2009 to 2010 NHANES had 9,571 age-eligible respondents. Sequential exclusions included missing food availability data (N=142), pregnancy (N=125), missing body mass index (BMI) values (N=326), and missing tract SES score (N=3). The weighted percentage of missing income data was 6.9% of the sample. Missing family income-to-needs ratios were imputed by adding a random component to the weighted sample mean of nonmissing values. There were no missing data for the remaining variables included in the analyses. Participants with and without these missing values had similar distributions of individual characteristics (age, sex, race or ethnicity, BMI, immigrant status, income-to-needs ratio, education, marital status, and family size). The final sample size was 8,975 adults including 4,479 men and 4,496 women. The study was approved by the Institutional Review Board at the University of Utah.

Home Food Availability Questions and Outcome Variables

The home food availability questions from NHANES measure the frequency of availability of fruits (fresh, dried, canned and frozen fruits), dark green vegetables (fresh, dried, canned and frozen vegetables), fat-free or low-fat milk (1%, skim or fat-free; excluding 2%), salty snacks (such as chips and crackers; excluding nuts), and sugary drinks (soft drinks, fruit-flavored drinks, or fruit punch; excluding diet drinks, 100 percent juice, or sport drinks) in the home. A 5-point scale (always, most of the time, sometimes, rarely or never available) was used for survey responses and was coded on a scale of 1 to 5 with 1 referring "always" and 5 referring "never available." The response also included "Refused" (coded as 7) and "I don't know" (coded as 9).[23] Participants who responded with "Refused" or "I don't know" were