Community Food Environment, Home Food Environment, and Fruit and Vegetable Intake of Children and Adolescents

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ABSTRACT

Objectives: To determine (1) reliability of new food environment measures; (2) association between home food environment and fruit and vegetable (FV) intake; and (3) association between community and home food environment.

Methods: In 2005, a cross-sectional survey was conducted with readministration to assess test-retest reliability. Adolescents, parents of adolescents, and parents of children (n = 458) were surveyed in San Diego, Boston, and Cincinnati.

Results: Most subscales had acceptable reliability. Fruit and vegetable intake was positively associated with availability of healthful food ($r = 0.15$-0.27), FV ($r = 0.22$-0.34), and ratio of more-healthful/less-healthful food in the home ($r = 0.23$-0.31) and was negatively associated with less-healthful food in the home ($r = -0.17$ to -0.18). Home food environment was associated with household income but not with community food environment.

Conclusions and Implications: A more healthful home food environment was related to youth FV intake. Higher income households had more healthful food in the home. The potential influence of neighborhood food outlets warrants further study.

Key Words: adolescent, children, dietary behavior, home food environment, food outlets (*J Nutr Educ Behav*. 2012;44:634-638.)

INTRODUCTION

Fruits and vegetables (FV) are important components of healthful diets, and their consumption is recommended by health experts.[1] In the United States, few children or adolescents meet the national dietary guidelines for FV intake.[2-4]

Ecological models provide frameworks for understanding environmental influences on health behaviors.[5-7] Young people have limited control over their food environment and are likely to be influenced by food environments in the home and community.[8-10]

Several studies examined how the home food environment was related to dietary behaviors.[11-16] The availability and accessibility of FV in the home has been positively associated with FV consumption among children and adolescents.[12-15] The accessibility of healthful food in the home has been inversely associated with children's total energy and fat intake.[16]

The community food environment includes food outlets in the community, such as stores and restaurants,[9,17] which are associated with adults' food purchasing and dietary behaviors.[18,19] However, little is known about how the community food environment influences adolescents' and children's dietary behaviors. Further, the community food environment may be related to the home food environment, but no study has examined this association among children or adolescents.

The current study focused on 2 important components of the food environment: community and home.[9] The study aimed to examine (1) reliability of new food environment measures based on adolescent and parent reports; (2) the association between home food environment and FV intake; and (3) the association between community and home food environment.

METHODS

Design and Sample

Adolescent-parent pairs and parents of children were recruited from neighborhoods in San Diego, CA, Boston, MA, and Cincinnati, OH in 2005.

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Different methods were used to select a sample that was diverse in geography, neighborhood walkability, and sociodemographic characteristics.[20,21] In Cincinnati and San Diego, participants were recruited from neighborhoods that varied in income (based on census data) and walkability (based on expert opinions, residential and intersection density). In Boston, participants were recruited from community centers mainly serving low-income students with diverse racial/ethnic backgrounds. Multiple recruitment methods (eg, random phoning and mailing) were used. Written informed consents or assents were obtained from all participants. Institutional Review Boards at San Diego State University, University of California San Diego, University of Cincinnati, and Children's Hospital of Boston approved the study protocols.

A test-retest design was used, with 2-4 weeks (average 27 days) between surveys. The average response rate for Survey 1 was 47% across study sites, and 69% of participants (74% of parents and 62% of adolescents) who completed Survey 1 also completed Survey 2. Cross-sectional analyses of correlates used data from Survey 1, which included 171 adolescent-parent pairs and 116 parents of children.

Measures

The questionnaire was developed based on ecological models,[7,9,22] which emphasized multilevel environmental influences (eg, community, home) on behavior. The questionnaire was self-administered in written form.

Two questions were asked regarding the number of servings of FV the adolescent or child ate in a typical day.[23] Examples of a serving were given for different types of FV. Responses ranged from 0 to 4 or more servings/day. Responses to the 2 questions were summed to create a scale for daily FV intake. This measure has good correct classification rate and specificity compared to 3-day diet recall/record combinations, and it has demonstrated comparable reliability and validity to other brief FV intake measures.[23]

Home food environment was assessed by asking, "How often are the following food items available in your home?" As suggested by Campbell et al,[10] a list of 16 food items was provided, with a 5-point response format ranging from 1 (never) to 5 (always). Items were categorized into more-healthful and less-healthful food, based on nutrition values and calorie density. More-healthful choices included fruits, vegetables, 100% fruit juice, baked chips, sugar-free sodas, 1% fat or skim milk, and unsweetened breakfast cereals. Less-healthful choices included chocolates, candies, cakes, regular chips, juice drinks, sugared sodas, sports drinks, whole or 2% milk, and sweetened breakfast cereals. Although baked chips and sugar-free sodas were not nutritious or "healthful," they were categorized as "more-healthful" options because they were lower in calories than "less-healthful" counterparts (regular chips and sugared sodas). Four home food environment variables were computed based on the 16 items: availability of more-healthful food, less-healthful food, FV, and a more-healthful to less-healthful food ratio (a higher ratio represented more-healthful food available relative to less-healthful food).

Community food environment was measured by neighborhood food outlet questions from the validated Neighborhood Environment Walkability Scale.[24] Participants estimated the proximity to each type of food outlet. Based on nutrition characteristics of each outlet,[18,25] 2 subscales were created: more-healthful food outlets (supermarkets, fruit/vegetable markets, non-fast-food restaurants) and less-healthful food outlets (convenience stores, fast-food restaurants). Responses were made on a 5-point scale (1 = 1-5 minutes; 5 = 31+ minutes from the respondent's home) as a measure of proximity to the food outlets.

Demographic variables included age, sex, race/ethnicity, and annual household income. For the adolescent-parent pairs, questions regarding family socioeconomic status were asked of parents only.

Analysis

Data were analyzed separately for the 3 samples (adolescent self-report sample, adolescent sample reported by parents, children sample reported by parents) using SPSS (version 15.0, SPSS, Inc., Chicago, IL, 2006). Cronbach α assessed internal consistency of scales. One-way, single-item, intraclass correlation coefficients (ICC) were computed for test-retest reliability of FV intake, home and community food environment, and for the agreement between parent reports and adolescent reports. Partial correlations assessed the association between environmental variables and FV intake, adjusting for youth's age, sex, race/ethnicity (dichotomized as "non-Hispanic white" vs "other"), family income, and study site (San Diego, Cincinnati, Boston). Associations were tested using data from the first survey administration.

Linear regression models were specified for all 4 home food environment dependent variables (availability of more-healthful food and less-healthful food, FV at home, and a more-healthful to less-healthful food ratio). Independent variables were community food outlets, youth's age, sex, race/ethnicity, family income, and study site. All statistical tests were 2-tailed, with α at .05.

RESULTS

Sample Characteristics

Adolescent participants were 12 to 18 years old (mean = 14.6, SD = 1.7), 51% were females, 53% were non-Hispanic white, 20% were African American, 10% were Hispanic, and 17% were other race/ethnicity. Parents of adolescents had a mean age of 45.0 years (SD = 6.8), and 80% were females. The children sample ranged in age from 5 to 11 years (mean = 8.3, SD = 1.9), 52% were females, 78% were non-Hispanic white, 10% were African American, 8% were Hispanic, and 4% were other race/ethnicity. Parents who reported on their children were on average 39.6 years old (SD = 7.7), and 85% were females. Median annual household income for the families of adolescents and children was within the range of $60,000-$69,999.

Reliability

The average daily FV consumption was 3.6 (SD = 2.1) servings for the adolescent self-report sample, 3.3 (SD = 1.7)

servings for the adolescent parent-report sample, and 3.9 (SD = 1.7) servings for children (Table 1). Most subscales had acceptable to excellent internal consistency and test-retest reliability.[26] Availability of more-healthful food in the home had the lowest internal consistency. On most subscales, parental reports had higher test-retest reliability than adolescent reports. Adolescents and their parents reported more consistently on community food environment (ICC 0.82-0.88) than the home food environment (ICC 0.51-0.63) and adolescent FV intake (ICC = 0.47).

Association Between Environmental Variables and FV Intake

Adjusting for demographic variables, FV intake was significantly associated with home food environment, but not with the community food environment (Table 2). Availability of FV in the home and the more-healthful/less-healthful food ratio were significantly associated with FV intake in all 3 samples. Availability of more-healthful and of less-healthful food in the home was associated with FV intake in adolescent samples. Intake of FV was not associated with neighborhood food outlets.

Correlates of Home Food Environment

In multiple linear regressions, proximity of neighborhood food outlets showed few associations with the 4 home food environment variables (results not shown). Family income was associated with availability of more-healthful food in the home across all samples (standardized β = .23 to .47, $P < .01$), but not associated with availability of less-healthful food. Families with adolescent girls reported fewer less-healthful food items available and a higher more-healthful/less-healthful food ratio compared to families with adolescent boys (standardized β = -.20 to -.25, and .16-.23, respectively, $P < .05$).

DISCUSSION

This study found a consistent association between home food environment and youth FV intake. These results support those of previous studies.[11,14,15] Four variables were used to assess the home food environment: more-healthful food, less-healthful food, the more-healthful/less-healthful food ratio, and FV. All variables showed significant associations with FV intake in expected directions. Availability of FV in the home and the more-healthful/less-healthful food ratio had the strongest and most consistent associations with FV intake. The finding suggests that competing availability of more-healthful and less-healthful food choices is important. If the finding is confirmed by future studies, it implies that providing fewer unhealthful food items but more healthful food items in the home may encourage children and adolescents to consume more FV.

There was little evidence for associations between the community food environment, as measured, and the home food environment after adjusting for demographic and socioeconomic factors. This finding was contrary to the expectation that nearby food outlets would provide easy access and visual prompts for purchasing food. A possible explanation is that food access is so ubiquitous, and food shoppers are so mobile (eg, 95% of the sample had at least 1 car in the home), that the proximity of food outlets is not important, at least for some population segments. Food can be accessed at or near school, work, and frequently traveled routes, and the locations of food purchasing are not well understood.[27]

The strongest and most consistent correlate of the availability of more-healthful food in the home was household income. This association could be explained by higher-income families having the affordability to purchase higher-priced food, such as FV. This finding was consistent with a review[28] and empirical findings that cost is 1 of the most important correlates of food decisions,[29] and lower-income families tend to spend less on FV.[30]

In contrast to more-healthful food, availability of less-healthful food in the home was not associated with income. In adolescent samples, girls' households had fewer less-healthful food items available. This finding

Table 1. Descriptive Statistics, ICC, and Cronbach α of Subscales in 3 Samples

		Adolescents, self-report (n = 171)			Adolescents, parent report (n = 171)			Children, parent report (n = 116)		
Subscales	Number of items	Mean (SD)	ICC	α	Mean (SD)	ICC	α	Mean (SD)	ICC	α
Fruit and vegetable intake	2	3.6 (2.1)	0.60	0.76	3.3 (1.7)	0.56	0.65	3.9 (1.7)	0.78	0.58
Availability of fruit and vegetables at home[a]	3	3.9 (0.8)	0.47	0.60	4.2 (0.8)	0.72	0.69	4.5 (0.6)	0.70	0.67
Availability of more-healthful food at home[a]	7	3.4 (0.7)	0.58	0.62	3.5 (0.7)	0.76	0.65	3.7 (0.5)	0.81	0.40
Availability of less-healthful food at home[a]	9	3.4 (0.7)	0.51	0.75	3.1 (0.6)	0.78	0.73	3.0 (0.7)	0.88	0.74
More-healthful food outlets[b]	3	3.6 (1.4)	0.79	0.74	2.9 (1.2)	0.67	0.74	3.0 (1.1)	0.68	0.62
Less-healthful food outlets[b]	2	2.8 (1.5)	0.74	0.77	2.5 (1.2)	0.80	0.79	2.7 (1.1)	0.65	0.63

ICC indicates intraclass correlation coefficients.
[a]On a 5-point scale: 1 = never, 2 = rarely, 3 = sometimes, 4 = frequently, 5 = always.; [b]On a 5-point scale: 1 = 1-5 min, 2 = 6-10 min, 3 = 11-20 min, 4 = 21-30 min, 5 = 31 min or more from home.

Table 2. Partial Correlation Coefficients for Fruit and Vegetable Intake and Food Environments

	Youth Fruit and Vegetable Intake					
	Adolescents, self-report (n = 171)		Adolescents, parent report (n = 171)		Children, parent report (n = 116)	
	r	*P*	*r*	*P*	*r*	*P*
Home food environment[a]						
Availability of more-healthful food in the home	**0.195**	**.02**	**0.274**	**.001**	0.149	.15
Availability of less-healthful food in the home	**-0.175**	**.04**	**-0.171**	**.04**	-0.165	.11
More-healthful/less-healthful food ratio in the home	**0.229**	**.01**	**0.306**	**< .001**	**0.236**	**.02**
Availability fruits and vegetables in the home	**0.307**	**< .001**	**0.221**	**.008**	**0.342**	**.001**
Community food environment[a]						
More-healthful food outlets	-0.126	.14	0.064	.43	-0.023	.83
Less-healthful food outlets	0.075	.38	0.017	.83	-0.104	.32

[a]Adjusting for youth's sex, age, race/ethnicity, family income, and study site.
Note: Bold values indicate statistical significance ($P < .05$).

may suggest that adolescent girls made different food requests or reported differentially compared to boys.

This study had several strengths. The inclusion of 3 samples provided internal replications. Recruiting participants from 3 geographic regions increased generalizeability. The more-healthful/less-healthful food ratio is a novel measure that may provide more complete quantification of the home food environment by reflecting the competing choices of food options, and it could adjust for a tendency to over-report or under-report on every item.

However, this study can be improved. Unhealthful dietary behaviors—such as consumption of sugared beverages and large portion sizes, which contribute to childhood obesity—should be measured.[31] Objective measures should be used for the community food environment. Consumer food environment, such as the types of food in stores, may be important. Food purchasing behavior should be examined to understand the impacts of food outlets. Since sex of the child is an important determinant of the home food environment, information about other children in the home (eg, age, sex) would allow analysis of sibling effects on the home food environment.

In conclusion, hypotheses of environmental correlates of youth dietary behaviors were partially supported. Home food environment was consistently related to child and adolescent FV intake, supporting a recommendation for parents to provide more-healthful food at home. The community food environment was not related to the home food environment. Family income was the main correlate of more-healthful food in the home, therefore interventions to reduce price or to subsidize healthful food for low-income families should be considered. Families of all income levels may benefit from reducing availability of less-healthful food at home.

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