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Relationship between Grocery Shopping Frequency and Home- and Individual-level Diet Quality among Low-income Racial/ Ethnic Minority Households with Preschool-age Children

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Abstract

Background: The home food environment can shape the diets of young children. However, little is known about modifiable factors that influence home food availability and dietary intake.

Objective: The purpose of this study was to examine the relationship between grocery shopping frequency with home- and individual-level diet quality.

Design: This was a secondary, cross-sectional analyses of data from the Study on Children's Home Food Availability using TechNology (SCAN). Data were collected in the homes of participants from November 2014 through March 2016.

Participants/Settings: A purposive sample of ninety-seven low-income African American and Hispanic/Latinx parent-child dyads residing in Chicago, IL enrolled in the study.

Main outcome measures: The main outcomes were home- and individual-level diet quality. Healthy Eating Index-2010 (HEI-2010) scores were calculated from home food inventory data collected in participants' homes to assess home-level diet quality. To assess individual-level diet quality, HEI-2010 scores were based on multiple 24-hour diet recalls from parent-child dyads.

Statistical Analyses: Grocery shopping frequency was examined in relation to diet quality at the home and individual levels. Grocery shopping frequency was defined as the number of times households shopped on a monthly basis (i.e. once/month, twice/month, three times/month, or four times/month or more). Multivariable linear regression analysis, controlling for covariates, tested the relationships between grocery shopping frequency and HEI-2010 total and component scores at the home- and individual-levels.

Results: Grocery shopping frequency was positively associated with home-level HEI-2010 scores for total diet, whole grains, and empty calories (higher scores reflect better diet quality) and with individual-level HEI-2010 scores for total and whole fruit (parents only), vegetables (children only), and sodium (children only).

Conclusions: Grocery shopping frequency was associated with multiple dimensions of diet quality at the home- and individual- levels. These results offer a potential strategy to intervene on home food availability and individual dietary intake.

Keywords

African-American; Black; Hispanic-American; Latina; Latino; child; preschool; diet; households

INTRODUCTION

Diet quality is positively associated with better health outcomes.¹⁻³ However, the diets of many Americans are unhealthful. Based on data from the National Health and Nutrition Examination Survey (NHANES), diet quality has improved over time (NHANES 1999–2016), but scores indicate that most US adults and children still have diets of poor quality, although the diet quality of some groups are better than others.^{4,5} For example, higher-income individuals have shown larger improvements in diet quality than those of lower-income.^{4,5} Also, younger children (e.g. 2–5 years) improved more compared to older children.⁴ Specifically, preschool-age children have diets higher in fruits, vegetables, and

whole grains and lower in “empty calorie” foods than older children.^{6,7} Interventions to improve diet quality on a population basis should consider targeting young children to prevent the decline of diet quality observed in older children and communities more vulnerable to consuming poor quality diets such as low-income racial/ethnic minority households, who are more likely to encounter obstacles to accessing and consuming a healthy diet.^{8–10}

The home food environment is an important context for families with young children (2–5 years). Despite the shift in popularity with eating away from home, it is still the location where young children eat most meals and form eating habits.^{11,12} One factor thought to be associated with diet quality among young children is home food availability (HFA), such that availability of healthful and unhealthful foods is associated with the consumption of these foods.^{13–20} Impacting HFA could influence diet quality among households with young children. However, a greater understanding of modifiable factors that influence HFA is needed. Greater grocery shopping frequency is associated with fruit and vegetable intake,^{21–24} but less is known about its relationship to other aspects of diet quality or with HFA. Therefore, the purpose of this study is to examine the relationship between grocery shopping frequency and home-level diet quality (based on home-food inventories) among low-income racial/ethnic minority households with preschool-age children. As a secondary aim, the relationship between grocery shopping frequency and individual-level diet quality (based on dietary intake) was also examined.

METHODS

This was a secondary, cross-sectional analyses of data from the Study on Children’s Home Food Availability using TechNology (SCAN).¹⁵ From November 2014 through March 2016, data were collected during two home visits on a sample of 97 African American(AA) (n=50) and Hispanic/Latinx(H/L) (n=47) parent-child dyads living in Chicago, IL. Home food inventories and 24-hour diet recalls were conducted at both visits, but all other measures were collected during the first visit.

A full description of recruitment, screening, eligibility/exclusion criteria, and enrollment procedures have been previously reported.¹⁵ Briefly, the study’s target population were parents that self-identified as either African American/Black or Hispanic/Latinx residing in Chicago with a 2–5 year child living in the same household. Parent-child dyads were passively recruited through brochures and flyers advertised in settings that offered Head Start²⁵ or the Special Supplemental Nutrition Program for Women, Infant, and Children (WIC)²⁶ in Chicago. Written informed consent was obtained from participants upon study enrollment. Study procedures were approved by the University of Illinois at Chicago Institutional Review Board.

Measures

Sociodemographics—Trained research staff interviewed study participants to obtain the following sociodemographic information: race/ethnicity, age, education level, household income, marital status, employment status, household size, and use of food assistance programs.

Food Security Status—Food security was measured with USDA’s Six Item Short Form of the US Food Security Module.²⁷ Participants responded to questions about their household food situation in the past 12 months. Scores were based on the number of affirmative responses and based on a six-point scale (i.e. 0–1 implied high or marginal food security, 2–4 meant low food security, and 5–6 was very low food security).

Anthropometrics—Trained research staff measured parents and children’s heights and weights twice and averaged the results. Individuals were measured in light clothing without shoes. Weight was measured with a SECA 214 portable digital scale (SECA, Hanover, MD), and height was measured using a BWB-800 portable stadiometer (Tanita Corp., Arlington Heights, IL). Height and weight measurements were used to calculate body mass index (kg/m²).

Grocery Shopping-related and family meal behaviors—Participants were asked questions about grocery shopping frequency, mode of transportation to the store, number of stores frequented along with store names. Store names were categorized by store type based on a classification scheme used for a similar target population/setting:²⁸ 1) conventional supermarket (e.g. Jewel, Mariano’s), 2) discount or limited assortment supermarket (e.g. Aldi, Food 4 Less), 3) general retailers with grocery section (e.g. Walmart), 4) warehouse club (e.g. Sam’s Club). Grocery shopping frequency was assessed by asking: “Thinking about the past month, how often do you food shop for the family?” Response categories were: 1) less than once a month, 2) once a month, 3) twice a month, 4) three times a month, 5) four times a month or more. Participants were also asked if additional trips to purchase foods were made in between their main visits with the following question: “In the time between those visits, do you ever make additional trips to purchase foods for your family?” The response categories were “yes” or “no”.

To assess how frequently families ate meals purchased from restaurants (e.g. fast food, take out, etc.), parents were asked,^{29–31} : “During the past week, how many times was a family meal purchased from a fast food restaurant and eaten together either at the restaurant or at home (pizza counts)?” Response categories included “never”, “1 time”, “2 times”, “3 or more times”.

Dietary Intake—Diets of parent-child dyads were assessed by trained data collectors at each home visit through 24-hour diet recalls (one recall per person). Parents provided the recalls for the children. If the 24-hour recall period occurred on a day that the child was at childcare, parents were asked to gather information from the childcare provider regarding the foods offered and consumed. Parents notified childcare providers ahead of time to make notes on the menu regarding the foods the child selected and consumed. Twenty-four hour recalls were collected using the Nutrition Data System for Research (NDS-R),³² a computer-based software application that facilitates the collection of recalls through a guided, automated, multi-pass approach. Standardized amount booklets assisted in estimating portions, and Spanish-translated versions of the materials (e.g. interviewer prompts and amount booklets) were used when appropriate.

Home food inventories—Home food inventories were conducted at both home visits approximately two weeks apart. A full description of this inventory process was provided previously.¹⁵ Briefly, foods with universal product codes (UPC) were inventoried with a tablet device (iPad mini 2, Apple, Inc. Cupertino, CA) using a commercially available app (Prep and Pantry, version 3.7.01, © 2011–2016 Mark Patrick Media LLC) that collected detailed information on each food item (e.g. product name, net weight, quantity, calories per serving), and foods without UPCs were assessed separately on a log form that described the food item and the amount (net weight and quantity). Digital photographs were taken for all food items (with and without UPCs). Foods without UPCs were weighed (in grams) on digital food scales (Soehnle 67080 Page Profi Kitchen Scale, Backnag, Germany) which were calibrated prior to each home visit. Data collectors weighed the food in the containers they were found in to avoid directly touching any food. When available, a similar or exact container was weighed separately so that the container weight could be subtracted from the total weight (i.e. food item plus container weight) to obtain the net weight of the food item. Otherwise, research staff collected and used detailed information about the container (e.g., material, dimensions, and photograph) to find a suitable match so that the container weight could be subtracted from the total weight to obtain the food item's net weight.

Diet quality

The Healthy Eating Index-2010 (HEI-2010) measures adherence to the Dietary Guidelines for Americans (DGA) and demonstrates appropriate construct and concurrent criterion related validity and reliability.^{33,34} The total diet quality score (maximum score of 100) is based on twelve dietary components, with higher scores indicating better diet quality. All food items (barcode and non-barcode) from home food inventories and 24-hour diet recalls were entered in NDS-R. Home- and individual-level Healthy Eating Index-2010 (HEI-2010) scores calculated from home food inventory data and multiple 24-hour dietary recalls, respectively, were used to measure home- and individual-level diet quality. A full description of this process was provided previously.¹⁵ Briefly, to compute total HEI-2010 and component scores, foods were disaggregated into component ingredients; these ingredients were then assigned to corresponding food groups and food groups were converted into food pattern equivalents so that units reported conformed with the HEI (e.g. ounce equivalents, cup equivalents, etc.).

Analysis

Descriptive data were presented as means (standard deviation) or proportions, as appropriate. Variables were stratified by grocery shopping frequency categories. Chi square or one-way analysis of variance were used to test for differences where appropriate. The simple HEI scoring algorithm was used to estimate HEI scores.³⁵ This method can be used in regression models to estimate total and component scores among individuals.³⁶ Average scores of two home food inventories were used to estimate home-level diet quality and the average scores of two diet recalls for parents and children, respectively, were used to estimate individual-level diet quality. In instances where households were missing inventories and/or recalls from the second visit (n=3), available data from the first visit only were used for those households. Multivariable linear regression models were estimated to examine the relationships between grocery shopping frequency (independent variable) and

diet quality (dependent variable) at the home and individual levels. Robust standard error was used to correct for potential non-normality of regression residuals.^{37,38} Models controlled for race/ethnicity, parent BMI, household income, number of household members, marital status, food security status, food assistance use (SNAP), transportation mode to grocery store, family meals with foods prepared away from home, and number of stores visited per grocery shopping trip. All statistical tests were two-sided with an alpha of <0.05 and all analyses were performed using STATA version 14.2.³⁹

RESULTS

Descriptive results

Table 1 displays characteristics of the study sample by grocery shopping frequency. Grocery shopping frequency was not significantly different in most sociodemographic variables, except that the proportion of households shopping once/month was greater in AA households than in H/L households (Table 1). Most households visited more than one store during grocery shopping trips, regardless of grocery shopping frequency (range: 77.8% to 94.4%) and tended to shop at discount/limited assortment supermarkets (e.g. Aldi, Food 4 Less, Save a Lot). Greater proportions of frequent shoppers (twice/month: 60.0%, three times/month: 77.8%; four times/month: 80.6%) drove themselves to the store compared to monthly shoppers (38.9%; *p* value = 0.01).

Main results

Table 2 reports adjusted mean differences in HEI-2010 scores by grocery shopping frequency; more frequent grocery shopping groups were compared to once/month shoppers (reference category). Unadjusted means can be found in the Supplementary Figure. Compared to once/month shoppers, home-level HEI-2010 scores for total diet were ~10 points higher among households that shopped three times/month and about 8 points higher among households that shopped twice/month and four times/month or more (Table 2). Empty calorie scores were ~4 points higher and whole grain scores were ~2 points higher among households that shopped more frequently compared to once/month shoppers (Table 2).

Total HEI-2010 scores at the individual level were not significantly different in households that shopped more frequently compared to once/month shoppers, but differences were observed with some HEI-2010 components. Among parents, scores for total and whole fruit, respectively, were significantly higher among households that shopped 3 times/month and 4 times/month or more compared to once/month shoppers (Table 2). Among children, sodium scores were higher in the twice/month group and vegetable scores were higher in the 4 times/month or more group, compared to once/month shoppers.

DISCUSSION

The purpose of this study was to examine the relationship between grocery shopping frequency and diet quality at the home and individual levels among low-income, racial/ethnic minority families with preschool-age children. Greater grocery shopping frequency was positively associated with home-level HEI-2010 scores for total diet, empty calories,

and whole grains, but not other components of home-level diet quality. Shopping frequency was not associated with individual-level HEI-scores for total diet but was positively associated with individual-level HEI-2010 scores for total fruit and whole fruit among parents and vegetable and sodium among children.

There is support from previous studies that grocery shopping frequency is positively related to fruit and vegetable(F/V) consumption.^{21,23,24} Liese et al. analyzed the interrelationships between supermarket availability, perceived access to healthy foods, shopping frequency, distance, and F/V consumption among households in South Carolina (n=831) and found grocery shopping frequency to be the only variable with a direct effect on F/V consumption.²³ These findings were later replicated in an updated model.^{23,24} Among households in New Orleans (n=3000), Gustat et al. identified grocery shopping frequency as a mediator of F/V consumption.²¹ They also found shopping frequency was positively related to car access and inversely related to store distance. The inverse relationship between grocery shopping frequency and store distance has been reported previously;^{23,40,41} however, distance may be less of a barrier for those with car access.⁴²⁻⁴⁴ In this current study, grocery shopping frequency was positively related to F/V consumption and car access was less common among monthly shoppers. However, it is not clear if car access was a primary reason for shopping less frequently and how driving independently influenced grocery shopping purchases. Further investigation is needed to understand these relationships.

Less is known about how grocery shopping frequency influences food purchases and home food availability (HFA). Pechey et al. examined panel data for 24,879 households in the United Kingdom and found that shopping frequency was positively associated with buying F/V and negatively associated with unhealthful foods.²² In this current study, shopping less frequently (i.e. once/month) was associated with a greater availability of unhealthful foods based on home-level empty calorie scores; however, no relationship was observed with F/V availability. Unlike Pechey et al., this current study relied on home inventories rather than purchases. Therefore, it is possible that purchased F/V were consumed before they could be inventoried. This may be one explanation for why grocery shopping frequency was related to F/V intake, but not availability in this current study. Similarly, grocery shopping frequency was positively associated with empty calorie scores at the home level, but not individual level. This may suggest monthly shoppers have an abundance of foods with added sugars and solid fats available in the home and could rely on these foods when supplies run low, but do not consume these foods daily.

Higher home-level HEI-2010 scores in total diet and whole grains were also observed among more frequent shoppers compared to monthly shoppers. However, mechanisms linking grocery shopping frequency and diet quality are not well understood. Among households of similar SES who reside in comparable neighborhoods, factors in addition to SES and healthy food access may explain differences in home- and individual-level diet quality. Further research should include qualitative approaches and mediation models to provide a better understanding of these differences.

This study offers newer insight about how grocery shopping behaviors relate to overall diet quality and its components. For instance, this study found that children's sodium scores

were worse in households that shopped less frequently (i.e. once/month). Trend data from NHANES suggests that sodium intake among youth has increased significantly across cycles⁴ and is an area that requires more attention. Previous studies on this topic have mainly limited their scope to fruits and vegetables;^{21,23,24,45,46} however, consumption or availability of F/V does not inform us about other aspects of diet quality, particularly unhealthful foods. Evidence suggests that the consumption or availability of healthful foods (e.g. fruits and vegetables) is not inversely correlated with unhealthful foods (e.g. sugar sweetened beverages).⁴⁷⁻⁴⁹ For instance, Anderson et al. examined whether higher consumption of healthful foods was related to consuming less unhealthful foods among preschoolers from low-income communities and found no inverse relationship.⁴⁷ These findings were later reproduced with data from the Early Childhood Longitudinal Study-Birth Cohort.⁴⁸ Trofholz et al. assessed the home food environments of racially/ethnically diverse households with young children, and households with the highest levels of fruits and vegetables also had high availability of unhealthful foods in the home.⁴⁹

Strengths and limitations

A major strength of this study was home-level diet quality was based on an objective measure for assessing HFA. Specifically, HFA was measured through exhaustive home food inventories rather than a self-reported checklist. There are also limitations to note. Homes were only inventoried twice over the course of a month and foods might have been missed, particularly among households that shopped less frequently. Additionally, not all grocery shopping trips may have been accounted for because additional trips (e.g. trips for smaller purchases, online purchases, etc.) were not included in the main analyses. While 24-hour recalls are considered the least biased of the self-reported instruments, they are still subject to bias and recall errors.⁵⁰ In particular, the 24-hour diet recalls collected were scheduled and not random and parents provided recalls to assess children's diet quality which could result in underreporting of some meals and/or foods.⁵¹ This study was cross-sectional, so causal inferences between grocery shopping frequency and diet quality cannot be made. Finally, the sample was small and consisted of low-income AA and H/L families in an urban setting, which limits the generalizability of these findings.

CONCLUSIONS

The findings show that grocery shopping frequency was positively associated with overall home-level diet quality and other components of diet quality at the home- and individual levels. Grocery shopping behaviors could be a promising target of intervention. However, future research should further examine mechanisms linking grocery shopping behaviors with both purchases and dietary intake.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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RESEARCH SNAPSHOT

Research Question(s):

What is the relationship between grocery shopping frequency with home-level diet quality and individual-level diet quality, respectively?

Key Findings:

In this cross-sectional analysis based on a sample of 97 low-income, racial/ethnic minority households with preschool-age children, grocery shopping frequency was positively associated with home-level Healthy Eating Index-2010 (HEI-2010) scores for total diet and HEI-2010 components such as whole grains and empty calories (higher scores reflect better diet quality), but not other home-level HEI-2010 components. Greater shopping frequency was not associated with total diet HEI-2010 scores at the individual level, but was positively associated with individual-level HEI-2010 components such as total and whole fruit (parents only), total vegetables (children only) and sodium (children only).

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Table 1.

Characteristics of parent-child dyads participating in SCAN^a residing in Chicago, IL from 2014–2016 by categories of grocery shopping frequency (n=97).

	Once/month (n=18)	Twice/month (n=25)	Three times/ month (n=18)	Four times/ month or more (n=36)	P value ^b
Parent Age(yrs) mean (<i>sd</i>)	29.6 (4.7)	32.7 (7.7)	33.9 (8.3)	35.5 (8.9)	0.06
Child Age (yrs) mean (<i>sd</i>)	4.3 (1.4)	3.8 (1.2)	4.4 (1.3)	3.6 (1.2)	0.07
Race/Ethnicity					
Hispanic/Latinx % (n)	11.1%(2)	48.0%(12)	44.4% (8)	69.4%(25)	0.001
African American % (n)	88.9%(16)	52.0%(13)	55.6%(10)	30.6% (11)	
Female % (n)					
Parent	100% (18)	100% (25)	100% (18)	94.4% (34)	0.33
Child	22.2% (4)	44.0% (11)	38.9% (7)	38.9% (14)	0.51
Educational status % (n)					
High School/GED or more	83.3% (15)	80.0% (20)	94.4% (17)	75.0% (27)	0.38
Annual Income % (n)					
<\$20,000	72.2% (13)	60.0% (15)	77.8% (14)	66.7% (24)	0.76
Marital status % (n)					
Married or living with a partner	27.8% (5)	40.0% (10)	44.4% (8)	58.3% (21)	0.17
Employment status % (n)					
Full time or part time	27.8% (5)	40.0% (10)	27.8% (5)	30.6% (11)	0.79
Household Size mean (<i>sd</i>)					
Total adults and children in the house	4.2 (1.9)	4.8 (2.3)	4.3 (1.5)	4.2 (1.6)	0.77
Food Assistance Use: % <i>yes</i> (n)					
SNAP	83.3% (15)	72.0% (18)	94.4% (17)	75.0%(27)	0.27
WIC	55.6% (10)	64.0% (16)	55.6% (10)	63.9% (23)	0.88
Food Security Status % (n)					
High or marginal	44.4% (8)	64.0% (16)	50.0% (9)	55.6% (20)	0.61
Low or very low	55.6%(10)	36.0% (9)	50.0% (9)	44.4% (16)	
Family meals from fast food % (n)					
One time/week or more	38.9% (7)	72.0% (18)	77.8% (14)	69.4% (25)	0.06
Number of stores per grocery shopping trip % (n)					
One store	16.7% (3)	8.0% (2)	5.6% (1)	22.2% (8)	0.28
More than one store	83.3% (15)	92.0% (23)	94.4% (17)	77.8% (28)	
Grocery Store Type % (n)					
Discount or limited assortment supermarket	77.8% (14)	76.0%(19)	72.2%(13)	66.7%(24)	0.80
Transportation to the store % (n)					
Drive yourself	38.9% (7)	60.0% (15)	77.8% (14)	80.6% (29)	0.01

	Once/month (n=18)	Twice/month (n=25)	Three times/ month (n=18)	Four times/ month or more (n=36)	P value ^b
Additional food purchases ^c % (n)					
Yes	81.3% (13)	62.5% (15)	58.8% (10)	58.8% (20)	0.45
Parent BMI ^d					
BMI mean (sd)	31.7 (7.5)	29.8 (6.7)	32.1 (6.3)	31.9 (9.0)	0.59
Child BMI percentile % (n)					
>= 95th percentile	11.1%(2)	16.0% (4)	16.7% (3)	16.7% (6)	0.96

^aStudy on Child Home Food Availability using TechNology (SCAN),

^bobtained from chi square or analysis of variance where appropriate.

^cMade additional trips to purchase foods in between primary grocery shopping trips,

^dBody mass index (BMI).

Adjusted mean differences in home- and individual-level HEI-2010^a scores by grocery shopping frequency among households participating in SCAN^b from 2014–2016 in Chicago, IL (n=97).

Table 2.

	Home ^c		Parent ^d		Child ^d	
	β^e	95% CI	β^e	95% CI	β^e	95% CI
Total HEI-2010						
Twice/month	7.88	(1.22, 14.53)	3.45	(-3.38, 10.28)	-1.32	(-8.10, 10.7)
Three times/month	9.56	(2.15, 16.96)	5.91	(-3.42, 15.25)	-3.28	(-7.48, 14.04)
Four times/month or more	8.39	(1.08, 15.71)	4.65	(-2.62, 11.92)	4.12	(-6.21, 14.46)
Total Vegetables						
Twice/month	0.28	(-0.54, 1.10)	0.48	(-0.51, 1.46)	0.21	(-0.44, 0.87)
Three times/month	0.44	(-0.50, 1.39)	0.40	(-0.70, 1.50)	0.64	(-0.12, 1.40)
Four times/month or more	0.72	(-0.18, 1.60)	0.31	(-0.69, 1.31)	1.00	(0.25, 1.74)
Greens and Beans						
Twice/month	0.37	(-0.63, 1.36)	0.66	(-0.62, 1.93)	0.64	(-0.25, 1.53)
Three times/month	0.59	(-0.73, 1.90)	0.39	(-1.40, 2.19)	0.22	(-0.86, 1.29)
Four times/month or more	0.63	(-0.37, 1.63)	-0.11	(-1.35, 1.12)	0.60	(-0.18, 1.38)
Total Fruit						
Twice/month	0.42	(-0.07, 0.92)	0.21	(-0.71, 1.12)	-0.003	(-1.35, 1.35)
Three times/month	0.30	(-0.22, 0.81)	2.00	(0.71, 3.30)	0.39	(-1.03, 1.81)
Four times/month or more	0.47	(-0.11, 1.06)	1.15	(0.12, 2.19)	-0.06	(-1.39, 1.27)
Whole Fruit						
Twice/month	0.56	(-0.18, 1.29)	0.62	(-0.58, 1.83)	0.35	(-1.06, 1.75)
Three times/month	0.32	(-0.40, 1.04)	1.61	(0.09, 3.13)	0.10	(-1.43, 1.63)
Four times/month or more	0.40	(-0.43, 1.24)	1.34	(0.22, 2.47)	0.42	(-1.10, 1.94)
Whole Grains						
Twice/month	1.10	(-0.66, 2.86)	0.32	(-1.98, 2.63)	-0.92	(-3.27, 1.42)
Three times/month	1.70	(0.10, 3.29)	-0.49	(-2.57, 1.60)	-0.25	(-3.09, 2.60)
Four times/month or more	1.83	(0.16, 3.49)	-0.48	(-2.59, 1.63)	-0.48	(-2.92, 1.97)
Dairy						

	Home ^c		Parent ^d		Child ^d	
Twice/month	0.29	(-0.60, 1.17)	-1.56	(-3.86, 0.75)	-0.99	(-3.05, 1.07)
Three times/month	0.65	(-0.53, 1.82)	-1.55	(-4.55, 1.46)	0.47	(-1.74, 2.68)
Four times/month or more	0.53	(-0.35, 1.41)	-1.26	(-3.81, 1.30)	-0.27	(-2.21, 1.68)
Total Protein Foods						
Twice/month	-0.12	(-0.85, 0.62)	-0.16	(-0.52, 0.20)	-0.14	(-1.05, 0.77)
Three times/month	-0.26	(-0.94, 0.43)	-0.50	(-1.13, 0.14)	0.05	(-0.90, 1.10)
Four times/month or more	0.07	(-0.66, 0.80)	-0.40	(-0.91, 0.12)	-0.34	(-1.25, 0.57)
Seafood and Plant Proteins						
Twice/month	-0.003	(-0.86, 0.85)	-0.03	(-1.15, 1.10)	-0.13	(-1.62, 1.35)
Three times/month	-0.21	(-1.32, 0.91)	-0.57	(-1.58, 0.44)	-0.72	(-2.49, 1.06)
Four times/month or more	-0.17	(-1.01, 0.66)	0.43	(-0.75, 1.61)	-0.20	(-1.81, 1.40)
Fatty Acids						
Twice/month	0.15	(-1.39, 1.69)	1.56	(-0.86, 3.98)	0.99	(-1.29, 3.27)
Three times/month	0.64	(-0.93, 2.21)	1.67	(-1.51, 4.86)	-0.25	(-2.74, 2.25)
Four times/month or more	-0.54	(-2.07, 0.99)	1.41	(-1.32, 4.16)	1.33	(-0.94, 3.59)
Sodium						
Twice/month	0.35	(-2.53, 3.24)	1.88	(-0.67, 4.42)	2.59	(0.28, 4.89)
Three times/month	1.36	(-1.44, 4.17)	2.21	(-0.52, 4.92)	1.08	(-1.64, 3.79)
Four times/month or more	0.45	(-2.27, 3.17)	2.14	(-0.56, 4.83)	1.58	(-0.88, 4.04)
Refined Grains						
Twice/month	0.38	(-1.83, 2.58)	1.29	(-0.80, 3.38)	0.44	(-2.01, 2.89)
Three times/month	-0.32	(-2.71, 2.07)	1.08	(-1.00, 3.16)	-0.90	(-3.93, 2.14)
Four times/month or more	0.40	(-1.80, 2.61)	0.94	(-0.90, 2.78)	-0.72	(-3.40, 1.95)
Empty Calories						
Twice/month	4.10	(1.37, 6.84)	-1.82	(-5.23, 1.60)	-1.72	(-4.50, 1.07)
Three times/month	4.34	(1.10, 7.59)	-0.36	(-3.96, 3.24)	2.45	(-0.23, 5.13)
Four times/month or more	3.61	(0.90, 6.31)	-0.84	(-4.03, 2.35)	1.26	(-1.15, 3.67)

p value < 0.05;

^a HEI-2010: Healthy Eating Index 2010;

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^bSCAN: Study on Children's Home Availability Using Technology;

^cHome-level HEI-2010 scores were based on two home food inventories from each household (n=97) to estimate home-level diet quality.

^dIndividual-level HEI-2010 scores were based on 24-hour diet recalls (two recalls per person) to estimate individual-level diet quality for parents (n=97) and children (n=97), respectively.

^eRegression coefficients compare the grocery shopping categories reported in the table to the reference group (i.e. once/month) by presenting the mean difference in HEI-2010 scores adjusted for covariates. Covariates in the model are race/ethnicity, parent body mass index, income level, total number of household members, marital status, food security status, food assistance status (SNAP), transportation mode to grocery store, family meals prepared away from home, and number of stores visited per shopping trip.