

# How Adolescents and Parents Food Shopping Patterns and Social Interaction when Shopping is Associated with Dietary Outcomes in Rural Communities

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## Abstract

**Objective:** The aim of this study was to:

- 1) Describe the bi-directional relationship between parent and adolescent food shopping patterns and behaviors.
- 2) Assess the association between adolescent and parent self-reported food shopping behaviors, dietary patterns and body mass index.

**Design:** Cross-sectional survey.

**Setting:** Four rural counties in Kentucky and Ohio, United States, 2013

**Subjects:** Adolescents, ages 13-18, and their primary caregiver who conducted at least 25% of the food shopping.

**Results:** Close to 60% of adolescents report grocery shopping with their parent. There was almost complete agreement between the parent and adolescent for eating fast-food together ( $p=0.0069$ ), but low agreement on purchasing food from convenience stores ( $p=0.15$ ). Adolescents who purchase food from school vending, gas stations, and convenience stores combined often consumed more added sugars and sugar-sweetened beverages (SSB) (2.66 [95% CI 0.43, 4.90]). Lastly, those who shopped with a friend at a fast food establishment consumed more mean added sugars.

**Conclusion:** Adolescents and parents are influenced by their social and food store shopping behaviors. Policies and interventions need to address cumulative shopping behavior practices and social interactions within these venues.

## Introduction

Adolescents are consuming excessive amounts of high-fat, high-sodium, and non-nutrient dense foods, such as salty snacks and sugar-sweetened beverages (SSB) [1,2], while consumption of whole grains, fruits, vegetables, and dairy foods fail to meet dietary recommendations [3]. These dietary patterns place adolescents at risk for obesity and chronic disease [4-6]. Research suggests that family plays a major role in determining dietary patterns of youth, with parent-offspring associations for intakes of total energy, foods and nutrients related to disease risk [7]. However, after the age of 10, there is an enhanced propensity for children to rely more on their peers and less on their parents [8]. During the critical teen years, adolescents are largely influenced by peers and their environment [9, 10]. Because adolescents also begin to have more mobility during this period, the types of stores they frequent and have access tends to shift [11]. It has been documented that adolescents who frequent convenience stores and live in neighborhoods with a greater density of fast-food restaurants consume more calories, report lower Healthy Eating Index (HEI) scores [12], higher consumption of SSB [13], and have higher body mass index (BMI) levels [14]. Conversely, other studies have found no association between densities of fast-food restaurants with any diet or weight outcomes [15,16].

Although parents and peers play a significant role in dietary intakes among adolescents [7], food shopping behaviors with peers and parents and within one's food environment remains an underrepresented construct [17]. Therefore a more proximal determinant of diet and weight status may be certain food shopping behaviors (venue choice, frequency, companionship, and day time pattern). When adolescents were shopping with peers and healthier option snacks were subsidized, adolescents chose the healthier option [18]. However, a different study reported that adolescents who frequently grocery shopped with their parent consumed more calories [17]. These findings suggest that companionship of the adolescents when shopping may influence to

a greater or lesser extent food choice. In regards to store choice and frequency, a recent study reported that there was no difference between store choice or shopping frequency between different types of food environments [19] suggesting that simply measuring access to different types of food venues does not capture individual level variables of choice and frequency. Indeed it may be where an adolescent chooses to shop and who they are with rather than just having a certain store type in their neighborhood that influences purchasing and consumption of certain foods [10].

Therefore the aims of this study were to 1) describe the bi-directional relationship between parent and adolescent food shopping patterns and behaviors; and 2) determine the individual associations between adolescent and parent self-reported food shopping behaviors and patterns in relation to fiber, calcium, fruit and vegetables, whole grains, SSB, and added sugar intakes as well as body mass index.

## Methods

### Study sample

Families with adolescents between the ages of 13 and 18 years

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living within Webster and Woodford Counties in Kentucky and Noble and Jefferson counties in Ohio were recruited to participate in a cross-sectional survey in the fall of 2013. A total of 76 adolescents and parent dyads were called to participate in the study. However, only 54 adolescent and parent dyads were found to be eligible based on screening and eligibility criteria (71% response rate).

### Study Region

	Webster (KY)(20)	Woodford (KY)	Noble (OH)	Jefferson (OH)
Persons below poverty	16%	11.3%	14.9%	17.7%
Median HH income	\$39,635	\$56,537	\$39,500	\$37,527
Free and Reduced Lunch	54%	29%	33%	40%
Non-Hispanic White	91%	89.7%	95.8%	91.1%
Mean travel miles to work	22	21	27	22

Table 1: Study region.

### Recruitment

Kentucky adolescents were recruited within middle and high schools in both Webster and Woodford County. Both school districts gave permission to put flyers within the school, send an e-mail to all students and parents about the study, and distributed the flyer in homeroom to all classes. Ohio dyads were recruited through 4-H program coordinators in each county. Newsletter announcements and emails were sent to potential participants involved in the county 4-H programs.

### Eligibility

Adolescent eligibility consisted of being between the ages of 13-18 year, resided in the county for at least one year, spoke English, obtained parental permission, had no serious health conditions that would dramatically alter their dietary intake, and the parent agreed to participate in the study. Parental eligibility consisted of conducting at least 25% of the food shopping, spoke English, and did not have any serious health conditions which would dramatically alter their dietary intake, and the adolescent provided assent to participate.

### Enrollment and informed consent/assent

Interested study participants could text, phone, or complete an online survey to request information or study participation. The PI or trained graduate student reviewed the eligibility criterion for all interested participants. Information sessions were conducted in early fall 2013 to gather informed consents from parents, acquire parental permission for the adolescents to participate in the study, and for the adolescents to sign the assent form. Internal review Board approved all procedures and protocols for this study.

### Survey

The 30-40 minute phone survey was designed to capture food shopping patterns, behaviors, and dietary intake among adolescents and their parents. The survey utilized previously validated questions from the University of Minnesota Project EAT on food purchasing habits, home availability, fast-food buying habits, and eating out behaviors [17]. Dietary assessments were performed using the validated National Health and Nutrition Examination Survey (NHANES) 2009–2010 dietary screener [21] that has been previously tested among adolescents. The NHANES Dietary Screener Questionnaire is composed of 26 questions quantifying the frequency of consumption of selected foods and drinks to capture intakes of fruits and vegetables, dairy/calcium,

whole grains/fiber, added sugars, red meat, and processed meat during the past month.

Trained research assistants (RAs) administered 106- and 131-item surveys about food shopping behaviors, travel patterns and dietary habits to each parent and adolescent, respectively, via telephone. At enrollment, the adolescent and parent provided their phone numbers as well as convenient days and times to conduct the phone survey. This information was used to contact study participants. Participant responses were recorded with Research Electronic Data Capture (REDCap) [22].

### Incentives

Both the adolescent and the parent each received a \$25 check payment as incentive per survey after participation. A mailed check was sent to each participant's residence. If the adolescent agreed, a \$50 check was sent to the residence made out to the parent.

### Independent and Dependent variables

**Independent–Food Shopping Behaviors:** To capture each construct of food purchasing behaviors, the following survey questions were used:

Food store choice and frequency was captured with the following question- How often do you shop or purchase food from the following types of food venues (fast-food restaurant, convenience store, gas station, grocery store, super center, school vending, school cafeteria, farmers' market, buffet or cafeteria, deli, coffee shop, sit-down restaurant)? The answers for each questions consisted of 'yes' and 'no' if they purchased food at this type of venue. To categorize frequency the above question was asked with the answers consisting of 'never'; 'sometimes'; and 'often'. In this analysis, a binary variable was used to assess if they shopped at this venue, and the categories for frequency were retained. In descriptive statistics and regression but were categorized into 'never' and 'ever' (combined sometimes and often) when conducting Kappa Statistics and agreement test.

Companionship and day time patterns of food purchasing the following survey questions were used: 1) Do you purchase fast-food in the morning alone, with a friend, with a parent?; and 2) Do you purchase fast-food after school alone, with a friend, with a parent? similar format was used to capture gas station purchases before and after school, and grocery store shopping anytime alone, with a friend or with a parent. The responses for these questions were 'never'; 'sometimes'; and 'often'. These variables maintained a categorical pattern for analysis.

### Dependent variables

**Dietary intake:** Responses to the NHANES dietary screener were scored using the algorithm provided by the National Cancer Institute [23]. The algorithm generates predicted values for fiber (gm), calcium (mg), added sugars (tsp), added sugars excluding cereal (tsp), whole grains (ounce equivalents), dairy (cup equivalents), fruits and vegetables (cup equivalents, with and without French fries) and added sugars from SSB (tsp). In these analyses, all variables retained a linear shape and were not categorized.

**Body Mass Index (BMI):** Self-report BMI was captured by asking participants their height and weight. BMI for the parent was generate using kg/m<sup>2</sup> where as for the adolescent z-scores were used.

**Covariates:** Age was captured by asking what year each participant was born. Race was categorized as 'white' or 'other'. Education was categorized as 'High School', 'some College', and 'College'. Employment

	Adolescents (mean/SE or percentage) Male n=9	Adolescents (mean or percentage) Female n=19	Parent (mean or percentage) n=25
<b>Education</b>			
High School	N/A		20%
Some College	N/A		44%
College	N/A		36%
<b>Employment Status</b>	N/A		
Unemployed	N/A		8%
Homeworker	N/A		4%
Employed	N/A		88%
<b>Household Income</b>	N/A		
\$25,000-\$50,000	N/A		37.5%
greater than \$50,000	N/A		62.5%
<b>WIC participation</b>	N/A		
No	N/A		100%
<b>SNAP participation</b>	N/A		
Yes	N/A		8%
<b>Gender</b>			
Male	32%		8%
Female	68%		92%
<b>Age (yrs)</b>	14.4 (0.56)	15.1 (0.41)	44.2 (6.25)
<b>Race</b>			
White	100%	100%	100%
<b>Body Mass Index</b>			
Normal Weight	62.50%	57.90%	45.50%
Overweight	25%	36.80%	40.90%
Obese	12.50%	5.30%	13.60%
<b>Dietary Habits</b>			
Fiber (g) range 8.1-28.6	17.5	11.1	0.148
Calcium (mg) range 500-2763	1547	7.81	9.61
Added sugars (tsp) range 3.1-55	17.3	15.2	13.8
Whole grain (oz) range 0.1 - 5.8	1.2	0.5	0.6
Fruit/Veg minus french fries (cups) range 0.5-4.8	3	1.8	2.5
Added Sugar from SSB (tsp) range 0 - 49	9.5	8.6	7.2

**Table 2:** Demographics of Adolescents and Parents from 4 counties in Ohio and Kentucky, 2013.

was categorized as ‘employed’, ‘unemployed’, and ‘homemaker’. Household income was categorized as ‘\$25,000-\$50,000’ and ‘\$50,000 or greater’ based upon responses. Gender was coded as ‘female’ or ‘male’. Age and gender were asked among adolescents and parents. All other covariates were only captured from the parent.

**Statistical analyses:** Continuous variables were summarized with descriptive statistics (mean and standard errors); dietary intake, BMI, and age were treated as continuous variables. Categorical variables were described with percentages; demographic characteristics, frequency of shopping and food behaviors, and dichotomized variables were treated as categorical variables. Comparisons were made between males and females among adolescents by Chi-square tests of independence. Kappa statistics and tests of agreement were calculated based on parent-to-adolescent matched pairs (N of pairs=54). To test the association between food shopping behaviors with dietary outcomes and BMI linear regressions, adjusting for parental income, education, and cluster command on county were used. Additionally, factor analysis

was performed to explore food shopping patterns; four factors were retained based on eigenvalues, scree plots, interpretability.

All statistical tests used a significance level of 0.05 and all analyses were performed using SAS V9.3 (SAS Institute, Cary, NC)

## Results

The study sample (Table 2) consisted of 24 parents and 28 adolescents (54 dyads with 4 adolescents coming from the same household), Adolescent mean age was about 15 years for males and females (64% of adolescent under 16 year-old), indicating most of the sample was reliant on others for transportation. Lastly, approximately 40% of both the adolescent males and females were overweight or obese.

Results from food venue choice and frequency (Table 3) indicate a high majority of male adolescents purchase food from the cafeteria ‘often’ (89%) while a smaller percentage of female adolescents

Location of Where Food is purchased	Adolescents (N=28)		Parents (N=25)
	Male (N=9)	Female (N=19)	
<u>School cafeteria/work(parent)</u>			
Yes	88.9%	68.4%	75%
No	11.1%	31.6%	25%
<b>Frequency</b>			
Never	11.1%	31.6%	66.7%
Sometimes	0%	31.6%	33.3%
Often	88.9%	36.8%	0%
<u>School vending</u>			
Yes	33.3%	47.4%	NA
No	66.7%	52.6%	NA
<b>Frequency</b>			
Never	66.7%	52.6%	NA
Sometimes	33.3%	42.1%	NA
Often	0%	5.3%	NA
<u>Grocery Store</u>			
Yes	66.7%	84.2%	100%
No	33.3%	15.8%	0%
<b>Frequency</b>			
Never	11.1%	15.8%	0%
Sometimes	22.2%	31.6%	4%
Often	66.7%	52.6%	96%
<u>Super Center</u>			
Yes	66.7%	78.9%	84%
No	33.3%	21.1%	16%
<b>Frequency</b>			
Never	11.1%	15.8%	12%
Sometimes	44.4%	42.1%	48%
Often	44.4%	42.1%	40%
<u>Gas Stations</u>			
Yes	44.4%	63.2%	36%
No	55.6%	36.8%	64%
<b>Frequency</b>			
Never	55.6%	36.8%	44%
Sometimes	22.2%	52.6%	52%
Often	22.2%	10.5%	4%
<u>Convenience Stores</u>			
Yes	55.6%	52.6%	48%
No	44.4%	47.4%	52%
<b>Frequency</b>			
Never	66.7%	26.3%	48%
Sometimes	22.2%	63.2%	52%
Often	11.1%	10.5%	0%

<i>Fast-food Restaurant</i>			
Yes	55.6%	94.7%	82.1%
No	44.4%	5.3%	17.9%
<i>Frequency</i>			
Never	22.2%	5.3%	10.7%
Sometimes	66.7%	73.7%	71.4%
Often	11.1%	21.1%	17.9%
<i>Sit-down restaurant</i>			
Yes	77.8%	78.9%	96%
No	22.2%	21.1%	4%
<i>Frequency</i>			
Never	22.2%	26.3%	4%
Sometimes	66.7%	42.1%	88%
Often	11.1%	31.6%	8%
<i>Farmers' Market</i>			
Yes	33.3%	21.1%	64%
No	66.7%	78.9%	36%
<i>Frequency</i>			
Never	66.7%	63.2%	32%
Sometimes	11.1%	36.8%	56%
Often	22.2%	0%	12%

**Table 3:** Food shopping venues and frequency among adolescents and parents, KY and OH, 2013.

purchase food from the school cafeteria (37%) (p-value=0.0309). Yet, a higher percentage of females (42%) report purchasing food from school vending 'sometimes' relative to their male counterparts (33%) (p-value=0.669).

In regards to food purchasing habits and companionship more adolescents report sometimes or often purchasing food from fast-food restaurants or from gas stations with friends (32% purchasing from fast-food, 19% purchasing from gas station) or with a parent (29% purchasing from fast-food, 22% purchasing from gas station) relative to being alone (14% purchasing from fast-food, 17.9% purchasing from gas station) (Table 4). When the parent and child were asked about frequency of eating fast-food, the responses were almost in complete agreement (p= 0.0069). However, with all other food venues there was low agreement between the dyads.

For models testing the association between food shopping behaviors and dietary outcomes and BMI (Table 5) among adolescents, results indicate that frequently shopping at fast-food restaurants consume fewer ounces of whole grains (-1.00 [95% CI -1.83, -0.18]) compared to those that never shop at fast-food restaurants. Higher consumption of added sugars was associated with frequently shopping at convenience stores (2.66 [95% CI 0.43, 4.90]), gas stations (5.82 [95% CI 0.35, 11.29]), and sit-down restaurants (6.09 [95% CI 0.614, 11.57]). Similar results are seen with SSB among these same venues.

The factor analysis indicated that convenience stores, gas stations, and school vending loaded similarly. Grocery stores, supercenters, school cafeteria, and sit-down restaurant loaded together. Interestingly fast-food restaurant shopping behaviors represented a separate factor. For the convenience store group results indicate that those who frequently shop at all three types of venues consume more added sugars and SSB relative to those who do not frequently engage in this cumulative shopping behavior (added sugars 2.66 [95% CI 0.43, 4.90], SSB 3.35 [1.26, 5.43]). Additionally, those who frequently shop at grocery stores, supercenters, sit-down restaurants, and school cafeteria consume more added sugars and SSB relative to those who do not frequently engage in this cumulative shopping behavior (added sugars 2.60 [95% CI 0.53, 4.66], SSB 2.66 [0.60, 4.71]).

Lastly, models testing the association between shopping alone, with a friend, and with a parent for SSB intake and added sugars (Table 6) indicate that those who purchases fast-food in the morning with a friend consumed more mean teaspoons of added sugar and SSB relative to those who never purchased fast-food in the morning (t=5.63 added sugar and t=6.84 SSB p<0.001). However, when adolescents purchase fast-food after school alone they report more mean teaspoons of added sugar and SSB relative to those who never purchased fast-food after school (t=2.87 p=0.087 and added sugar and t=2.52 p=0.02). All other dietary outcomes (fiber, calcium, whole grains) were not associated with any social purchasing behavior.

## Discussion

Results from this cross-sectional study shed light on the food shopping behavior and patterns among adolescents, their parents, and the associations with dietary intake. In these rural communities, results indicate that a major source of food purchasing occurs at gas stations and convenience stores among both parents and adolescents. Frequent shopping at these types of venues is associated with higher intake of sugar and SSB among our sample. Results from this study suggest that frequently shopping at a variety of venues combined (convenience stores, gas stations, and school vending) was associated with higher sugar intakes. The type of person that purchases food from school vending also frequents gas stations and convenience stores which may lead to increased consumption of SSB. Previous studies have found that the availability of healthy foods at convenience stores and gas stations is limited [24] and that adolescents who frequently purchase food from these types of stores consumed more energy, total fat, and saturated fats [25]. This result highlights the need for not simply addressing access to one store type but also a behavior of shopping in totality that is associated with higher intake of SSB [19].

In regards to the role of companionship our results confirm previous studies related to dietary intake among peers and parents. When the adolescent is with their friend or parent, they consume more added sugars and SSB. Literature has suggested that adolescents will change their eating patterns when in the presence of peers to conform to, impress or avoid judgments [18]. In regards to purchase behavior, adolescent girls shopping with peers tended to purchase food higher in calories when their friend purchased a food item higher in calories [26]. Interventions aimed at improving dietary intake among adolescents need to consider targeting peer influence while shopping.

In regards to fast-food restaurants, the factor analysis suggests that this type of behavior is unique as well as the time of day when purchasing food from this type of venue. When eating at fast-food restaurants in the morning adolescents consumed higher intakes of sugar with a friend. However, eating at a fast-food restaurant after school was only associated with higher intake when alone. These different results highlight how different food venues and social interactions within specific venues are associated with dietary intake among adolescents. One recent study found that adolescents will consume more SSB if they perceived their friend or family member to be consuming this type of beverage and consume more fast-food [27]. However, to our knowledge this result of highlighting how time of day may also influence what is purchased at a fast-food restaurant which influences dietary intake is unique. This finding suggests that only targeting fast-food restaurant access does not accurately capture who the adolescent is with and time of day which may be a more proximal determinant to dietary intake. Studies highlighting how access to fast-food restaurants is not associated with intake may not have fully explored the complexity of individual choice and social interactions at these venues [10,28] in the

<b>Companionship</b>	Male (n=9)	Female (n=19)	Adolescents (n=28)	Parents (n=25)	Kappa Statistic (95% CI)	P-value
<b>Frequency eat at sit down restaurant with your parent/child</b>					-0.1796, -0.0022	1
Never	0 (0.0%)	2 (10.5%)	2 (7.1%)	2 (8.0%)		
Sometimes	6 (66.7%)	11 (57.9%)	17 (60.7%)	21 (84.0%)		
Often	3 (33.3%)	6 (31.6%)	9 (32.1%)	2 (8.0%)		
<b>Frequency eat at buffet or cafeteria with your parent/child</b>					-0.1360, 0.6360	0.2191
Never	4 (44.4%)	8 (42.1%)	12 (42.9%)	12 (48.0%)		
Sometimes	4 (44.4%)	10 (52.6%)	14 (50.0%)	13 (52.0%)		
Often	1 (11.1%)	1 (5.3%)	2 (7.1%)	0(0.0%)		
<b>Frequency eat at fast food restaurant with your parent/child</b>					-0.1320, 1.0000	<b>0.0069*</b>
Never	2 (22.2%)	1 (5.3%)	3 (10.7%)	1 (4.0%)		
Sometimes	6 (66.7%)	13 (68.4%)	19 (67.9%)	20 (80.0%)		
Often	1 (11.1%)	5 (26.3%)	6 (21.4%)	4 (16.0%)		
<b>Frequency eat at deli with your child</b>					-0.3548, 0.4601	1
Never	8 (88.9%)	12 (63.2%)	20 (71.4%)	19 (76.0%)		
Sometimes	1 (11.1%)	6 (31.6%)	7 (25.0%)	5 (20.0%)		
Often	0 (0.0%)	1 (5.3%)	1 (3.6%)	1 (4.0%)		
<b>Frequency eat at take-out foods from a convenience store with your parent/child</b>					-0.0632, 0.5247	0.1515
Never	6 (66.7%)	5 (26.3%)	11 (39.3%)	19 (76.0%)		
Sometimes	3 (33.3%)	12 (63.2%)	15 (53.6%)	5 (20.0%)		
Often	0 (0.0%)	2 (10.5%)	2 (7.1%)	1 (4.0%)		
<b>Frequency eat at coffee shop with your parent/child</b>					-0.3321, -0.0383	0.3422
Never	7 (77.8%)	15 (78.9%)	22 (78.6%)	21 (84.0%)		
Sometimes	2 (22.2%)	3 (15.8%)	5 (17.9%)	4 (16.0%)		
Often	0 (0.0%)	1 (5.3%)	1 (3.6%)	0(0.0%)		
<b>Food purchasing patterns</b>						
<b>Fast-food purchases in the morning alone</b>						
never						
Sometimes						
Often						
<b>Fast-food purchases in the morning with a friend in the morning</b>						
Never		6 (66.7%)		13 (68.4%)		19 (67.9%)
Sometimes		3 (33.3%)		5 (26.3%)		8 (28.6%)
Often		0 (0.0%)		1 (5.3%)		1 (3.6%)
<b>Fast-food purchases in the morning with a parent in the morning</b>						
Never		7 (77.8%)		13 (68.4%)		20 (71.4%)
Sometimes		2 (22.2%)		5 (26.3%)		7 (25.0%)
Often		0 (0.0%)		1 (5.3%)		1 (3.6%)
<b>Gas stations purchases in the morning alone</b>						
Never		7 (77.8%)		16 (84.2%)		23 (82.1%)
Sometimes		2 (22.2%)		3 (15.8%)		5 (17.9%)
<b>Gas stations purchases in the morning with a friend</b>						
Never		8 (88.9%)		15 (78.9%)		23 (82.1%)
Sometimes		1 (11.1%)		2 (10.5%)		3 (10.7%)
Often		0 (0.0%)		2 (10.5%)		2 (7.1%)
<b>Gas stations purchases in the morning with a parent</b>						
Never		7 (77.8%)		15 (78.9%)		22 (78.6%)
Sometimes		1 (11.1%)		4 (21.1%)		5 (17.9%)
Often		1 (11.1%)		0 (0.0%)		1 (3.6%)
<b>Fast-food purchases after school alone</b>						
Never		8 (88.9%)		12 (63.2%)		20 (71.4%)
Sometimes		1 (11.1%)		4 (21.1%)		5 (17.9%)
Often		0 (0.0%)		3 (15.8%)		3 (10.7%)
<b>Fast-food purchases after school with a friend</b>						
Never		7 (77.8%)		9 (47.4%)		16 (57.1%)
Sometimes		2 (22.2%)		8 (42.1%)		10 (35.7%)
Often		0 (0.0%)		2 (10.5%)		2 (7.1%)
<b>Fast-food purchases after school with a parent</b>						
Never		6 (66.7%)		8 (42.1%)		14 (50.0%)

Sometimes	3 (33.3%)	8 (42.1%)	11 (39.3%)
Often	0 (0.0%)	3 (15.8%)	3 (10.7%)
<b>Grocery store or super center purchases with a friend</b>			
Never	7 (77.8%)	13 (68.4%)	20 (71.4%)
Sometimes	2 (22.2%)	5 (26.3%)	7 (25.0%)
Often	0 (0.0%)	1 (5.3%)	1 (3.6%)
<b>Grocery store or super center purchases with a parent</b>			
Never	3 (33.3%)	8 (42.1%)	11 (39.3%)
Sometimes	6 (66.7%)	9 (47.4%)	15 (53.6%)
Often	0 (0.0%)	2 (10.5%)	2 (7.1%)

**Table 4:** Companionship and food purchasing patterns among adolescents and parents, KY and OH 2013.

Food Venue	Fiber		Calcium		Added sugars (tsp)		Whole grain (oz)		Fruit/Veg minus FF		Sugar from SSB		BMI	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Fast-food restaurant	-1.88	(-5.68, 1.92)	-237.6	(-681.7, 206.5)	7.23	(-0.46, 14.90)	-1.00*	(-1.83, -0.18)	-0.09	(-0.87, 0.69)	6.24	(-1.1, 13.58)	1.7	(-1.36, 4.76)
Convenience stores group(a)	-0.06	(-1.24, 1.11)	-54.17	(-190.19, 81.85)	2.66*	(0.43, 4.90)	-0.05	(-0.33, 0.23)	-0.01	(-0.26, 0.24)	3.35*	(1.26, 5.43)	0.58	(-0.43, 1.58)
Convenience stores	-0.95	(-3.94, 2.04)	-238.11	(-577.2, 100.97)	7.15*	(1.52, 12.79)	0.34	(-1.1, 0.30)	-0.14	(-0.78, 0.49)	8.49*	(3.14, 13.8)	1.45	(-1.12, 4.01)
Gas Stations	0.03	(-2.80, 2.86)	-60.59	(-391.28, 270.09)	5.82*	(0.35, 11.29)	-0.06	(-0.74, 0.61)	-0.04	(-0.63, 0.55)	7.26*	(2.17, 12.35)	1.17	(-1.21, 3.54)
School vending	0.7	(-2.80, 4.20)	-66.62	(-477.65, 344.41)	4.79	(-2.28, 11.85)	0.22	(-0.61, 1.05)	0.17	(-0.55, 0.90)	6.41	(-0.38, 13.19)	1.2	(-1.73, 4.14)
Grocery store and sit-down restaurant(b)	0.33	(-0.76, 1.42)	89.17	(-34.04, 212.37)	2.6*	(0.53, 4.66)	-0.06	(-0.32, 0.21)	-0.07	(-0.30, 0.16)	2.66*	(0.6, 4.71)	0.31	(-0.62, 1.24)
Grocery store	0.33	(-2.37, 3.03)	75.17	(-240.37, 390.71)	4.6	(-0.76, 9.97)	-0.09	(-0.73, 0.56)	-0.22	(-0.78, 0.34)	4.63	(-0.70, 9.95)	1.05	(-1.2, 3.31)
Super Center	-0.61	(-3.43, 2.21)	142.29	(-183.92, 468.50)	4.61	(-1.06, 10.27)	-0.47	(-1.12, 0.17)	-0.3	(-0.88, 0.28)	5.27	(-0.21, 10.74)	-0.47	(-2.89, 1.95)
Sit-down restaurant	0.75	(-2.08, 3.57)	238	(-80.21, 556.21)	6.09*	(0.614, 11.57)	-0.13	(-0.81, 0.55)	-0.05	(-0.63, 0.54)	5.51*	(0.14, 10.88)	2.05	(-0.24, 4.34)
School cafeteria	1.29	(-1.10, 3.67)	98.35	(-185.46, 382.16)	1.07	(-4.02, 6.16)	0.24	(-0.33, 0.82)	0.11	(-0.38, 0.60)	0.8	(-4.09, 5.68)	-0.48	(-2.54, 1.59)
Farmers' market	3.53*	(0.74, 6.33)	208.75	(-152.05, 569.55)	-1.58	(-8.19, 5.03)	0.75*	(0.06, 1.44)	0.5	(-0.14, 1.13)	-3.41	(-9.87, 3.04)	-0.68	(-3.36, 2.0)

\*stores, gas station and school vending were grouped after factor analysis.

<sup>b</sup>Grocery store, super center, sit-down restaurant and school cafeteria were grouped after factor analysis. \* indicates p<0.05

**Table 5:** Food shopping frequency among adolescents and the association with dietary intake and body mass index, KY and OH, 2013

Shopping Patterns and companionship	Added Sugars (tsp)				Sugar-Sweetened Beverages			
	mean	SD	t-value	p-value	mean	SD	t-value	p-value
<i>Fast-food purchases in the morning</i>								
Never	11.97	5.04	REFERENCE		3.55	1.06	REFERENCE	
Alone	16.39	8.1	1.36	0.187	9.65	8.52	1.67	0.11
With a friend	42.11	18.29	5.63*	0.001	37.66	16.15	6.84*	0.001
With a parent	16.85	6.27	1.09	0.289	9.36	7.06	1.13	0.27
<i>Gas stations purchases in the morning</i>								
Never	14.96	11.72	REFERENCE		7.5	11.24	REFERENCE	
Alone	12.83	6.25	-0.26	0.79	5.47	3.81	-0.25	0.8
With a friend	17.69	15.28	0.34	0.74	12.77	16.46	0.66	0.51
With a parent	14.13	1.42	-0.12	0.91	6.47	2.21	-0.15	0.87
<i>Fast-food purchases after school</i>								
Never	10.85	3.22	REFERENCE		4.34	2.74	REFERENCE	
Alone	22.18	13.49	2.87*	0.0087	7.75	1.65	2.52*	0.02
With a friend	6.88	1.06	-0.41	0.68	1.13	0.54	-0.31	0.76
With a parent	14.69	4.01	0.71	0.49	7.01	5.2	0.47	0.64

\*indicates p<0.05

**Table 6:** Food shopping patterns and companionship among adolescents and the association with added sugars and sugar-sweetened beverages, KY and OH, 2013.

pathway between access and diet. Perhaps neighborhood or school access to fast-food restaurants does not influence intake directly, but rather choosing to eat at this type of venue, alone or with a friend, to a greater degree dictates food and beverage choice. Thus for larger public health impact understanding how store choice and companionship are influenced by access may result in larger gains in regards to improving dietary intake.

### Limitations

A severe limitation of this study was the small sample size and ability to make more than statements about association. The cross-sectional nature of this study limits any ability to make causal inference. To date, several longitudinal studies have only been primarily conducted in urban areas making causal inference in rural population's non-

existent. The population was representative of rural communities in the Appalachian region but may not be representative of more urban or racially diverse neighborhoods. However, given that rural communities are often underrepresented in the literature and experience health disparities similar to minority groups, the sample is important for public health impact. However, future studies assessing food shopping behavior patterns shift overtime are needed in order to understand where best to intervene from a policy and behavior approach.

Lastly, our sample had higher rates of overweight and obese combined (37.5 boys and 42.1 girls), relative to the national average of 21%[29]. However, the parent reported lower rates of overweight and obesity relative to the national average. The higher rates among adolescents may reflect accurate self-report and not systematic under reporting as seen with adults. Our sample of adolescents is reflective of the state population where they were recruited from. However, our adult population does not reflect the sample population. Based on potential under reporting by the adult our results of no association with food environment and food purchasing habits with BMI may not hold true. Rather if accurate measurement of BMI was conducted there may have been associations found between the independent variables and BMI as an outcome. Additionally, since our sample may not represent the overall state population results cannot be generalized to a larger sample.

## Conclusion

These results taken together suggest that adolescent purchasing and consumption patterns are influenced by multiple forces within the food environment and social sphere. Previous findings addressing one type of food purchasing venue do not reflect the nuance of food shopping patterns and behaviors, especially among adolescents. Additionally, certain food venues are more or less influenced by companionship and time of day relative to other venues. These results bring to light the highly complex nature of food shopping patterns and behaviors among rural adolescents. Interventions and policies aimed at reducing added sugar and SSB intake need to address multiple levels of influence and frequency and sources of food to see larger public health impacts.

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