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Cover Page Footnote

At the time of the study reported herein, Virginia B. Gray was a visiting scholar in the Office of Nutrition Education at Mississippi State University while on sabbatical leave from her appointment as associate professor at California State University Long Beach. We would like to acknowledge the Extension agents, community wellness planners, and nutrition educators who helped collect data for our study.

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Food Availability and Cost Patterns in Mississippi Retail Stores Participating in the Supplemental Nutrition Assistance Program

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Abstract. Research has suggested that availability of healthful food varies according to rurality/urbanicity, Supplemental Nutrition Assistance Program (SNAP) participation, and sociodemographic variables. We investigated differences in variety and cost of fruits and vegetables in convenience stores, grocery stores, and supermarkets across Mississippi. We collected data using the Nutrition Environment Measures Survey–Corner Store. Among stores surveyed ($n = 453$), fruit and vegetable variety was greater in nonmetro versus metro areas for convenience and grocery stores but not supermarkets. Elucidation of food availability in retail establishments serving SNAP Education (SNAP-Ed) clients is valuable for planning outreach efforts; smaller retailers may be important partners in rural settings.

INTRODUCTION

Efforts to reduce food insecurity among populations who have low incomes and minority populations in recent years have included an emphasis on improving access to healthful, affordable food. Extension has a long history of providing nutrition and healthy lifestyle education. In many states, recipients of Supplemental Nutrition Assistance Program (SNAP) benefits take part in SNAP Education (SNAP-Ed) programming that is implemented through Extension and is part of Extension's approach to providing nutrition education to individuals and families with limited resources. SNAP-Ed implementation has historically focused on providing health education through individual consultation and group-based classes, but program leaders are currently being encouraged to adopt policy, systems, and environmental approaches to support healthful food decisions (U.S. Department of Agriculture [USDA], 2019). Access to healthful, affordable food is an environmental factor that can influence food security. Through the Office of Nutrition Education at Mississippi State University Extension, we conducted a study to help guide policy, systems, and environmental change efforts across the state.

Research has suggested that store type (e.g., supermarket vs. convenience store) and healthful food availability vary according to rurality/urbanicity, SNAP participation, and sociodemographic characteristics (Franco et al., 2008; Racine et al., 2018; Shannon et al., 2018; Shaver et al., 2018; Shikany et al., 2018). A recent study in Atlanta, Georgia, suggested an association between demographic shifts in neighborhoods, such as increasing SNAP participation, and the food retail

environment (Shannon et al., 2018). Specifically, increased access to small food retailers and decreased access to larger supermarkets were evident in Atlanta neighborhoods with increased SNAP participation between 2008 and 2013 (Shannon et al., 2018). Health disparities among residents of neighborhoods with less access to healthful foods call attention to the need to assess patterns of not only healthful food availability but also food price and food quality.

The Nutrition Environment Measures Survey (NEMS) has been used for assessing healthful food availability across store types and community characteristics and includes assessment of food availability, food price, and quality of fresh foods (Andreyeva et al., 2015; Franco et al., 2008; Shaver et al., 2018; Shikany et al., 2018). The NEMS score range is -9 to 54 , and although a value has not been established for a "good" score, higher scores on the NEMS indicate greater availability of healthful options, more affordable prices, and higher quality food products (Ko et al., 2018; Shikany et al., 2018). Through a study in rural Alabama, researchers found the mean NEMS score for grocery stores to be significantly higher than that for convenience stores (29.8 vs. 7.2) but great room for improvement in both store types (Shikany et al., 2018). A study in Baltimore, Maryland, showed healthful food to be less available in neighborhoods where residents have lower incomes and are predominantly Black (Franco et al., 2008). A study in New Haven, Connecticut, suggested improvement in supermarket access since 1971 in areas where residents have lower incomes but also less variety and lower quality fresh food in such areas (Andreyeva et al., 2015). Although many studies linking community characteristics with food

availability have focused on urban settings, there may be differences in how this connection manifests in some rural environments. For example, transportation is often cited as a barrier to healthful food access in urban neighborhoods with few large grocery stores. However, in some rural settings where having a car is fairly essential, driving a long distance to a store may be considered normal (Hartley et al., 2011). Distance in rural environments also may elevate the importance of purchasing foods with longer shelf life when making infrequent, large shopping trips (Harnack et al., 2019). Lenardson et al. (2015) emphasized the importance of seeking to understand individual rural settings rather than considering rural settings to be homogenous. Mulangu and Clark (2012) also supported examining rural food access as distinct from urban food access, suggesting examination of food available at venues not considered retail grocery stores (such as dollar stores).

A recent body of literature has addressed relationships between community food access and eating behaviors (Gustafson et al., 2013; Lorts et al., 2019; Taillie et al., 2019). For example, sugar-sweetened beverage consumption is often reported to be higher among SNAP recipients than non-SNAP participants (Gorski Findling et al., 2018); however, a recent study suggested that community food access may play a role in this relationship, showing higher consumption of sugar-sweetened beverages to be related to SNAP participation when study respondents lived closer to convenience stores/small grocery stores (Lorts et al., 2019). Studies also have suggested a relationship between store access (e.g., supermarkets vs. convenience, dollar, or drug stores) and obesity risk (Gorski Findling et al., 2018; Morland et al., 2006). Although attention to purchases at convenience and smaller retailers has provided insight into contributions to diet quality, a recent study suggested the need for greater focus on purchases at grocery stores (Taillie et al., 2019), as most SNAP dollars (82.5%) are redeemed at supermarkets and superstores (Food and Nutrition Service [FNS], 2019). Taillie et al. (2019) used a national data set to investigate SNAP participant purchases across store types and found that SNAP participants, income-eligible nonparticipants, and nonparticipants with higher incomes all purchased the greatest volume of foods and beverages from grocery stores, followed by big-box and other stores, with little from convenience stores. SNAP household purchases were notably different from those of non-SNAP participants at grocery stores and big-box stores, where SNAP household members purchased more calories from starchy vegetables, processed meat, desserts, sweeteners and toppings, junk food, sugar-sweetened beverages, and milk (Taillie et al., 2019).

High rates of chronic diseases (Centers for Disease Control and Prevention, n.d.) and high persistent poverty rates in Mississippi (19.8%, 2016–2018; U.S. Census Bureau, 2019) highlight a need for efforts that reduce diet-

related health disparities. Relevant programming aimed at encouraging the purchase of healthful foods among limited-resource audiences may be enhanced by understanding neighborhood food environments; variation in disease patterns across Mississippi suggests a need for tailored strategies that respond to local environments (United Health Foundation, 2018). Thus, the purpose of our study was to investigate differences in food retail settings across Mississippi. Specifically, we aimed to investigate differences by store type (convenience store, grocery store, or supermarket), rurality (using the Rural-Urban Continuum Codes [RUCCs]), and SNAP participation rate with regard to the following variables:

- fruit and vegetable (fresh, frozen, and canned) availability;
- fruit and vegetable variety;
- cost of fruits and vegetables; and
- quality of fresh fruits and vegetables.

METHODS

INSTRUMENTATION

We collected data for the study using the Nutrition Environment Measures Survey–Corner Store (NEMS-CS). The NEMS-CS was developed for use in measuring availability, prices, and quality of healthful food options in corner stores (Cavanaugh et al., 2013). The NEMS-CS tool includes all items from the NEMS-Store tool but also addresses availability of fresh, frozen, and canned fruits and vegetables; after the respondent indicates availability of 10 identified fruits and 10 identified vegetables, the respondent is asked to list additional available fruits and vegetables. Because we surveyed representatives from convenience stores, grocery stores, and supermarkets, we chose NEMS-CS for data collection. Studies support the interrater and test-retest reliability of the NEMS-CS (Cavanaugh et al., 2013; Glanz et al., 2007).

STORE SELECTION

For inclusion in the study, a store (a) had to be located in Mississippi, (b) had to accept SNAP benefits, (c) had to be open to the general public without a fee (e.g., not Sam's Club or Costco), and (d) could not be a store specializing in any one food category (e.g., bakery, butcher shop, deli). The FNS provided a current list of SNAP-authorized retail businesses and their locations in Mississippi ($n = 3,729$; FNS, 2017). After we eliminated stores we determined did not fit the criteria on the basis of their names (e.g., Sam's Club, Quality Poultry and Seafood, Barnes Meat Market), 3,585 stores were eligible to be surveyed. Trained data collectors (Extension county agents, Extension nutrition educators, and our

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research team members) received a list of stores in the areas assigned to them and surveyed a specific number of stores ($n = 2\text{--}49$ per surveyor) in their respective counties to promote inclusion of a representative sample of eligible stores across the state. Data collectors were instructed to select stores used most by SNAP clients in their areas.

PROCEDURES

A data collection lead completed the NEMS online training (Honeycutt et al., 2010) and led training of data collectors across the state via an interactive videoconference. Data collectors also received print materials to ensure standardization of data collection. Data collectors presented a document to store employees or managers explaining the survey and asking for permission to complete the study; the survey was completed during store business hours in January and February of 2017. The Mississippi State University Institutional Review Board (IRB) determined that the study did not meet the federal definition of human subjects research and therefore was exempt from IRB review.

Once store representatives were surveyed, we sorted stores by number of cash registers into three categories: convenience stores, grocery stores, and supermarkets. The cash registers counted included self-checkout registers but excluded pharmacy and customer service cash registers. The number of cash registers in a store reflects the square footage of the store and the expected number of items purchased by a customer and can be easily and objectively assessed. Similar studies have involved use of square footage of a store, number of aisles in a store, number of cash registers in a store, availability of items in a store, or categorization of stores in varying databases for categorizing stores (Caspi et al., 2016; Dannefer et al., 2012; Gebauer & Laska, 2011; Gittelsohn et al., 2012; Lent et al., 2015; Martin et al., 2012; Smith et al., 2013). We categorized stores with one or two cash registers as convenience stores, three to six cash registers as grocery stores, and seven or more cash registers as supermarkets.

DATA ANALYSIS

We coded the data, entered the coded data into an Excel spreadsheet, and then exported the data to SPSS for analysis. We created variables for store type (convenience store, grocery store, and supermarket), metro versus nonmetro status, and SNAP tertile. RUCCs of 1–3 indicated “metro” areas, whereas RUCCs of 4–9 indicated “nonmetro” areas (Economic Research Service, 2013). According to Office of Management and Budget (OMB), metro areas have “at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties” (OMB, 2013, Brief Overview of the Classification section, para. 2). Within nonmetro areas, RUCCs 8 and 9 are used for the most rural areas, with populations below 2,500

(Economic Research Service, 2013). Because only 8.8% of stores sampled were in communities with RUCCs 8 or 9, we focused our primary analysis on comparison of metro and nonmetro areas. However, as an exploratory analysis, we also compared RUCCs 1–3 (metro), 4–7 (nonmetro), and 8 and 9 (nonmetro, completely rural). We used SNAP participation rates and population statistics for 2017 to create tertiles of SNAP participation (3.2%–7.1%, 7.2%–9.7%, and 9.8%–22.5%). There were 453 eligible surveys for analysis, with 243 convenience stores, 164 grocery stores, and 46 supermarkets; 183 stores were in counties categorized as metro areas, and 270 stores were in counties categorized as nonmetro areas.

As noted, the food variables of interest were fruit and vegetable availability and variety, cost of fruits and vegetables, and quality of fresh fruits and vegetables.

- **Availability and variety.** We compared availability of any fresh, frozen, and canned fruits and vegetables across store types. We assessed variety of fresh fruits using a variable that indicated the total number of fresh fruits out of 10 specifically identified varieties. The same procedure was used for vegetables. Varieties of canned fruits and vegetables were also assessed. Because we collected data in the form of 0, 1, 2, 3, 4, 5, or 6 or more canned varieties, we created new variables for 0 to 2 and 3 or more canned fruit varieties and for 0 to 4 and 5 or more vegetable varieties. We created these categories so that approximately 50% of responses were in each of the two fruit categories and in each of the two vegetable categories.
- **Cost.** We chose the three most commonly available fruits and three most commonly available vegetables for cost comparisons across metro/nonmetro areas and SNAP tertiles. For prices reported per piece rather than per pound, we performed conversions using standard weights provided by the USDA national nutrient database for one medium banana (118 g), one medium Red Delicious apple (212 g), one orange with a diameter of 2-7/8 in. (140 g), one medium tomato (123 g), one medium green pepper (119 g), and one head of green leaf lettuce (360 g; USDA, 2019).
- **Quality.** Although we collected data on fresh food quality, only 13 of 344 fruits (4%) and 4 of 349 vegetables (1%) were marked as poor quality. Low variability in quality measures precluded comparison by store type, rurality, and SNAP participation rate.

We used chi-square tests of independence to investigate relationships between availability and store type, metro versus nonmetro status, and SNAP tertile for categorical variables. For tests in which cell counts were less than 5, we applied Fisher’s exact tests. We used independent-

samples *t* tests and Mann-Whitney *U* tests (depending on sample sizes) to investigate differences in mean cost and number of available fruit and vegetable varieties in metro versus nonmetro areas. We implemented one-way analysis of variance tests and Kruskal Wallis tests (depending on sample sizes) to investigate variation in fruit and vegetable availability by store type and to investigate differences in mean costs of fruits and vegetables in areas of low, medium, and high SNAP participation.

RESULTS

Table 1 illustrates availability of fresh, frozen, and canned fruits and vegetables across store types. Availability and variety were greater in larger stores than in smaller stores. Table 2 shows data regarding availability in metro and nonmetro areas for each store type. Convenience stores and grocery stores in nonmetro areas had significantly more fresh fruit and vegetable variety than those in metro areas; differences in fresh fruit and vegetable variety between supermarkets in metro areas and those in nonmetro areas were not significant. Canned fruit variety in convenience

stores was greater in nonmetro areas than in metro areas. Although cost differences in metro and nonmetro areas for six selected fruits and vegetables were largely not significant (see Table 3), mean prices were lower in nonmetro than metro areas for most foods across store types.

The number of stores in rural communities having RUCCs of 8 or 9 (*n* = 40) limited a primary analysis comparing metro, nonmetro, and completely rural areas. However, a comparison across metro, nonmetro, and completely rural areas of mean varieties of the 10 fruits and vegetables identified on the survey instrument suggested differences along the spectrum of rurality that were consistent with our primary comparison (metro vs. nonmetro). For example, in convenience stores, the means for fruit varieties were 0.42 ± 1.23 (*n* = 105), 0.78 ± 1.53 (*n* = 112), and 1.83 ± 2.98 (*n* = 23) in metro, nonmetro, and completely rural areas, respectively. The means for vegetable varieties in convenience stores were 0.30 ± 1.50 (*n* = 105), 0.57 ± 1.59 (*n* = 111), and 2.3 ± 3.98 (*n* = 23) in metro, nonmetro, and completely rural areas, respectively. In grocery stores, the means for fruit varieties were 2.87 ± 3.72 (*n* = 64), 4.45 ± 4.06 (*n* = 84), and 6.06 ± 3.80 (*n* = 16) in metro, nonmetro, and completely rural

Table 1. Availability of Fresh, Frozen, and Canned Fruits and Vegetables in Convenience Stores, Grocery Stores, and Supermarkets in Mississippi

Food	<i>n</i>	Store type			Total	<i>p</i>
		Convenience stores (<i>n</i> = 243)	Grocery stores (<i>n</i> = 164)	Supermarkets (<i>n</i> = 46)		
Fruit						
Any fruit available	446	176 (73.9) ^a	151 (93.2) ^a	44 (100) ^a	373 (83.6) ^b	<i>p</i> < .001 ($\chi^2 = 36.2$)
Fresh fruit available	450	65 (27.1) ^a	87 (53.0) ^a	42 (91.3) ^a	194 (43.1) ^b	<i>p</i> < .001 ($\chi^2 = 75.3$)
Frozen fruit available	441	19 (8.1) ^a	79 (49.4) ^a	39 (86.7) ^a	137 (31.3) ^b	<i>p</i> < .001 ($\chi^2 = 148.4$)
Canned fruit available	445	129 (54.4) ^a	142 (87.7) ^a	46 (100) ^a	317 (71.2) ^b	<i>p</i> < .001 ($\chi^2 = 72.6$)
Fresh fruit varieties	450	.72 ± 1.65 ^c	3.99 ± 4.01 ^d	7.98 ± 2.74 ^e		<i>p</i> < .001 ^f
Vegetables						
Any vegetables available	449	188 (78.3) ^a	156 (95.7) ^a	46 (100) ^a	390 (86.9) ^b	<i>p</i> < .001 ($\chi^2 = 33.4$)
Fresh vegetables available	450	43 (17.9) ^a	84 (49.7) ^a	42 (91.3) ^a	169 (37.6) ^b	<i>p</i> < .001 ($\chi^2 = 109.2$)
Frozen vegetables available	442	55 (23.4) ^a	94 (58.4) ^a	42 (91.3) ^a	191 (43.2) ^b	<i>p</i> < .001 ($\chi^2 = 96.0$)
Canned vegetables available	446	173 (73.0) ^a	154 (94.5) ^a	46 (100) ^a	373 (83.6) ^b	<i>p</i> < .001 ($\chi^2 = 42.6$)
Fresh vegetable varieties	446	.62 ± 1.99 ^c	4.46 ± 4.52 ^d	8.35 ± 2.85 ^e		<i>p</i> < .001 ^f

^a *n* (%) within store type. ^b *n* (%) in all store types. ^{c, d, e} Superscripts designate means (*M* ± *SD*) that are significantly different for total number of fresh varieties out of 10 specifically identified varieties. ^f *p* values for one-way analysis of variance test results.

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areas, respectively. In grocery stores, the means for vegetable varieties were 3.08 ± 4.22 ($n = 62$), 5.13 ± 4.05 ($n = 83$), and 6.31 ± 4.98 ($n = 16$) in metro, nonmetro, and completely rural areas, respectively. There were no supermarkets in communities having RUCCs of 8 or 9.

We did not find significant differences in fruit and vegetable availability by SNAP tertile for any store type (see Table 4). Furthermore, we found no differences in cost of apples, bananas, oranges, tomatoes, green peppers, and lettuce by SNAP tertile within each store type (see Table 5). Investigating differences in cost of fruits and vegetables across store types suggested greater variation in cost among fruits by store type ($p < .05$) than among vegetables.

DISCUSSION

Findings from our study suggest that smaller retailers (convenience stores and smaller grocery stores) in nonmetro Mississippi counties have greater fruit and vegetable variety than smaller retailers in metro counties. Other research has suggested that residents in rural areas or in small urban settings may rely more on smaller retailers for groceries than residents in areas with greater access to supermarkets (Harris et al., 2010). In addition, retailers that accept SNAP use are required to offer at least three varieties of fruits and/or vegetables (FNS, 2016). Our findings do not suggest appreciable differences in availability of fruit and vegetable variety in counties across the spectrum of SNAP participation.

Although we did not assess purchase and consumption patterns, other studies have shown that stocking of a greater variety of fruits and vegetables by stores is associated with more nutritious purchasing patterns among customers (Caspi et al., 2017) and a greater probability of customers' purchasing fruits and vegetables, especially among SNAP recipients (Martin et al., 2012). Enacting policies to improve supermarket access in areas with fewer large food retailers may seem like a promising strategy but may be limited by stores' lack of potential for profitability in rural settings. Studies have suggested that working with existing retailers could have advantages in rural or small urban settings (Harris et al., 2010; Johnson et al., 2014). Changing dynamics of grocery retail (Shannon et al., 2018) suggest the potential for partnership with smaller grocers in areas with higher SNAP enrollment.

Involving Extension agents and educators in data collection and developing shared goals with local grocery retailers, as we did in our study, may be promising strategies for improving purchase and consumption of healthful foods in Mississippi. Additionally, grocery stores, particularly smaller stores, may be promising locations for delivering SNAP-Ed indirect education, such as food demonstrations or taste testings of healthful recipes. These stores also could be a setting for disseminating SNAP-Ed social marketing messages that encourage healthful shopping or food selection. Retailers with expanded healthful fruit and vegetable options also could be used for grocery store tours as part of SNAP-Ed efforts. Extension agents also could empower SNAP

Table 2. Varieties of Fruits and Vegetables by Rural-Urban Continuum Codes (RUCCs) in Convenience Stores, Grocery Stores, and Supermarkets in Mississippi

Food	Convenience stores ($n = 240$)			Grocery stores ($n = 164$)			Supermarkets ($n = 46$)		
	In metro areas ^a ($n = 105$)	In nonmetro areas ^b ($n = 135$)	p	In metro areas ^a ($n = 64$)	In nonmetro areas ^b ($n = 99$)	p	In metro areas ^a ($n = 11$)	In nonmetro areas ^b ($n = 35$)	p
Fresh fruit varieties	0.42 ± 1.23 ^c	$.96 \pm 1.89$ ^c	.008 ^d	2.87 ± 3.72 ^c	4.71 ± 4.05 ^c	.003 ^d	7.09 ± 3.65 ^c	8.26 ± 2.38 ^c	.39 ^e
Fresh vegetable varieties	0.30 ± 1.50 ^c	$.87 \pm 2.27$ ^c	.02 ^d	3.08 ± 4.22 ^c	5.32 ± 4.50 ^c	.002 ^d	7.23 ± 3.88 ^c	8.74 ± 2.47 ^c	.54 ^e
Three or more canned fruit varieties ^f	17 (17.0) ^g	40 (30.3) ^g	$p = .02$ ($\chi^2 = 5.43$)	32 (51.6) ^g	67 (67.0) ^g	$p = .05$ ($\chi^2 = 3.81$)	11 (100) ^g	33 (94.3) ^g	1.0 ^h
Five or more canned vegetable varieties ⁱ	30 (29.4) ^g	43 (32.6) ^g	$p = .60$ ($\chi^2 = .27$)	39 (61.9) ^g	67 (67.4) ^g	$p = .40$ ($\chi^2 = .71$)	11 (100) ^g	29 (82.9) ^g	.31 ^h

^a Metro areas are RUCCs 1–3. ^b Nonmetro areas are RUCCs 4–9. ^c Total number of fresh varieties ($M \pm SD$) out of 10 specifically surveyed varieties. ^d p values for independent-samples t -test results. ^e p values for Mann-Whitney U test results. ^f Analyzed against two or fewer varieties. ^g n (%) within column. ^h Fisher's exact test used for tests with cells with $n < 5$ counts. ⁱ Analyzed against four or fewer varieties.

Table 3. Cost (Mean in Dollars ± SD) of Most Commonly Available Fruits and Vegetables by Rural-Urban Continuum Codes (RUCCs) in Convenience Stores, Grocery Stores, and Supermarkets in Mississippi

Food	Convenience stores			Grocery stores			Supermarkets		
	Cost per lb in metro areas ^a	Cost per lb in nonmetro areas ^b	<i>p</i> ^c	Cost per lb in metro areas ^a	Cost per lb in nonmetro areas ^b	<i>p</i> ^c	Cost per lb in metro areas ^a	Cost per lb in nonmetro areas ^b	<i>p</i> ^c
Bananas	2.14 ± 1.43 (12) ^d	1.59 ± 1.13 (38)	.27	0.92 ± .81 (27)	0.70 ± .42 (60)	.58	.65 ± .19 (9)	.62 ± .28 (31)	.80
Apples	1.75 ± .46 (9)	1.56 ± .47 (28)	.29	1.62 ± .58 (24)	1.24 ± .44 (56)	.001	1.55 ± .19 (9)	1.38 ± .58 (30)	.05
Oranges	2.55 ± .95 (11)	1.97 ± .99 (28)	.17	1.62 ± .95 (23)	1.80 ± 1.02 (56)	.69	1.65 ± 1.21 (8)	1.22 ± .79 (28)	.56
Tomatoes	2.05 ± .63 (4)	1.89 ± .78 (21)	.41	1.63 ± .77 (23)	1.54 ± .87 (58)	.72	1.67 ± .58 (8)	1.91 ± .76 (27)	.77
Green peppers	3.04 ± .31 (3)	2.53 ± .99 (17)	.69	2.41 ± .90 (23)	2.27 ± 1.18 (57)	.22	1.91 ± .96 (7)	2.64 ± .87 (31)	.06
Green leaf lettuce	2.12 ± .53 (2)	1.92 ± .65 (18)	.76	2.05 ± .61 (23)	1.90 ± .73 (58)	.15	2.16 ± 1.03 (9)	1.79 ± .51 (30)	.57

^a Metro areas are RUCCs 1–3. ^b Nonmetro areas are RUCCs 4–9. ^c *p* values for Mann-Whitney U test results. ^d Because cost data varied across foods and store types, *n* is given for each data point.

Table 4. Varieties of Fruits and Vegetables by Supplemental Nutrition Assistance Program (SNAP) Participation Tertile in Convenience Stores, Grocery Stores, and Supermarkets in Mississippi

Food	Convenience stores (n = 240)			Grocery stores (n = 164)			Supermarkets (n = 46)				
	Tertile 1 (n = 70)	Tertile 2 (n = 77)	Tertile 3 (n = 93)	Tertile 1 (n = 53)	Tertile 2 (n = 59)	Tertile 3 (n = 52)	Tertile 1 (n = 17)	Tertile 2 (n = 18)	Tertile 3 (n = 11)		
Fresh fruit varieties	.69 ± 1.40 ^a	.74 ± 1.74 ^a	.73 ± 1.76 ^a	3.34 ± 3.90 ^a	4.3 ± 4.08 ^a	4.29 ± 4.05 ^a	.36 ^b	8.29 ± 2.52 ^a	7.22 ± 3.46 ^a	8.73 ± 1.19 ^a	.46 ^c
Fresh vegetable varieties	.30 ± 1.25 ^a	.75 ± 2.28 ^a	.74 ± 2.16 ^a	3.89 ± 4.52 ^a	4.54 ± 4.50 ^a	4.96 ± 4.55 ^a	.47 ^b	8.76 ± 2.56 ^a	7.78 ± 3.67 ^a	9.27 ± 1.19 ^a	.52 ^c
Three or more canned fruit varieties ^d	11 (16.7) ^e	16 (21.6) ^e	30 (32.6) ^e	33 (62.3) ^e	34 (57.6) ^e	32 (64.0) ^e	<i>P</i> = .78 ($\chi^2 = 5.78$)	15 (88.52) ^e	18 (100) ^e	11 (100) ^e	.18 ^f
Five or more canned vegetable varieties ^g	24 (34.8) ^e	18 (24.7) ^e	31 (33.7) ^e	36 (67.9) ^e	34 (59.6) ^e	36 (70.6) ^e	<i>P</i> = .34 ($\chi^2 = 2.14$)	15 (88.2) ^e	15 (83.3) ^e	10 (90.9) ^e	1.0 ^f

Note. Tertiles 1, 2, and 3 include stores in counties with 3.2%–7.1%, 7.2%–9.7%, and 9.8%–22.5% SNAP participation, respectively.

^aTotal number of fresh varieties (*M* ± *SD*) out of 10 specifically identified varieties. ^b*p* values for one-way analysis of variance test results. ^c*p* values for Kruskal-Wallis test results. ^dAnalyzed against two or fewer varieties. ^e*n* (%) within tertile. ^fFisher's exact test used for tests with cells with *n* < 5 counts. ^gAnalyzed against four or fewer varieties.

Table 5. Cost (Mean in Dollars ± SD) of Most Commonly Available Fruits and Vegetables by Supplemental Nutrition Assistance Program (SNAP) Participation Tertile in Convenience Stores, Grocery Stores, and Supermarkets in Mississippi

Food	Convenience stores			Grocery stores			Supermarkets			P ^a
	Cost/lb in Tertile 1	Cost/lb in Tertile 2	Cost/lb in Tertile 3	Cost/lb in Tertile 1	Cost/lb in Tertile 2	Cost/lb in Tertile 3	Cost/lb in Tertile 1	Cost/lb in Tertile 2	Cost/lb in Tertile 3	
Banana	2.10 ± 1.24 (13) ^b	1.72 ± 1.26 (15)	1.50 ± 1.18 (22)	.64 ± .35 (24)	.90 ± .77 (34)	.72 ± .41 (29)	.58 ± .05 (15)	.62 ± .15 (15)	.72 ± .48 (10)	.96
Apple	1.65 ± .58 (12)	1.63 ± .37 (11)	1.55 ± .45 (14)	1.30 ± .41 (23)	1.35 ± .33 (33)	1.41 ± .76 (24)	1.43 ± .48 (16)	1.52 ± .63 (15)	1.21 ± .34 (8)	.40
Orange	2.15 ± 1.14 (13)	2.51 ± 1.75 (11)	1.85 ± 1.00 (15)	1.57 ± .90 (23)	2.03 ± 1.00 (31)	1.57 ± 1.03 (25)	1.59 ± 1.15 (16)	1.08 ± .54 (13)	1.12 ± .64 (7)	.54
Tomato	1.34 ± .13 (4)	2.21 ± .81 (11)	1.83 ± .68 (10)	1.45 ± .78 (24)	1.81 ± 1.16 (29)	1.43 ± .29 (28)	1.88 ± .82 (14)	1.98 ± .73 (13)	1.61 ± .54 (8)	.53
Green pepper	2.20 ± .75 (5)	3.07 ± .26 (6)	2.53 ± 1.22 (9)	2.38 ± 1.12 (23)	2.33 ± .74 (31)	2.22 ± 1.44 (26)	2.13 ± 1.01 (14)	3.00 ± .50 (14)	2.35 ± .99 (10)	.06
Lettuce	1.89 ± .62 (5)	1.84 ± .51 (6)	2.03 ± .76 (9)	1.79 ± .58 (22)	2.16 ± .84 (31)	1.83 ± .55 (28)	1.91 ± .83 (15)	2.02 ± .57 (14)	1.60 ± .50 (10)	.16

Note. Tertiles 1, 2, and 3 include stores in counties with 3.2%–7.1%, 7.2%–9.7%, and 9.8%–22.5% SNAP participation, respectively. ^a p values for Kruskal-Wallis test results. ^b Because cost data varied across foods and store types, n is given for each data point.

participants to request improved stocking of healthful foods in neighborhood stores.

Future studies are needed to elucidate impacts of fruit and vegetable availability (particularly in smaller stores) on overall fruit and vegetable consumption. Harnack et al. (2019) highlighted important considerations for rural SNAP participants when striving to improve nutritional impacts of the program. For example, incentive programs intended to increase likelihood of using SNAP benefits to purchase healthful foods have prioritized fresh fruits and vegetables; Harnack et al. (2019) suggested including canned, frozen, and dried fruits and vegetables in future incentive programs to better align with food procurement and storage practices of rural SNAP participants, for whom distance to supermarkets may be longer. Our study supports this recommendation, as availability of canned fruits and vegetables in stores located in nonmetro counties was similar to or greater than availability of canned fruits and vegetables in stores in metro counties. Additionally, Harnack et al. (2019) suggested conducting pilot tests of online grocery delivery for rural SNAP participants while also assessing the needs of low-income rural families to guide adaptations of SNAP-Ed programming (such as remote delivery). Involving audience members in development of food retail strategies may improve the fit between strategies and audience needs. Although we did not survey SNAP participants, involving Extension agents and educators in data collection may have improved their understanding of the context in which the SNAP audience is making food decisions. This new understanding may affect ways Extension agents partner with SNAP participants and local retailers to shape food environments.

Limitations of our study include classification of stores on the basis of county statistics (rurality and SNAP participation), which might not account for neighborhood differences in a county. This limitation has been reported in other, similar studies (Pitt et al., 2017). Also, the stores included in our study were not randomly selected. Rather, they were selected to represent where SNAP clients shop and were carefully selected by surveyors to promote representativeness. We suggest future food retail studies that involve oversampling of stores in most rural areas to better describe food availability in these areas.

CONCLUSIONS

Food availability patterns elucidated by the study described in this article may help guide Extension outreach efforts. Specifically, smaller grocery retailers serving SNAP-Ed participants, especially in nonmetro areas, may be important partners in supporting and/or incentivizing purchase of healthful foods. Extension's collaboration with local food retailers could ultimately increase the purchase and consumption of fruits and vegetables.

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