

FRUIT AND VEGETABLE ACCESS DIFFERS BY COMMUNITY RACIAL COMPOSITION AND SOCIOECONOMIC POSITION IN DETROIT, MICHIGAN

Objective: To compare the availability, selection, quality, and price of fresh fruit and vegetables at food stores in four Detroit-area communities: 1) predominately African-American, low socioeconomic position (SEP); 2) racially heterogeneous, low SEP; 3) predominately African-American, middle SEP; and 4) racially heterogeneous, middle SEP.

Design: Cross-sectional observational survey, conducted fall 2002.

Setting: Detroit, Michigan

Sample: Overall, 304 food stores located in the four communities were evaluated: chain grocery, large independent grocery, "mom-and-pop" grocery, specialty (meat, fruit and vegetable markets), convenience without gasoline, and liquor stores.

Main Outcome Measures: Availability was indicated by whether a store carried fresh fruit or vegetables, selection was based on a count of 80 fruit and vegetables, quality was evaluated according to USDA guidelines for a subset of 20 fruit and vegetables, and price was assessed for 20 fruit and vegetables by using the lowest-cost method.

Results: Mean quality of fresh produce was significantly lower in the predominately African-American, low-SEP community than in the racially heterogeneous, middle-SEP community. Differences in the types of stores present only partially explained this quality differential. The predominately African-American, low-SEP community had more than four times more liquor stores and fewer grocery stores per 100,000 residents than the racially heterogeneous, middle-SEP community. Mean overall selection and price of fresh produce at stores did not differ among communities.

Conclusions: Increasing access to high-quality fresh produce in low-income communities of color is a critical first step toward improving health through better dietary practices in this population. (*Ethn Dis.* 2006;16:275–280)

Key Words: African-American, Food Security, Fruit and Vegetables, Neighborhood, Nutrition, Racial Residential Segregation, Socioeconomic Status

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INTRODUCTION

Prior research has found an association between living in an economically disadvantaged neighborhood and poorer dietary quality and higher body mass index, controlling for individual-level factors.^{1–3} Inadequate access to healthy foods, particularly when combined with a large number of adverse nutritional exposures (eg, fast food restaurants), may negatively affect dietary quality and maintenance of healthy weights in economically disadvantaged neighborhoods. Access to healthy foods at the neighborhood level is often referred to as community food security, which means that all residents have access to foods that are safe, culturally acceptable, and nutritious, as well as affordable and of high quality.^{4,5} The spatial accessibility of supermarkets and the availability, selection, quality, and price of foods at retail outlets are

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important components of community food security.

Some studies^{6–11} have shown that economically disadvantaged communities have fewer grocery stores and less availability and selection, inferior quality, and more expensive foods when compared with more affluent communities, but other studies^{12–15} have found different results. Communities with higher proportions of African Americans have greater access to fast food restaurants^{16,17} and fewer supermarkets^{10,17,18} and may have more expensive and lower-quality foods for sale^{13,19} compared to communities with lower proportions of African Americans. A limitation of research conducted to date is that studies have generally not considered race and poverty simultaneously, which could contribute to inconsistent findings.²⁰

The purpose of this study was to determine whether fruit and vegetable access differed by the racial composition

and socioeconomic position (SEP) of geographic communities in Detroit, Michigan. Our primary objective was to compare the availability, selection, quality, and price of fresh fruit and vegetables at food stores, as dimensions of access, in four Detroit-area communities that varied in racial composition and SEP. Secondary objectives were to: 1) compare the distribution of food stores across communities (grocery, specialty, convenience without gas stations, and liquor) and 2) examine whether differences in the types of stores present explained any observed community variation in the availability, selection, quality, or price of fresh produce. To achieve these objectives, we conducted a cross-sectional observational study of food stores in four Detroit-area communities during a five-week period in the fall of 2002.

METHODS

Setting

We selected three communities in Detroit and an adjacent suburb that varied in racial/ethnic composition and socioeconomic characteristics and exhibited different health profiles for diet- and obesity-related diseases.²¹ They were a predominately African-American, low-SEP community (AA-LOW); a racially heterogeneous (Latino, White, African-American), low-SEP community (RH-LOW); a predominately African-American, middle-SEP community (AA-MID); and a racially heterogeneous (African-American, White), middle-SEP suburban community (RH-MID).

Sample

Food stores were identified through the Michigan Department of Agriculture. The study evaluated 304 food stores located in one of the four communities. These stores included all grocery stores (chain, large independent [no chain affiliation and three or more cash registers], “mom-and-pop” [no

chain affiliation and one or two registers]), convenience stores without gasoline, specialty food stores (ie, meat markets, fruit and vegetable markets), and liquor stores. Because a number of studies have found an oversupply of liquor stores in economically disadvantaged communities and communities of color,¹⁰ we included liquor stores in our study to test the extent to which they contributed to fresh produce access. In this study, liquor stores were defined as stores classified as a “liquor” store in the telephone directory, had “liquor” or “party” in the name, or had “liquor,” “beer,” or “wine” as the main sign in front of the store. Thus, this category included “corner stores” that residents frequent for groceries, but which also sell liquor.

Access Measures

Availability and Selection

Availability of fresh fruit and vegetables was indicated by whether the store sold any fresh fruit or vegetables other than lemons or limes. A visual count of fresh fruit and vegetables at each store measured selection. An inventory of “powerhouse” produce guided the choice of the 80 fruits and vegetables (eg, cantaloupe, broccoli) to observe.^{22,23} Each produce item was recorded as available or unavailable on the day of the visit. Because some types of fruit and vegetables have particularly good health benefits, we also examined the selection of citrus fruit and cruciferous vegetables, as well as fruit and vegetables that are good sources of fiber, folate, and vitamins A, B6, C, and E.

Quality

We assessed quality and price for a subset of 20 fresh fruit and vegetables based on the lowest-cost brand and size. We drew upon quality descriptions of external physical appearance and condition provided by the USDA^{24–25} to develop a unique description of high-quality produce for each of the 20

selected fruits and vegetables. Quality was evaluated for each produce category on a four-point scale ranging from excellent (1) to poor (4) based on the estimated proportion of items at the store that did not meet high-quality standards: excellent (0%–4%), good (5%–24%), fair (25%–49%), or poor (50%–100%). Fresh produce quality at the store was the mean of up to 20 quality scores, depending on how many of the 20 selected fruits and vegetables were available. Quality scores were reverse coded so that higher scores corresponded to higher quality.

One of two observers evaluated quality at each store. The two observers completed 16 hours of training on quality ratings. Data collected at practice stores at three time points (the start of data collection, the end of week one, and the end of week three) evaluated interrater reliability (IRR) for quality. Intra-class correlations (two-way random effects model for absolute agreement) revealed high IRR for quality during data collection: .92 at the start of data collection, .82 at the end of week one, and .86 at the end of week three.

Price

Prices for the sample of 20 fruits and vegetables were calculated as price per pound with the exceptions of cantaloupe, heads of lettuce, and mangos, for which price per item was recorded. When other produce categories were sold as price per item, two average-size items were weighed to allow us to calculate price per pound. Because some prices were measured as price per pound and some as price per item, prices were *z*-scored. Price of fresh fruit and vegetables was the mean of up to 20 of these *z*-scores, depending on how many of the selected fruits and vegetables were available at each store.

Data Collection

During October–November 2002, a telephone call or in-person visit screened stores for the availability of

Table 1. Community comparison of number of food stores per 100,000 residents by type* and proportion of population within one mile of at least one store by type†

	AA-LOW Community		RH-LOW Community		AA-MID Community		RH-MID Suburban Community	
	<i>n</i>	% population	<i>n</i>	% population	<i>n</i>	% population	<i>n</i>	% population
Total food stores‡	123.9	100	134.2	100	70.3	100	49.8	100
Total grocery stores	14.4	93.9	31.7	83.5	7.7	83.3	24.2	95.3
Mom-and-pop	4.4	53.0	22.6	93.3	2.2	40.9	8.9	62.0
Large independent	10.0	93.9	9.1	83.5	3.3	75.7	5.1	31.8
Chain	0	0	0	0	2.2	17.0	10.2	70.0
Liquor stores§	102.9	100	90.5	100	50.5	100	23.0	91.0

* Specialty stores and convenience stores without gasoline are not listed separately due to small numbers.

† Results based on stores located within the community only and do not include stores surrounding the community.

‡ Includes all grocery stores, liquor stores, specialty stores, and convenience stores without gasoline.

§ Proportion of population within one mile of more than eight liquor stores: 97.0% AA-LOW community, 87.9% RH-LOW community, 59.3% AA-MID community, and 0% RH-MID community.

fresh fruit and vegetables. The first author and one of two observers visited stores that sold fresh produce a second time. At that visit, the first author collected data on selection and price while the hired observer rated quality. The length of time for data collection was 5–60 minutes per store, with a mean of 18 minutes. To control for seasonal variation, we collected data concurrently in each community and completed data collection in five weeks.

Data Analysis

Analyses were conducted with the Statistical Package for the Social Sciences (SPSS 11.0, SPSS Inc., Chicago, Ill. USA). Frequency counts determined the number of food stores, as well as the number of stores selling fresh fruit or vegetables, in each community. Because the communities differed in population, we based the community comparison of store distribution on the number of stores per 100,000 residents. However, findings based on the crude number of stores were consistent. In addition, the proportion of community residents living within one mile of various store types was determined using a geographic information system (GIS). For each store type, a one-mile Euclidean distance buffer was drawn around every store; residents living in a census block intersecting at least one of these buffers were considered to be within a mile of

a store of that type. Ordinary least squares (OLS) regression tested whether mean selection, quality, or price of fresh produce differed by community, as well as the extent to which store type explained any observed community variation in selection, quality, or price.

RESULTS

Spatial Distribution of Food Stores

Between 83.3% and 95.3% of residents in the four communities lived within a mile of a grocery store of some type (Table 1). The RH-LOW community had the most grocery stores of any type per 100,000 residents, though 71% of these stores were mom-and-pop groceries. The AA-MID community had the fewest grocery stores of any type per population. The RH-MID suburban community had the most large grocery stores (chain and large independent) per population. Neither the AA-LOW community nor the RH-LOW community had any chain grocery stores. In contrast, 70% of residents in the RH-MID suburban community and 17% of residents in the AA-MID community lived within a mile of at least one chain grocery. The AA-LOW community had more than four times more liquor stores per population than the RH-MID suburban community per

100,000 residents (102.9 vs 23.0). Whereas almost all residents of the four communities lived within a mile of a liquor store, no resident of the RH-MID suburban community lived within a mile of more than eight liquor stores. In contrast, 97% of residents in the AA-LOW community lived within a mile of more than eight liquor stores and half were within a mile of more than 15.

Availability, Selection, Quality, and Price

Overall, 31% (95 of 304) of food stores sold fresh fruit or vegetables. Stores selling fresh produce included all grocery stores ($n=60$), approximately a quarter of both specialty (3 of 13) and convenience stores (4 of 14), and just 13% of liquor stores (28 of 217). The RH-LOW community had the most stores (52.8 per 100,000 residents) selling fresh produce, followed by the RH-MID suburban community (31.9), the AA-LOW community (26.5), and the AA-MID community (12.1). (Findings based on the crude number of stores selling fresh produce were similar.)

The mean number of fruit and vegetables available at stores was 23.77 (SD=19.69, range 1–66). The mean z -scored price at stores was 0.12 (SD=0.83, range -1.97 to 2.68). Neither the mean selection nor the mean price of fresh produce at stores differed signifi-

Table 2. Mean fresh produce quality regressed on community and store type*

	Model 1	Model 2
	Coefficient (S.E.)	Coefficient (S.E.)
Constant	2.664	3.132
AA-LOW community	-.662 (.242)**	-.571 (.210)**
AA-MID community	-.479 (.322)	-.493 (.282)
RH-LOW community	-.206 (.221)	.009 (.195)
Mom-and-pop grocery stores		-.662 (.201)**
Liquor, convenience, & specialty stores		-1.020 (.181)***
Adjusted R-squared	.058	.303

* Because of the relatively small number of observations, we grouped some store types together for this analysis. Specifically, we combined chain grocery and independent grocery as large grocery (the reference category) and liquor, convenience, and specialty stores as one category. Results of analyses with the store types entered individually were similar to those presented here. ** $P < .01$; *** $P < .001$

cantly by community (analyses not shown). However, stores in the RH-LOW community, on average, sold statistically significantly fewer cruciferous and folate-rich produce than those in the RH-MID suburban community (analyses not shown). The communities were similar in mean selection of citrus fruit and fresh produce that were good sources of fiber and vitamins A, B6, C, and E.

Mean quality of fresh produce at stores was 2.37 (SD=0.84, range 1–4). Model 1 of Table 2 shows fresh produce quality regressed on community (the RH-MID suburban community was the reference category); Model 2 added store type (large grocery stores [chain and large independent] was the reference category). As shown in Model 1, fresh produce quality was significantly lower in the AA-LOW community when compared with the RH-MID suburban community ($P < .01$). The coefficient for the AA-LOW community was reduced in Model 2, but remained statistically significant. Models 1 and 2 accounted for 5.8% and 30.3% of the variance in fresh produce quality respectively.

DISCUSSION

Community Variation in Fruit and Vegetable Access

These results provide evidence that the quality of fresh produce at food

stores was significantly lower in the AA-LOW community when compared to the RH-MID suburban community. Differences in the types of stores present in the communities only partially explained this quality differential. The AA-LOW community had more liquor stores and fewer grocery stores than the RH-MID suburban community. To the extent that access to high-quality fresh produce affects dietary practices, these differences contribute to the multitude of factors that undermine the health of residents in the AA-LOW community. We did not find a difference in mean overall selection or price of fresh produce at stores across communities.

The finding that fresh produce was available at more stores in the RH-LOW community than in the other three communities seemed to be due to the presence of a large number of bodegas (small Latino grocery stores) serving the large Latino population. However, stores in the RH-LOW community, on average, had a poorer selection of cruciferous vegetables and folate-rich produce than those in the RH-MID suburban community. The inventory of fresh produce from which measures of selection were derived was not exhaustive. Therefore, these differences may reflect a bias in the inventory if produce popular among Latinos were underrepresented.

Community variation in access to grocery stores was evident in the types of

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grocers present and in the number of options available. Whereas the RH-MID suburban community had the most large grocery stores, almost all residents of the four communities lived within a mile of a grocery store of some type. Our finding of no chain grocery store in either of the two low SEP communities is consistent with prior research.^{6,8–10} Because fresh produce quality tended to be better at grocery stores, particularly chain and large independent outlets, than at other food stores, having relatively few grocery stores in the AA-LOW community limited residents' access to high-quality fresh produce. In fact, some residents of the AA-LOW community may not be able to consistently obtain high-quality fresh produce at grocery stores outside the community, given that approximately one third of households did not own a car in 2000.²⁶ The finding that the AA-MID community had the fewest grocery stores of any type and the fewest stores selling fresh produce may not be as problematic because only 13.4% of households did not own a car in 2000.²⁶

One aim of this study was to expand on prior studies with Detroit residents, particularly in the AA-LOW community, who identified inadequate access to supermarkets and limited availability and selection, poor quality, and high prices of fruit and vegetables as barriers to healthy eating.^{27–30} Given these results, what might explain the fact that

no statistically significant difference across communities was found in this study in the mean overall selection or price of fresh produce at stores? One potential explanation is economic inequality. Those with lower incomes in the AA-LOW community were asked to pay a higher proportion of their income for produce that we found to be of inferior quality; therefore, fresh produce may be too expensive. Other potential explanations center on factors that may negatively affect residents' perceptions of the selection or price of fresh produce for sale in their communities. These factors include inferior selection and higher prices for other foods or goods sold; perceptions that the types of food stores in their communities are less desirable, to the extent that residents prefer chain grocery stores as some data suggest;³¹ dilapidated or dirty stores when store cleanliness is valued;^{27,31,32} and well-documented strained relationships between African-American residents and historically White and now largely Middle-Eastern store owners and operators.³³

Study Limitations

Results of this study should be interpreted as conservative for three reasons. First, the relatively small number of stores in each community that sold fresh produce provided low statistical power to detect differences in selection, quality, or price. Second, community variation in selection or price, and possibly larger differences in quality, may have been observed if more socially and economically advantaged communities (eg, predominately White, high-SEP community) had been included in the comparisons. Third, use of the lowest-cost brand and size to assess quality may have underestimated quality differences.

The four communities differed in other ways besides racial composition and SEP, creating a challenge in attributing differences to race and SEP. Inclusion of gas stations with conve-

nience stores was beyond the scope of our study; future studies could examine the extent to which these stores contribute to fresh fruit and vegetable access for urban populations. Other limitations of this study include the following: data were collected at only one time point; inclusion of only four communities limits the generalizability of results; estimates for the proportion of the population in each community that was within a mile of a store were based only on stores located within the community and not stores surrounding the community; and we did not consider frozen, canned, or dried fruit and vegetables, which may also contribute to dietary intakes.

Implications

Larger samples of communities and stores with better statistical power and control for confounders are needed to determine whether access to healthy food differs by community racial composition, SEP, or a combination of the two. Future studies in which individual-level data are collected concurrently with systematic assessments of food environments are warranted to directly test hypotheses regarding relationships between neighborhood food environments and dietary practices, obesity, and racial/ethnic disparities in health. Improving access to high-quality fresh produce in this and possibly other low-income communities of color is necessary to modify dietary practices, as improvements in dietary habits cannot happen without access, even if access alone is insufficient. Greater access to healthy food options could cultivate preferences for healthy foods like fruit and vegetables and thus lead to improved dietary quality and health in this population.³⁴

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