

Research and Professional Briefs

Associations between Neighborhood Availability and Individual Consumption of Dark-Green and Orange Vegetables among Ethnically Diverse Adults in Detroit

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ABSTRACT

Diets rich in dark-green and orange vegetables have been associated with a reduction in chronic diseases. However, most Americans do not consume the number of daily servings recommended by the 2005 Dietary Guidelines for Americans. An increasing number of studies suggest that changes to the neighborhood food environment may be critical to achieving population-wide improvements in eating. The objective of this study was to examine the relationship between observed neighborhood availability and individual consumption of dark-green and orange vegetables among low- to moderate-income and ethnically diverse adults in Detroit. This study used a cross-sectional design that drew upon a 2002-2003 community survey and 2002 in-person audit of food stores. A total of 919 adults (mean age 46.3 years, 52.2% female) including African Americans (56.7%), Latinos (22.2%), and whites (18.7%) residing in three Detroit communities participated in the survey. Two-level weighted, hierarchical linear regression was used to analyze the data. On average, survey respondents ate 0.61 daily servings of dark-green and orange vegetables. Residents of neighborhoods with no stores carrying five or more varieties of dark-green and orange vegetables were associated with an average of

0.17 fewer daily servings of these foods compared with residents of neighborhoods with two stores carrying five or more varieties of dark-green and orange vegetables ($P=0.047$). These findings suggest that living in a neighborhood with multiple opportunities to purchase dark-green and orange vegetables may make an important contribution toward meeting recommended intakes.

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Diets rich in dark-green and orange vegetables have been associated with a reduction in chronic diseases such as cardiovascular disease, certain cancers, and type 2 diabetes (1). These protective effects are generally credited to the additive and synergistic effect of antioxidants and other nutrients found in these vegetables (2-4). The importance of consuming dark-green and orange vegetables is underscored by the Healthy People 2010 guidelines, which include an objective to increase the proportion of individuals aged 2 years and older who eat at least one daily serving (5). The US Department of Agriculture also included a specific recommendation for dark-green and orange vegetable intake in the 2005 Dietary Guidelines for Americans (6,7). In general, 0.6 to 0.9 servings of dark-green vegetables and 0.4 to 0.6 servings of orange vegetables per week are recommended for adults (6,7). Yet, recent research indicates that intakes of dark-green and orange vegetables among Americans do not meet recommendations (5,7-9). Among adults aged 19 years and older, average daily servings of dark-green vegetables ranged from a low of 0.1 for adults aged 19 to 30 years to a high of 0.3 for men aged 51 to 70 years and women aged 31 to 70 years (7). For orange vegetables, the average daily servings among subpopulations ranged from a low of 0.1 for men aged 19 to 50 years and women aged 51 to 70 years to a high of 0.2 for all other adults (7).

Eating behavior is complex and is influenced by factors at multiple levels, including individual factors (ie, demographic, cognitive, behavior, and biologic) and social (eg, peer interactions and social support), physical (eg, restaurants and workplace), and macro-level (eg, food policies and societal norms) environments (10). Dietetics practitioners have traditionally focused their research and intervention efforts at the individual level. Yet, increasingly, researchers are emphasizing the need for environmental and policy strategies that increase the availability of nutritious foods to support individuals in

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making healthy food choices (10,11). Research has found associations between neighborhood availability of retail food stores and eating patterns among residents, even after controlling for individual-level characteristics (12-21). Most of these studies have relied on store type (eg, supermarkets) as a proxy for the supply of nutritious foods (13,16,18,20), despite research showing neighborhood differences in the food supply after accounting for store type (22-25). Of those studies using observed measures of food availability, the majority have found that greater neighborhood availability of nutritious foods is associated with higher intakes across demographically diverse groups (12,14,15,17,19,21).

Although the literature suggests that neighborhood food availability may play an important role in fruit and vegetable consumption, extant research is limited in at least two ways. First, few studies have gone beyond using store type as a proxy for the supply of nutritious foods to examine relationships between directly observed availability and individual intake of fruits and vegetables. Second, little is known about the relationship between neighborhood availability and individual intake of dark-green and orange vegetables specifically, despite their health benefits. The purpose of this study, therefore, was to examine the relationship between observed neighborhood availability and individual consumption of dark-green and orange vegetables among low- to moderate-income and ethnically diverse adults in Detroit, MI. It was hypothesized that greater availability of dark-green and orange vegetables would be associated with higher consumption of these foods.

METHODS

Setting

This study was conducted in three large geographic communities in Detroit, MI, where residents experience excess mortality due to cardiovascular disease compared to the state and the nation (26-28). Similar to other urban communities, Detroit residents have limited access to stores that sell nutritious foods, and this is particularly true in low-income, predominantly African-American communities (14,15,25,29). Once a thriving and prosperous city, Detroit has experienced population out-migration and economic disinvestment since the 1950s (28,30). Economic restructuring and a history of policies and practices that facilitated movement of employers and whites—but not African Americans—to suburban neighborhoods are among the factors that have shifted the city's racial composition, employment opportunities, and access to resources such as supermarkets (28,29,30-33).

Study Design and Sample

This community-based participatory research study used a cross-sectional design and drew upon two data sources. The first data source was a 2002-2003 community survey of a stratified proportional probability sample of 919 African-American, Latino, and non-Hispanic white adults aged ≥ 25 years residing in eastside, southwest, or northwest Detroit (28). The survey was developed and conducted by the Healthy Environments Partnership, a community-based participatory research partnership that

examines environmental factors associated with cardiovascular disease risk and inequities (28). The overall response rate (number of completed interviews from the number of households in the sample estimated to have an eligible respondent) was 55%. Interviews were completed with 75% of households in which an eligible participant was identified (34). Participants were nested within 146 Census blocks. All participants provided written informed consent and received \$25 for their participation. The University of Michigan Institutional Review Board approved all study protocols. The second data source was a 2002 in-person audit of 80 fresh fruits and vegetables at 304 food stores located in the involved communities, conducted by two graduate students (including second author) and one community resident (25).

Measures

Dark-Green and Orange Vegetable Intake. Dark-green and orange vegetable intake was measured using an interviewer-administered, modified Block Food Frequency Questionnaire (35) in which participants were asked to evaluate their individual food intake. Dark-green and orange vegetables were defined as sweet potatoes, yams, carrots, greens (ie, collard greens, mustard greens, or spinach), kale, broccoli, and winter squash (ie, pumpkin, acorn squash, and butternut squash). Standard serving-size pictures were used to improve participants' estimations of the portion sizes they consumed. Daily servings of dark-green and orange vegetables were calculated using a two-step procedure. First, reported intake frequencies, ranging from "never" to "every day," were converted into daily frequencies using the following weights: "almost never" = 0, "2 to 3 times per month" = 0.1, "1 to 3 times per week" = 0.29, "4 to 6 times per week" = 0.71, and "every day" = 1. Second, serving size was coded between 0.5 to 1.5 servings. For each item, daily servings were then calculated by multiplying the frequency of reported intake for each item by its portion size.

Neighborhood Availability of Dark-Green and Orange Vegetables. Drawing on prior research (36-38), neighborhood was defined as a 0.5-mile radial buffer from participants' census block centroids (geometric centers). To assess availability of dark-green and orange vegetables, food stores (ie, all sizes of grocery stores, convenience stores, stores without gasoline, meat markets, fresh produce and meat markets, and liquor stores) were first identified from a list provided by the Michigan Department of Agriculture (25,39). Next, through in-person audits (25), store locations were confirmed and availability of 16 fresh dark-green and orange vegetables was assessed: sweet potatoes, yams, carrots, collard greens, mustard greens, turnip greens, spinach, kale, broccoli, pumpkin, acorn squash, butternut squash, spaghetti squash, buttercup squash, green leaf lettuce, and romaine lettuce. Neighborhood availability of dark-green and orange vegetables was measured as a count of the number of stores in the neighborhood that carried five or more varieties of dark-green or orange vegetables. (Five was used as the cutoff point to define stores with a selection of dark-green and orange vegetables from which to choose because it was the mean number of varieties of dark-green and orange vegetables available across the stores.) The number of stores carrying five or more vari-

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