Access to Healthy Food Stores Modifies Effect of a Dietary Intervention

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Background: Recent evidence suggests that opening a grocery store in a food desert does not translate to better diet quality among community residents.

Purpose: This study evaluated the influence of proximity to a healthy food store on the effect of a dietary behavioral intervention on diet among obese adults randomized to either a high fiber or American Heart Association diet intervention.

Methods: Participants were recruited from Worcester County, Massachusetts, between June 2009 and January 2012. Dietary data were collected via 24-hour recalls at baseline and 3, 6, and 12 months post-intervention. Based on in-store inspection data, a store was considered as having adequate availability of healthy foods if it had at least one item available in each of 20 healthy food categories. Linear models evaluated maximum change in dietary outcomes in relation to road distance from residence to the nearest June healthy food store. The analysis was conducted in January to June 2014.

Results: On average, participants (N=204) were aged 52 years, BMI=34.9, and included 72% women and 89% non-Hispanic whites. Shorter distance to a healthy food store was associated with greater improvements in consumption of fiber (b=–1.07 g/day per mile, $p<0.01$) and fruits and vegetables (b=–0.19 servings/day per mile, $p=0.03$) with and without covariate adjustment.

Conclusions: The effectiveness of dietary interventions is significantly influenced by the presence of a supportive community nutrition environment. Considering the nationwide efforts on promotion of healthy eating, the value of improving community access to healthy foods should not be underestimated. Clinical Trial Registration Number: NCT00911885

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Introduction

To curb the rising prevalence of obesity and associated chronic diseases, nationwide efforts are being made to improve accessibility of healthy foods in communities. These efforts are well justified because a calorically balanced diet that is low in saturated fat and sodium, and high in fruits and vegetables, is essential for maintaining health and has been associated with lower risk for obesity and related chronic diseases.[1] However, nutrient-rich, calorie-light foods are predominantly only available in well-stocked grocery stores.

Many studies,[2–9] mostly cross-sectional, have shown associations of greater access to healthy foods with better dietary quality and lower prevalence of chronic conditions. A study[10] of 60,775 postmenopausal women in the U.S. found that greater availability of grocery stores within a 1.5-mile radius of the participant's home was associated with lower BMI and diastolic blood pressure. In the Framingham Heart Study,[11] however, living closer to a grocery store was associated with a higher BMI. In the Multi-Ethnic Study of Atherosclerosis,[5] a population-based prospective study of adults aged 45 and older, better access to healthy foods was associated with a 38% lower incidence in type 2 diabetes. Among younger adults, greater availability of grocery stores was not associated with better diet quality.[3] To date, the evidence

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for greater healthy food availability translating into better health in communities remains equivocal.

Two critical issues regarding physical access to healthy foods remain to be answered. The first is whether improving a community's retail food infrastructure alone will induce desired changes in dietary behaviors. A recent study by Cummins et al.[12] reported that the opening of a new supermarket in a low-income Philadelphia community considered a "food desert" did not lead to improvements in fruit and vegetable intake or BMI. These results highlight the importance of concurrent community-based behavioral interventions such as raising awareness and motivating residents for positive behavioral changes, because improved access alone failed to induce desired outcomes. The second issue is to what extent an individual living in a community with limited access to healthy foods can improve his or her diet. This paper addresses this issue by examining whether access to healthy food stores influences the success of a dietary intervention among community-dwelling obese adults with metabolic syndrome. The analysis used prospectively collected 24-hour dietary recall data on participants of a randomized dietary intervention trial funded by the National Heart, Lung, and Blood Institute (NCT00911885), and prospectively collected information on availability and quality of food items in food stores located in close proximity to participants' residence during the same period.

Methods

Study Population and Setting

Methods for recruiting participants and collection of participant sociodemographic, anthropometric, behavioral, clinical, and dietary data have been described elsewhere.[13] Briefly, 240 participants were recruited from Worcester County, Massachusetts, and surrounding municipalities between June 2009 and January 2012. The randomized trial was designed to compare the efficacy of two interventional approaches to dietary change among community-dwelling obese adults with metabolic syndrome. The two approaches were (1) the American Heart Association (AHA) Dietary Guidelines,[14] which are the current recommendation for patients with the metabolic syndrome,[15,16] and (2) a dietary change condition that focused exclusively on increasing dietary fiber consumption. Participants were randomized to one of the two interventions (n=120 per arm). The dietary intervention for both conditions consisted of 14 sessions (two individual and 12 group) described in detail elsewhere.[13] The study protocol was approved by the University of Massachusetts Medical School (UMMS) IRB, and all participants gave written informed consent.

The present analysis included 204 (85% of total) participants after excluding 19 without dietary recall data at a post-baseline visit, and an additional 17 whose residential neighborhoods were outside Worcester County, Massachusetts, where no food store data were collected.

Individual-Level Measurements

Dietary intake data were collected via 24-hour recalls at baseline and 3, 6, and 12 months post-intervention. Dietary intake was assessed with a 24-hour recall interview conducted by phone on two randomly selected weekdays and one weekend day, which is the gold standard for collecting dietary intake data among community-living adults. The dietary analysis was conducted using the current version of the multiple-pass, interactive Nutrition Data System for Research (NDS-R, Nutrition Coordinating Center, University of Minnesota, Minneapolis MN). Many measures have been developed to provide a single dietary score for U.S. populations with evidence that the whole-diet eating pattern is important in disease risk.[17–19] Dietary quality was measured using the alternate healthy eating index (AHEI),[20,21] which evaluates selected criteria of a healthy cardiovascular diet, including (1) fruit; (2) vegetables; (3) nuts and legumes; (4) ratio of white to red meat; (5) cereal fiber; (6) trans fat; (7) ratio of polyunsaturated fat to saturated fat; and (8) alcohol. Meal locations were identified by participants as where they consumed their food, which were chosen from locations in NDS-R and grouped according to meals eaten "at/away from home." Percentage of total kilocalories by meal location were then determined.

Anthropometric, sociodemographic, and clinical characteristics were evaluated at the baseline visit including age, race/ethnicity, income, employment status, blood pressure, lipids, and overall physical and mental health. In addition, the investigators assessed several psychosocial variables related to healthy eating, including dietary attitudes, self-efficacy, social support, and perceived barriers.

Geographic coordinates of participants' homes were obtained by geocoding their residential addresses using ArcGIS Desktop, version 10.1. Participants' town-level demographic and socioeconomic indicators were obtained from the U.S. Census 2010 and the American Community Surveys. Participants' neighborhood characteristics of interest included measures of income, educational attainment, housing characteristics, community stability, and urbanicity.

Neighborhood Healthy Food Availability Measurement

There were 106 grocery stores, defined as those selling at least one item of fresh produce year-round, in Worcester County. They were identified annually through on-site surveying and InfoUSA (Infogroup©, Papillion NE) databases using Standard Industrial Classification code 5411 and related subsidiary codes, including 541100 (grocery stores), 541101 (supermarkets), 541199 (grocery stores by type and ownership), and 5431 (fruit and vegetable markets) and its subsidiary codes. The stores were surveyed annually between 2007 and 2010.

Healthy food availability was assessed using the validated Community Nutrition Environment Evaluation Data System (C-NEEDS), which is modified from the Nutrition Environment Measures Survey.[22] Briefly, the C-NEEDS captures detailed information on availability, quality, and nutrient content of healthy and unhealthy foods sold in food stores in the Northeast region. Key modifications were (1) inclusion of regionally available and popular foods with improved cultural relevance to the Northeast; (2) addition of canned and frozen foods important to low-income and rural populations; (3) inclusion of foods common to Latino/Hispanic populations; (4) finer assessment of foods containing nutrients deemed beneficial or detrimental to cardiovascular health and weight control (e.g., saturated versus