

Rural and Urban Differences in the Associations between Characteristics of the Community Food Environment and Fruit and Vegetable Intake

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ABSTRACT

Objective: To examine the relationship between measures of the household and retail food environments and fruit and vegetable (FV) intake in both urban and rural environmental contexts.

Design: A cross-sectional design was used. Data for FV intake and other characteristics were collected via survey instrument and geocoded to the objective food environment based on a ground-truthed (wind-shield audit) survey of the retail food environment.

Setting: One urban and 6 contiguous rural counties.

Participants: This study involved 2,556 residents of the Brazos Valley, Texas, who were selected through random-digit dialing.

Main Outcome Measure: Two-item scale of FV intake.

Analysis: Data were analyzed using chi-square analysis, 2-sample *t* tests, and linear regression.

Results: Distance to supermarket or supercenter was insignificant in the urban model, but significant in the rural model ($\beta = -.014$, $P < .010$, confidence interval = $-.024, -.003$).

Conclusions and Implications: Retail food environments have different impacts on FV intake in urban and rural settings. Interventions to improve FV intake in these settings should account for the importance of distance to the retail food environment in rural settings.

Key Words: fruit and vegetable intake, retail food environment, rural and urban population, food security (*J Nutr Educ Behav.* 2011;43:426-433.)

INTRODUCTION

The consumption of fruits and vegetables (FV) is a key indicator of a healthful diet, which is associated with positive health outcomes such as a reduction in the incidence of cardiovascular disease and cancer.^{1,2} The 2005 Dietary Guidelines for Americans call for 4.5 cups (9 servings) of FV daily, based on a 2,000-calorie diet.³ This amount compares unfavorably to a nationwide assessment of total FV consumption that indicates mean per capita consumption of FV is roughly 2.6 cups, not accounting for losses resulting from cooking or other factors.⁴ Most Americans do not meet the 4.5-cup minimum, making the increase of FV intake a key target for healthful eating interventions.^{5,6}

Research on health promotion often frames explanations for individual health decisions within an ecological context.⁷ In the case of food choices such as FV consumption, the ecological context has been conceptualized as the nutritional or food environment.⁸⁻¹² The food environment, specifically the accessibility of healthful food, has been determined to influence a range of dietary health indicators including obesity rates, as well as the consumption of FV and low-fat dairy products.¹³⁻¹⁸

Research on food access often examines spatial disparity, which refers to the unequal distribution of goods among different spatially embedded populations.¹⁹ These studies often focus on urban rather than rural environments.⁹ Spatial disparity in access

to essential goods and services is exacerbated by living in a rural rather than an urban setting.¹⁹⁻²¹ However, little work has been done on the spatial distribution of food resources in rural communities.^{13-17,22,23} Even less work has been conducted on comparisons between urban and rural food environments. One exception is the work of Pearce et al, who found that more-deprived urban and semi-urban neighborhoods in New Zealand had better access to community resources than more affluent neighborhoods, but that access was worse for more-deprived rural environments.²⁴

Fruit and vegetable intake is also influenced by the ecological context of food choice. Both household and retail food environments influence food choice and FV intake. The household food environment, also referred to as the household food setting, has been characterized as the linkage between the retail food environment and individual consumption.²⁵ In work on food access among rural, low-income populations, Smith and Morton describe aspects of the household food environment, including food security and household economic concerns,

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as principal factors constraining food choice.²⁶ Food security is not only tied to overall household food supplies, but it is also directly linked to greater FV intake.²⁷⁻²⁹

The household food environment is, in turn, framed by the availability of food resources, which is in part determined by elements of the retail food environment.^{25,30} The retail food environment is composed of a variety of food store types, such as supercenters, supermarkets, small grocery stores, convenience stores, dollar stores, mass merchandisers or discounters, and pharmacies with food areas.^{31,32} The following are 3 retail food environment characteristics that serve as barriers or facilitators to food purchase: variety, quality or freshness, and price. Variety has been characterized as a structural constraint based on food store size that limits the range of food choice options.²⁶ There is greater variety in larger stores, which are more often located in urban centers.^{16,26} Greater variety has been associated with increased FV intake.³³ Food quality or freshness is another such constraint, and better food quality is a strong predictor of food choice.³³ In focus group research, Smith and Morton identified poor food quality, including spoiled FV, as a factor that limited food choices for rural populations. Furthermore, food in the smaller food stores typical of rural environments is often of lower quality than the food available in the larger grocery stores found mainly in urban settings, reducing the access of rural populations to higher quality fresh and frozen food.^{26,34} Price also influences food choice; and larger food stores in urban centers are understood to have better food prices.^{26,34} The perception that FV are relatively expensive in comparison to alternative food choices has been linked to overweight among parents and children, and to lower FV consumption.^{35,36}

Another structural aspect of the retail food environment is the spatial accessibility of retail food outlets to homes. Residents of neighborhoods with relatively poor access to supermarkets (often referred to as food deserts) tend to eat fewer FV and have greater body mass index.^{30,33,37-40} Disparities in food access are the greatest in rural communities. These disparities arise from the distance and

method of transportation involved in access. Transportation may be problematic, as public transportation is especially lacking in rural settings, forcing rural residents who do not own vehicles to rely on family members, friends, and others for their transportation or shopping.^{39,41} Furthermore, residents may travel much greater distances than urban residents to shop for food.²⁶ For example, Connell et al discovered a disparity in levels of physical access in the Mississippi Delta; more than 70% of low-income households were located at distances greater than 30 miles from a supermarket or large food retailer.²²

Across a limited number of studies, a range of methods has been used to successfully confirm the association between dietary intake and the accessibility of the retail food environment. Zenk et al determined the suburban or urban (city of Detroit) location of the most important source of groceries, and they found an indirect effect of location on FV intake.³³ Rose et al found that self-reported accessibility variables such as easy access or distance from home to food store were related to fruit consumption.⁴⁰ Laraia et al found that proximity of supermarkets measured in objective distance was positively associated with diet quality.³⁸ Inagami et al calculated accessibility as residents' distance from the census block group where they reported shopping for groceries, and Morland et al determined accessibility as the number of food store types in a resident's neighborhood.^{37,39}

Although previous research has examined the association between accessibility measures of the local food environment and measures of dietary health, few studies have compared these associations across urban and rural settings. This study aims to extend research in this area by (1) determining the extent of inadequacy of household and community food resources, and (2) identifying the varying sociodemographic, household, and community characteristics that influence FV intake in both the urban and rural food environments.

METHODS

This study used data from the 2006 Brazos Valley Health Assessment

(BVHA) and 2006 Brazos Valley Food Environment Project (BVFEP). Data on residents of the Brazos Valley were obtained from the 2006 BVHA, and data on the objective measure of access to the retail food environment were obtained from the 2006 BVFEP. Each data set includes the 1 urban and 6 rural counties of the Brazos Valley Economic Development District, located in central Texas. The Institutional Review Board at Texas A&M University approved both studies.

The BVFEP is a ground-truthed description of the Brazos Valley food environment (land area of 11,567 km²). Details on ground truthing and the Brazos Valley food environment were reported in an earlier study.³² Ground-truthed methods entail performing an on-site survey of all locations within the area where one can purchase food by driving each navigable road, conducting a windshield survey of food establishments, and obtaining on-site geographic coordinates for each location. Data on the network distance via road from each study participant to the nearest supermarket or superstore were obtained from the BVFEP.

Participants and Recruitment

A survey research firm at Texas A&M University identified 9,940 valid telephone numbers for BVHA respondents through random-digit dialed telephone screening. Telephone coverage was estimated by the 2000 Census at 96.8% for the Brazos Valley, with 95.2% for rural counties.⁴² As the survey was initially conducted to assess the health of the entire adult population of the Brazos Valley, the sampling was not stratified by age, race/ethnicity, or location. The sampling process identified 3,501 respondents who agreed to participate, with a response rate of 73.8% (2,584 respondents). The initial mailed packet included the survey booklet and cover letter, a small monetary incentive, and a postage-paid envelope, followed 2 weeks later by a postcard reminder. A complete description of the methodology has been published elsewhere.^{17,32} Respondents who did not answer items used in the 3 regression analyses were dropped from the sample, leaving an analytic sample of 2,260 respondents. All participants were geocoded to their residence.

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