Community food environment measures in the Alabama Black Belt: Implications for cancer risk reduction

Rebecca Gyawu a, Joseph E. Quansah b, Souleymane Fall b, Peter N. Gichuhi a, Adelia C. Bovell-Benjamin a,*

a Department of Food and Nutritional Sciences, Tuskegee University, Tuskegee, AL 36088, United States
b Department of Agriculture, Tuskegee University, Tuskegee, AL 36088, United States

A R T I C L E   I N F O

Keywords:
Alabama Black Belt
Retail food outlets
Community food environment
Cancer prevention
Health promotion messages
In-store food survey
Healthy food availability

A B S T R A C T

In-store measures were utilized to evaluate the availability of healthy food choices and nutrition/health promotion messages for cancer risk reduction in the selected Alabama Black Belt counties/cities. Sixty one retail food outlets (RFOs) were audited in 12 Alabama Black Belt cities. Store types included convenience stores (49.2%), restaurants (19.7%), fast food restaurants (16.4%), small supermarkets (8.2%), and large supermarket and farmers’ markets (3.3%), respectively. Although there were low numbers of farmers’ markets/street stands and large supermarkets, these had significantly (p < 0.0001) higher health scores than the other store types. A few health promotion messages were highly visible or obscurely positioned in some RFOs. The Alabama Black Belt food environment had limited opportunities for healthy food choices.

© 2015 Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Introduction

It is now recognized that the health and wellbeing of individuals can be most effectively handled at the community level (Glanz, 2009). Glanz (2009) has emphasized that availability of healthy food choices and health promoting resources such as amenities for healthy eating and physical activity are integral components for the maintenance of healthy behaviors and lifestyle within communities. Neighborhood or community food environments include the number, type, location, and accessibility of food outlets such as grocery stores, fast-food restaurants, and full-service restaurants, the availability of healthy food choices, price, health promotion and the placement of nutritional information (Story et al., 2008; Glanz et al., 2005).

Geographically, the Alabama Black Belt (ABB) is positioned within the Gulf South’s Coastal Plain in a crescent-shaped area, roughly 32.2 to 40.2 km wide, which stretches from eastern, south-central Alabama into northwestern Mississippi (Fig. 1). The racial makeup of the ABB was 49.8% African Americans, 35.0% White, 0.9% Hispanics or Latinos and 0.3% other races in the 2010 census. The ABB is characterized by persistent poverty, unemployment, low education levels, poor health, unhealthy eating habits, single parenthood and heavy dependence on public assistance programs (Zekeri, 2003). Other features typical of the rural communities observed in the ABB are the inherently sparse populations, and large distances, which influence the types of food environment present. Additionally, the ABB is also known for its high prevalence of chronic diseases such as cancer, heart disease and diabetes. For example, higher stroke mortality has long been found common among residents of these southeastern states also known as the “Stroke Belt region”, of which the ABB is inclusive (Liao et al., 2009).

Poor dietary habits and physical inactivity have been implicated as risks factors in the escalating occurrences of cancer of all sites globally, the United States (U.S.) included (WCRF/AICR, 2007). Estimates by World Cancer Research Fund/American Institute of Cancer Research (WCRF/AICR) found that 30 to 40% of all cancers can be prevented by appropriate diets, physical activity and maintenance of appropriate body weight (WCRF/AICR, 2007). In the U.S., cancer is the second leading cause of death, accounting for one of every four deaths (Hoyert and Xu, 2012). African Americans are more likely to develop and die from cancer than any other racial or ethnic group. The reasons for these differences are complex, with many interrelated factors, including barriers to high quality health care, poor diets, low incomes, low education levels, and racial discrimination (Ries et al., 1994). In Alabama, cancer is the second leading cause of death. Alabama’s cancer (all sites) incidence rate per 100,000 population for females from 2007 to 2011 were (406.3) and (435.8) for African Americans and Whites, respectively. However, African American females had higher mortality rates (173.0) as compared to their White (151.2) counterparts for the same period. Among males, both African Americans and Whites in Alabama had incidence rates of 606.2 and 540.8, respectively. Similar to the females, in Alabama, the mortality rates for African American males (275.5) were higher than that for the White males (214.0) (American Cancer Society Inc., 2015). It should be stressed that poor dietary habits and physical inactivity have also...
been implicated as risks factors in other chronic diseases such as diabetes and cardiovascular diseases.

Table 1 shows the cancer incidence and mortality rates for selected Black Belt counties in Alabama. Cancer incidence rates for all sites, races and genders indicated that Russell County had the highest incidence rate of 544.4/100,000 population between the period of 2007 and 2011, which was greater than the Alabama and U.S. average rates of 463.3 and 459.8, respectively. Shelby County had the lowest incidence rate of 378.8 (Table 1). With regards to cancer mortality rates, Russell County also had the highest rates of 224.1/100,000, while Shelby County had the lowest rates (157.4) (Table 1).

Recently, there has been an upsurge in research measuring relationships among community food environments, diet-related chronic diseases, food choices, and diet quality (He et al., 2012; Saelens et al., 2012; An and Sturm, 2012; Chaiz et al., 2013; LeDoux and Vojnovic, 2013; James et al., 2014; Richardson et al., 2014). The findings from this large body of research are contradictory, and several limitations have been reported (Lucan, 2015). Methodological limitations, inaccurate datasets to identify food sources, categorizations of food sources based on generalized type, inclusion of only a limited range of food sources and consideration of food sources in isolation are some of the limitations reported (Lucan, 2015; Larson and Story, 2009; Farley et al., 2010).

Despite the increasing food environment research and the limitations noted, little specific data are available on the food environment in the Alabama Black Belt. The USDA has a comprehensive Food Environment Atlas, which compares U.S. counties in terms of communities’ access to affordable, healthy food. However, the Atlas uses pre-existing datasets to identify the food outlets, and not primary collection. The Atlas does not take into account impermanent food sources such as Farmers’ street stands. Additionally, the reports in the Atlas are based on counties with no indication as to what is happening in the cities which make up the counties; some cities may be more affected than others.

In an effort to fill the large research gaps and issues regarding the food environment in the ABB, Bovell-Benjamin et al. (2009) began to systematically document the food environment in the ABB to discern whether community members in the ABB cities could consistently make healthy choices. In their earlier published work, the food environment...
in Macon County, a predominantly African American county, and one of the 18 traditional ABB counties was evaluated. The majority of studies have examined food environment in single contexts, such as in minority, low-income, Hispanic/Latino or African American and urban communities. The current study, unlike previous research, focused primarily on describing the food environment in the rural Alabama Black Belt. The Black Belt allowed for a multi-context situation in a single study, including communities with sub-populations of Whites, African Americans, low-income, and other minorities.

This study is part of an on-going, larger USDA-funded project, which has the goal and objectives to: i) systematically investigate the food and physical activity environment in the rural Alabama Black Belt counties; ii) examine the feasibility of increasing access to healthful food options in convenience stores in selected Alabama Black Belt counties, by engaging stakeholders in a formative evaluation; and iii) use the findings to implement a pilot project partnering with selected convenience stores to ensure healthy foods are more available and affordable. All 18 Alabama Black Belt counties will be ultimately evaluated; in this study the researchers evaluated those counties next on the list and used Shelby County for comparative purposes. Specifically, the current study utilized in-store measures to evaluate the availability of healthy food choices and nutrition/health promotion messages for cancer risk reduction in the selected Alabama Black Belt counties.

Table 1
Alabama cancer incidence and mortality rates for selected counties; all cancer sites, all races (includes Hispanic), both sexes and all ages; rate period 2007 to 2011 (cases/100,000 population/year).

| County     | Annual rate (95% confidence interval) | Annual rate (95% confidence interval) |
|------------|---------------------------------------|---------------------------------------|
|            | Incidence                             | Mortality                             |
| U.S.       | 459.8 (459.4–460.1)                   | 171.2 (171.0–171.4)                   |
| Alabama    | 463.3 (460.7–465.9)                   | 191.2 (189.5–192.9)                   |
| Russell    | 544.4 (517.0–572.8)                   | 224.1 (206.7–242.36)                  |
| Barbour    | 474.5 (440.9–510.1)                   | 201.0 (179.2–224.9)                   |
| Lowndes    | 466.6 (415.0–523.1)                   | 207.4 (173.1–246.6)                   |
| Pike       | 474.7 (441.4–509.9)                   | 189.8 (169.2–212.1)                   |
| Shelby     | 371.5 (358.8–384.5)                   | 157.4 (149.0–166.2)                   |

Available at: http://www.statecancerprofiles.cancer.gov; accessed 02/05/2015.

Methods

Research setting

The study was conducted in five counties and 12 cities in rural Alabama (Fig. 2). The counties were primarily located in the Alabama Black Belt with the exception of Shelby County. Study counties were Barbour, Russell, Pike, Lowndes and Shelby (Fig. 2). Table 2 shows the demographic characteristics of the counties and cities. The cities in Barbour County were Clayton and Clio with poverty rates of 29.3 and 28%, respectively. Of the four cities in Lowndes County, Mosses had the highest poverty rate (55.4%); while 96.7% of its residents were African Americans (Table 2). At the time of the study, Hurtsboro in Russell County had a poverty rate of 44.0% and 67.6% of its residents were African Americans. As shown in Table 2, Shelby County was predominantly White, and a non-Black Belt county with a poverty rate of 7.4%, making it the richest county in the study, as well as the richest and healthiest County in Alabama (Alabama Demographics, 2013).

Identification of retail food outlets (RFOs)

In order to compile a working database, a commercial list of stores was obtained from on-line local and regional Yellow Pages, Chamber of Commerce Directories, Trade Dimensions®, InfoUSA, other databases such as SNAP Retailer Locator, Directory of convenience stores and personal contacts. To complement the predetermined working database, and enhance its accuracy, a ground-truthing verification survey was utilized. The researchers systematically drove through all the study cities, verified and included all RFOs in each city.

Data collection tools

Checklist

The U.S. Department of Agriculture (USDA) Thrifty Food Plan (TFP) checklist was utilized as the surveying tool for the RFO audits. The TFP was designed by the USDA as a national standard for a healthy diet.
Demographic characteristics of the study counties and cities.

| Study counties and cities | Total population | African Americans (%) | Median income ($) | Poverty rate (%) |
|--------------------------|------------------|------------------------|------------------|-----------------|
| Barbour                  | 27,457           | 46.9                   | 33,219           | 29.3            |
| Clayton                  | 1913             | 64.0                   | 23,629           | 29.3            |
| Clio                     | 1399             | 36.3                   | 21,806           | 28.0            |
| Lowndes                  | 11,299           | 73.9                   | 29,714           | 27.3            |
| Whitehall                | 858              | 96.0                   | 30,000           | 31.0            |
| Moses                    | 1029             | 97.0                   | 13,750           | 55.4            |
| Hayneville               | 932              | 85.0                   | 19,140           | 35.3            |
| Fort Deposit             | 1344             | 76.0                   | 30,000           | 22.2            |
| Pike                     | 32,899           | 37.4                   | 29,181           | 28.6            |
| Brundidge                | 2076             | 62.7                   | 21,798           | 34.0            |
| Russell                  | 52,947           | 41.8                   | 32,084           | 23.3            |
| Hurtsboro                | 533              | 67.6                   | 25,000           | 44.0            |
| Seale                    | 4622             | 27.2                   | 35,612           | 20.2            |
| Fort Mitchell            | 3719             | 37.7                   | 49,755           | 6.4             |
| Shelby®                  | 195,085          | 11.1                   | 68,380           | 74.0            |
| Harpersville             | 1637             | 24.0                   | 37,768           | 28.4            |
| Wilsonville              | 1827             | 7.1                    | 46,979           | 18.1            |

*Non-black belt county.

A health promotion checklist (HPC) was utilized to document the health promotion messages, visibility, target and purpose of the message. The surveyors indicated appropriate response on the HPC. Restaurants were audited as described by Bovell-Benjamin et al. (2009). A healthy grading scorecard (HGS) was developed to grade each RFO. The scores were 1 to 3, with 1—being very unhealthy, 2—unhealthy, and 3—very healthy. To score a 3, a RFO had to contain 100% of the food items under the ‘Very healthy’ category. For a score of 2, 45–49% of the foods listed under the ‘Healthy’ category must be available in the RFO; and for a score of 1, 50–70% of the foods listed under the ‘Very unhealthy’ category should be available in the RFO (Table 3).

Conducting the audit

The study was of a cross-sectional, in-store, non-obtrusive, observational design. Training of the surveyors occurred in actual stores, which were not sampled in the study. Permission to conduct the audit was obtained from each RFO owner/manager. All RFOs in each city were audited by the surveyors. As described by Bovell-Benjamin et al. (2009), two trained surveyors conducted a walkthrough of each RFO to collect the data. All audits were conducted after 9:00 a.m. since many food outlets restock and shelve during the early morning hours (Bovell-Benjamin et al., 2009). Opportunities for healthy food choices were defined as availability, and availability was defined as the food being present on the shelf of the RFO at the time of audit. For the restaurants, including the fast food types, the menus were audited. Approximately 10 to 45 min were used to audit each RFO, depending on the type.

Table 2
Demographic characteristics of the study counties and cities.

| Study counties and cities | Total population | African Americans (%) | Median income ($) | Poverty rate (%) |
|--------------------------|------------------|------------------------|------------------|-----------------|
| Barbour                  | 27,457           | 46.9                   | 33,219           | 29.3            |
| Clayton                  | 1913             | 64.0                   | 23,629           | 29.3            |
| Clio                     | 1399             | 36.3                   | 21,806           | 28.0            |
| Lowndes                  | 11,299           | 73.9                   | 29,714           | 27.3            |
| Whitehall                | 858              | 96.0                   | 30,000           | 31.0            |
| Moses                    | 1029             | 97.0                   | 13,750           | 55.4            |
| Hayneville               | 932              | 85.0                   | 19,140           | 35.3            |
| Fort Deposit             | 1344             | 76.0                   | 30,000           | 22.2            |
| Pike                     | 32,899           | 37.4                   | 29,181           | 28.6            |
| Brundidge                | 2076             | 62.7                   | 21,798           | 34.0            |
| Russell                  | 52,947           | 41.8                   | 32,084           | 23.3            |
| Hurtsboro                | 533              | 67.6                   | 25,000           | 44.0            |
| Seale                    | 4622             | 27.2                   | 35,612           | 20.2            |
| Fort Mitchell            | 3719             | 37.7                   | 49,755           | 6.4             |
| Shelby®                  | 195,085          | 11.1                   | 68,380           | 74.0            |
| Harpersville             | 1637             | 24.0                   | 37,768           | 28.4            |
| Wilsonville              | 1827             | 7.1                    | 46,979           | 18.1            |

Table 3
Healthy grading scorecard (HGS) used in the study.

| Healthy | Very healthy | Healthy | Very unhealthy |
|---------|--------------|---------|----------------|
| Score   | (100%)       | (45–49%)| (50–70%)       |
| Grains  | Whole wheat bread | Whole wheat bread | Grains  |
| Fat and oils | Lean meat, fresh fish, low sodium meat | Canned fruits no added |
| Fruits and vegetables | Fruits and vegetables | Canned fruits no added |
| Meat    | Lean meat, fresh fish, low sodium meat | Canned fruits no added |
| Dairy product | Skim milk, low fat yogurt, milk 1% fat |Skim milk, low fat yogurt, milk 1% fat |

Statistical analysis

To quantify the types of RFOs, a frequency count was taken of each type. This was summed across the total number of RFO type available in each city. Fisher’s exact test was used to determine if there was any relationship between city and type of outlet, and county and type of outlet. For availability, frequency was taken of food items under the seven categories of the checklist. Also, Fisher’s exact test was used to determine whether selected food item availability was dependent on type of RFO and location, that is, city and county (Freeman and Julious, 2007). The Kruskal–Wallis test was utilized to determine whether there were differences in the health scores by RFOs (Chan and Walmsley, 1997).

Results

Identification and audit of RFOs

Sixty one retail food outlets were audited in five counties and 12 cities of Alabama. Overall, 30 convenience stores, 10 fast food restaurants, 12 restaurants, five small supermarkets, two large supermarkets and two Farmer’s street stands, respectively, were audited. Table 4 shows...
the number and types of retail food outlets identified and audited in the study.

Availability of healthy food choices

County Business Patterns (CBP) is an annual series, which provides subnational economic data by industry and the number of establishments and employment. This database could also serve as a useful tool for policymakers, administrators and planners. Tables 4 and 5 compare the establishments identified in this study and those from the CBP.

Milk, milk products and cheese

Russell County. Table 6 shows the types of outlets, milk, milk products and cheeses identified in Russell County.

Pike County. In Pike County, five types of RFOs were identified and audited (Table 6). Skimmed milk was available only in the large supermarket. Low fat milk was available in one convenience store and the supermarkets. All restaurants audited carried regular cheese.

Barbour County. Four types of RFOs were identified in Barbour County (Table 6). None of the RFOs contained low fat or low sodium cheese, but all with the exception of four convenience stores carried regular cheese.

Lowndes County. Table 6 shows the types of outlets, milk, milk products and cheeses identified in Lowndes County. Skimmed milk was available in one convenience store and the supermarket. In terms of city, availability of whole grain bread was similar. With whole grain rice, there was a statistically significant (p ≤ 0.05) relationship between skimmed milk availability and type of RFO. This indicated that at least one type of RFO did not stock skim milk; this was the convenience stores. Therefore, not all RFOs sold skimmed milk. In this study, skimmed milk was mostly available in the limited number of large and small supermarkets audited. In terms of skimmed milk availability by county, there was no statistically significant relationship; no county had more than the other. Overall, in the five counties studied, the RFOs presented limited opportunities for purchasing skimmed milk. With regards to cities, there were no statistically significant differences between skimmed milk availability and city.

Grains and grain product

Russell County. RFOs were also audited for grains and grain product availability (Table 6). More than 85% of the convenience stores in Russell County stocked whole grain bread. None of the restaurants served whole grain bread, but it was available at the fast food restaurant.

Pike County. In Pike County, 66 and 33% of the convenience stores carried whole grain bread and breakfast cereal, respectively (Table 6). Of the fast food restaurants, 66% served whole wheat bread.

Barbour County. Table 6 shows that 17% of the convenience stores in Barbour County carried whole grain bread, and 33% sold whole grain breakfast cereal.

Lowndes County. In this county, 20% of the convenience stores audited carried whole grain bread, whole grain breakfast cereal and whole grain rice (Table 6). None of the restaurants served whole grain product, but 66% of the fast-food restaurants audited carried whole grain bread. White bread, white rice, cookies, pastries and pies were the most available in RFOs audited.

Shelby County. In Shelby County, one of the four convenience stores identified carried whole grain bread and whole grain rice; two carried whole grain breakfast cereal (Table 6).

Fisher’s exact test revealed no statistical significant difference between whole bread availability and type of RFO. This implied that whole wheat bread was available in all types of RFOs. In terms of city and county, availability of whole grain bread was similar. With whole grain rice, there was a statistically significant (p ≤ 0.05) relationship between availability and type of outlet. At least one type of RFO did not carry whole grain rice. Overall, the cities and counties in this study lacked whole grain rice in the RFOs audited. With whole grain breakfast

Table 4
Retail food outlets (RFOs) identified and audited in the counties (N = 61).

| County and cities | Convenience store | Restaurant | Fast food restaurant | Large supermarket | Small supermarket | Farmer street stand | Total |
|-------------------|-------------------|------------|----------------------|-------------------|-------------------|-------------------|-------|
| Russell           | 7                 | 5          | 1                    | 0                 | 1                 | 1                 | 15    |
| Hurtsboro         | 2                 | 1          | 0                    | 0                 | 0                 | 0                 | 4     |
| Seale             | 1                 | 0          | 0                    | 0                 | 0                 | 0                 | 1     |
| Fort Mitchell     | 4                 | 4          | 1                    | 0                 | 1                 | 1                 | 9     |
| Pike              | 3                 | 1          | 3                    | 1                 | 1                 | 0                 | 9     |
| Brundidge         | 3                 | 1          | 3                    | 1                 | 1                 | 0                 | 10    |
| Barbour           | 6                 | 1          | 2                    | 0                 | 1                 | 0                 | 10    |
| Clayton           | 3                 | 1          | 2                    | 0                 | 1                 | 0                 | 10    |
| Clio              | 3                 | 0          | 0                    | 0                 | 0                 | 0                 | 6     |
| Lowndes           | 10                | 1          | 3                    | 1                 | 1                 | 0                 | 16    |
| Whitehall         | 0                 | 0          | 0                    | 1                 | 0                 | 0                 | 1     |
| Mosses            | 1                 | 0          | 0                    | 0                 | 0                 | 0                 | 1     |
| Hayneville        | 2                 | 1          | 1                    | 0                 | 1                 | 0                 | 4     |
| Fort Deposit      | 7                 | 0          | 2                    | 0                 | 0                 | 0                 | 9     |
| Shelby*           | 4                 | 4          | 1                    | 0                 | 1                 | 1                 | 11    |
| Harperville       | 3                 | 3          | 3                    | 0                 | 0                 | 1                 | 7     |
| Wilsonville       | 1                 | 1          | 0                    | 0                 | 1                 | 0                 | 2     |
| Total             | 20                | 12         | 10                   | 2                 | 5                 | 2                 | 61    |

* Non-black belt county.
cereals, there was a statistically significant \((p \leq 0.05)\) relationship between whole grain breakfast cereals availability and type of outlet, indicating that not all types of RFOs carried whole grain breakfast cereal; it was mostly found in the supermarkets.

**Fruits and vegetables (F&V)**

**Russell County.** RFOs were audited for fruit and vegetable availability (Table 6). None of the convenience stores in Russell County carried fresh F&V, but they carried canned vegetables. Sixty percent of the restaurants carried fresh vegetables, but none carried fresh fruits. Small and large supermarkets carried fresh F&V as well as the one Farmer’s street stand audited.

**Pike County.** In Pike County, fresh vegetables were available in the restaurants and fast-food restaurants but not fresh fruits (Table 6).

**Barbour County.** For Barbour County, one convenience as well as one restaurant store sold fresh vegetables (Table 6).

**Lowndes County.** The availability of F&V is shown in Table 6. None of the convenience stores in Lowndes County sold F&V. All fast-food restaurants audited served fresh vegetables but no fruits.

**Shelby County.** For Shelby County none of the convenience stores sold fresh vegetables, but two sold fresh fruits (Table 6). Again, fresh fruits and vegetables were available in the single Farmer’s street stand audited.

**Fats and oils**

**Russell County.** A high percentage (57%) of the convenience stores in Russell County carried regular oil and 43% stocked poly-mono unsaturated vegetable oil (Table 6). None of these convenience stores carried fat reduced poly-mono unsaturated margarine or unsalted butter. The small supermarket had in stock poly-mono unsaturated vegetables, regular vegetable oils, fat reduced poly-mono unsaturated margarine, unsalted butter and regular butter (Table 6). The restaurant used regular oil and unsalted butter and the fast food identified used regular oils. The small supermarket had available a wide variety of options such as poly-mono unsaturated vegetables oil, regular vegetable oils, fat reduced poly mono unsaturated margarine, unsalted butter and regular butter.

**Lowndes County.** In Lowndes County, of the 10 convenience stores, seven sold poly-mono unsaturated vegetables oil; six sold regular oil, and one stocked regular butter (Table 6). The small supermarket stocked everything with the exception of fat reduced poly-mono saturated margarine.

**Shelby County.** Poly-mono unsaturated vegetable oil was available in three of the four convenience stores in Shelby County (Table 6). Two convenience stocked regular oils and one stocked regular butter. The small supermarket audited stocked all options.

**Meats and meat alternatives**

**Russell County.** The meats found in convenience store in Russell County were mostly bacon, sausages and luncheon meat (Table 6). Most of the seven convenience stores sold canned fish; no fresh fish or lean meats were sold in the RFOs audited. The restaurants served regular cuts of meat, bacon, sausages and luncheon meat. Two of the restaurants sold lean cuts of meat and one served fresh fish.

**Pike County.** In Pike County, of the three convenience stores, one sold regular cuts of meat and two sold bacon, sausages and luncheon meat (Table 6). The small supermarket audited sold all options with the exception of low sodium meats and lean minced meat. The large supermarket carried no low sodium meat.

**Barbour County.** All convenience stores were mostly stocked with bacon, sausages and luncheon meat (Table 6). Similar to Russell County, the small supermarket identified sold all options with the exception of low sodium meat.

**Lowndes County.** The convenience stores in Lowndes County stocked mostly bacon, sausages and luncheon meat (Table 6). Restaurant sold regular cut of beef, bacon, sausages and luncheon meat, lean minced meat, lean cut of meat and fresh fish.

**Shelby County.** Canned fish in water was more available than bacon, sausages and luncheon meat in the convenience stores in Shelby County (Table 6). Restaurants sold regular cuts of beef, regular poultry skin off and lean cuts of meat and one sold fresh fish.

**Healthy grading scorecard (HCS)**

The obtained value of the H statistics in the Kruskal–Wallis Test revealed that there was a significant \((p <.0001)\) difference in mean health scores by type of RFOs. Further inspection of the scores by types of RFOs audited revealed that the two farmers’ street stands and the large

| Table 5 |
| --- |
| Establishments identified by the 2013 county business patterns. |
| NAICS code | NAICS code description | Food and beverage stores | Grocery stores | Supermarkets and other grocery except convenience stores | Specialty stores | *CS* | Gas stations with CS | Full service restaurants | Limited services restaurants | Cafeterias, grills, grill buffets |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4472 | Retail trade Accommodation and food services | 13 | 11 | 10 | 1 | 1 | 36 | 21 | 41 | 1 |
| 4479 | Accommodation and food services | 9 | 5 | 5 | 2 | 1 | 18 | 14 | 24 | - |
| 4476 | Accommodation and food services | 2 | 2 | 2 | - | 1 | 6 | 3 | 1 | - |
| 4478 | Accommodation and food services | 52 | 35 | 28 | 1 | 7 | 95 | 128 | 140 | 4 |

* CS—Convenience stores (2013 County Business Patterns [NAICS]; available at: Censstats.census.gov; accessed 07/21/2015).
### Table 6
Availability of healthy food choices.

| Availability of healthy food choices | Counties and cities                                                                 | Milk, milk product and cheese | Grains and grain products | Fruits and vegetables | Fat and oils | Meat and meat alternatives |
|-------------------------------------|-------------------------------------------------------------------------------------|------------------------------|--------------------------|-----------------------|-------------|--------------------------|
| Russell—Hurtsboro, Seale, Fort Mitchell | RFOs N = 15 Cities audited N = 3                                                   | CS (n(7))                    | √                        | √                     | √           |                          |
| Pike—Brundidge                       | RFOs N = 9 Cities audited N = 1                                                     | SS (n(1))                    | √                        | √                     | √           |                          |
| Barbour—Clayton, Clio                | RFOs N = 10 Cities audited N = 2                                                    | LS (n(0))                    | √                        | √                     | √           |                          |
| Lowndes—Whitehall, Mosses, Hayneville, Fort Deposit | RFOs N = 16 Cities audited N = 4                                                   | FFR (n(2))                   | √                        | √                     | √           |                          |
| Shelby—Harperville, Wilsonville      | RFOs N = 11 Cities audited N = 2                                                    | R (n(1))                     | √                        | √                     | √           |                          |
|                                     | √<sup>1</sup>,<sup>2</sup>,<sup>3</sup>,<sup>4</sup>,<sup>5</sup>,<sup>6</sup>,<sup>7</sup>,<sup>8</sup>,<sup>9</sup>,<sup>10</sup> | FM (n(0))                    | √                        | √                     | √           |                          |
|                                     | √<sup>11</sup>,<sup>12</sup>,<sup>13</sup>,<sup>14</sup>,<sup>15</sup>,<sup>16</sup>,<sup>17</sup>,<sup>18</sup>,<sup>19</sup>,<sup>20</sup> | √<sup>21</sup>,<sup>22</sup>,<sup>23</sup>,<sup>24</sup>,<sup>25</sup>,<sup>26</sup>,<sup>27</sup>,<sup>28</sup>,<sup>29</sup>,<sup>30</sup>,<sup>31</sup> | √                        | √                     | √           |                          |
|                                     | √<sup>32</sup>,<sup>33</sup>,<sup>34</sup>,<sup>35</sup>,<sup>36</sup>,<sup>37</sup>,<sup>38</sup>,<sup>39</sup>,<sup>40</sup>,<sup>41</sup> | √<sup>42</sup>,<sup>43</sup>,<sup>44</sup>,<sup>45</sup>,<sup>46</sup>,<sup>47</sup>,<sup>48</sup>,<sup>49</sup>,<sup>50</sup>,<sup>51</sup>,<sup>52</sup> | √                        | √                     | √           |                          |
|                                     | √<sup>53</sup>,<sup>54</sup>,<sup>55</sup>,<sup>56</sup>,<sup>57</sup>,<sup>58</sup>,<sup>59</sup>,<sup>60</sup>,<sup>61</sup>,<sup>62</sup> | √<sup>63</sup>,<sup>64</sup>,<sup>65</sup>,<sup>66</sup>,<sup>67</sup>,<sup>68</sup>,<sup>69</sup>,<sup>70</sup>,<sup>71</sup>,<sup>72</sup>,<sup>73</sup> | √                        | √                     | √           |                          |
|                                     | √<sup>74</sup>,<sup>75</sup>,<sup>76</sup>,<sup>77</sup>,<sup>78</sup>,<sup>79</sup>,<sup>80</sup>,<sup>81</sup>,<sup>82</sup>,<sup>83</sup> | √<sup>84</sup>,<sup>85</sup>,<sup>86</sup>,<sup>87</sup>,<sup>88</sup>,<sup>89</sup>,<sup>90</sup>,<sup>91</sup>,<sup>92</sup>,<sup>93</sup>,<sup>94</sup> | √                        | √                     | √           |                          |
|                                     | √<sup>95</sup>,<sup>96</sup>,<sup>97</sup>,<sup>98</sup>,<sup>99</sup>,<sup>100</sup>,<sup>101</sup>,<sup>102</sup>,<sup>103</sup>,<sup>104</sup> | √<sup>105</sup>,<sup>106</sup>,<sup>107</sup>,<sup>108</sup>,<sup>109</sup>,<sup>110</sup>,<sup>111</sup>,<sup>112</sup>,<sup>113</sup>,<sup>114</sup>,<sup>115</sup> | √                        | √                     | √           |                          |

<sup>n</sup>—Number of retail food outlets (RFOs) audited.
<sup>√</sup> represents the number of individual retail food outlet that carried the food item.
CS—convenience store; SS—small supermarket; LS—large supermarket; FFR—fast food restaurant; R—restaurant; FM—farmers market/street stand.
supermarket had significantly higher scores (57.5) than the other types of retail food outlets (Table 7). Convenience stores scored lowest (26.0). By county and city, none of the health score differed from the other, suggesting that there was a lack of opportunity for healthy food choices in both county and city (Table 7). As a result, in the counties and cities inventoried, community members have limited opportunities for healthy food options.

Health promotion checklist (HPC)

Older studies have supported the use of nutrition/health education messages in food outlets. For example, Brown-Rogers et al. (1994) emphasized that the facilitators for positive behavior change must be institutionalized. The authors presented the scenario of the food outlets providing appealing, usable information, which complements the healthful choices as an example of this process. More recent studies have also demonstrated that the provision of nutrition information can help modify food consumption behavior (American Planning Association, 2007; Laraia et al., 2004; Papas et al., 2007). The retail food outlets (N = 61) were assessed for health promoting materials availability. Only a small number of the RFOs audited exhibited health promotion messages (Table 8). Results from Fort Mitchell, Russell County showed four health promoting messages targeting calories, healthy lifestyle, heart healthy options and low sodium in a fast-food restaurant. Characteristics of the health promoting materials are shown in Table 8. In Clayton, Barbour County, one fast-food restaurant displayed a brochure targeting low fat, calories and low sodium intake, which was highly visible since it was well placed at the entrance/exit area. In Whitehall, Lowndes County, the only large supermarket displayed a medium-sized poster targeting healthy lifestyle. However, this health promoting message was visible only to consumers who shopped in certain sections of the supermarket. Similarly, in Brundidge Pike County one of the fast-food restaurants had a small-sized glass counter display nutrition message targeting low fat, low calories on the glass counter, which was obscurely placed.

Discussion

This study used food environment measures, which included identification of retail food outlets (store types), audits of in-store food contents, and health promotion messages to describe the relative availability of healthy options for cancer prevention in some ABB counties. The relationship among diet, cancer and other chronic diseases was derived from older epidemiological studies conducted in the 1970s, which noted that Western diets high in animal-source foods and fats, were associated with high rates of some types of cancer. This linkage between diet and cancer was not observed in developing countries, which had predominantly plant-based diets (Armstrong and Doll, 1975). Migration studies, which revealed that migrants from one country to another generally acquired the cancer rates of the new host country, implicated environmental factors as playing key roles in the variations of cancer rates (Doll and Peto, 1981).

To prevent cancer, the WCRF/AICR (2007) second expert report suggested the consumption of a variety of starchy staple foods, fruits and vegetables, modest intakes of dairy-source foods, lean meat and poultry, large amounts of dietary fiber, unsaturated fats, whole grains and legumes. The findings from the current study indicated that almost half (48%) of the RFOs audited were convenience stores. None of the convenience stores audited, carried fresh fruits and vegetables (FF&V) except for one in Barbour County and another in Shelby, which sold fresh fruits. Mostly, fruits and vegetables were available to community members in the processed (canned) form with high sodium contents. Bear in mind that fresh fruits and vegetables are integral constituents of healthy diets for cancer prevention (WCRF/AICR, 2007). Fruits and vegetables were not readily available to community members in the counties/cities studied.

A similar situation was seen for grain and grain products, mostly processed items such as white rice and bread, and low fiber, high sugar breakfast cereals were available. Again, the WCRF/AICR (2007),

|County| City| Type of RFO| Item| Size| Visibility level| Target|
|---|---|---|---|---|---|---|
|Russell| Fort Mitchell| Fast-food restaurant| Napkin| Small| Highly visible| Calories|
|Barbour| Clayton| Fast-food restaurant| Sticker (2)| Small| Obscure| Calories, healthy lifestyle and sodium|
|Lowndes| Fort Deposit| Fast-food restaurant| Menu board| Large| Highly visible| Heart healthy options|
|||| Notice| Large| Highly visible| Type of fat, calories, sodium|
|||| Brochure| Large| Highly visible| Low fat, nutrition information|
|Pike| Brundidge| Fast-food restaurant| Poster| Large| Highly visible| Calories, healthy lifestyle|
|||| Glass counter display| Small| Obscure| Low fat, low calories, nutrition information|
|Shelby| Hapersville| Fast-food restaurant| Sticker| Small| Highly visible| Calories, healthy lifestyle|
|||| Notice| Large| Highly Visible| Low fat, nutrition information|
|||| Menu board| Large| Highly visible| Calories (food under 500 calories)|
recommended modest intakes of lean meats, limited intakes of red meats and avoidance of processed meat for cancer prevention. However, the RFOs in Russell, Pike, Barbour and Lowndes counties stocked mostly processed meat and meat products such as bacon, sausages and luncheon meat. However, the RFOs in Shelby County carried more lean meats and regular cuts of beef than processed meats.

The RFOs audited had sugary beverages (carbonated soft drinks and juice flavored drinks) more readily available than 100% or natural fruit and vegetable juices. WCRF/AICR (2007) advocates limited consumption or avoidance of sugary drinks to prevent overweight, obesity, thereby reducing the risk of some types of cancers. Another WCRF/AICR's (2007) advice is restricted consumption of salty and processed foods (≤2300 mg sodium daily). Salt and salt preserved foods probably increase the chance of developing stomach cancer by damaging the lining of the stomach. Audits from the RFOs revealed the availability of more regular canned legumes and vegetables than those that were unsalted or had reduced salt. Also, regular butter was more obtainable than unsalted butter in all counties except Barbour, which had equal amounts of both types of butter. Low sodium meats were available only in Shelby County.

Richardson et al. (2014) found that predominantly African American communities had fewer full-service and fast food restaurants than predominantly white communities. However, our findings were varied. For example, in Russell County, the distribution of fast food restaurants was consistent with this finding; the mainly white city of Fort Mitchell had one fast food restaurant versus none in the predominantly African American city of Hurtsboro. On the other hand, in Barbour County, the largely African American city of Clayton had two fast food restaurants versus none in the primarily white city of Clio (Table 6). This is more in keeping with Duran et al.’s (2013) findings that fast food restaurants are more likely to be found in deprived neighborhoods. Perhaps, the outcomes observed in the current study are due to the fact that the white and African American communities were included in a single study rather than separate studies as presented in most of the prior research. Additionally, the uniqueness of the ABB’s characteristic impacted the outcomes, which supports the fact that there is need for more research to be conducted regarding the food environment in the region.

Shelby is the richest and healthiest county in the state of Alabama. Except for Fort Mitchell in Russell County, Wilsonville and Harperville in Shelby County had higher median incomes than all the other cities studied. The community members in the two latter cities were predominantly white. The rural communities in the ABB had similar food environment characteristics in terms of type of outlet (supermarkets, convenience stores) and healthy grading scores. Although our results revealed no statistical difference in the healthy grading scores for the counties, there were some visual divergences. For example, although Shelby County had four convenience stores, they were differently stocked when compared with the other convenience stores in the study. For example, healthy options including skimmed and reduced fat milk, whole grain and grain products, fresh fruits and a Farmer's street stand were available to provide fresh fruits and vegetables. Overall, the convenience stores and small supermarket in Shelby County provided the opportunity for community members to make healthy food choices for cancer risk reduction.

We saw a weak positive correlation (r = 0.36) between the cancer incidence rates for the counties, and the presence of convenience stores. A similarly weak, positive correlation (r = 0.47) was seen between cancer mortality and convenience stores. However, a strong, positive correlation (r = 0.92) was seen between cancer mortality in the counties and presence of fast food restaurants. The value of the coefficient of determination (R²) was 0.85 and the result was significant (p < 0.024) at the 5% level.

Study strengths and limitations

The study's strengths and limitations listed below should be taken into account when interpreting the findings. The ground-truthing approach, which ensured the inclusion of all retail food outlets in the study cities, was utilized. The data presented included a systematic, detailed measure of diverse store types and in-store contents. However, store type was not used as a proxy for the food environment, direct in-store audits were conducted, which limited potential bias and enhanced measurement accuracy. Hutchinson et al. (2012) supported the in-store approach because they reported that availability of healthy and unhealthy options may be a better way to describe the food environment rather than by store type only.

Our study, unlike previous research, allowed for a multi-context situation in a single study. A combination of various sub-population communities such as low-income, African Americans, whites, and other minorities were included in a single study of the food environment. This has rarely been seen in previous published studies. Our study location was advantageous, because the food environment in the ABB is understudied. The same standardized checklist and surveyors were used to measure the food environment in all the RFOs and all the cities/counties. In most food environment research, different tools have been utilized by the various researchers. A comprehensive checklist was utilized to measure in-store food availability and other characteristics such as price, which could ultimately affect purchases. In general, the checklists used by other researchers have been limited in scope. For example, Cheadle et al. (1994), used in-store survey of grocery stores, but the checklist was limited to only low-fat and high fiber foods. Grgisby-Toussaint et al. (2010) limited their assessment to the availability of 25 commonly consumed fruits and vegetables in African American and Latino neighborhoods. The inclusion of the health promotion messages component was novel because these have been shown to influence purchasing behaviors. Additionally, it was incorporated in a more holistic manner in the same study; other researchers have done it in separate studies.

Potential study limitations included: i) the cross-sectional design utilized limits our ability to state that the RFOs identified and audited would be there and stock the same items permanently. Also, closures and changes such as new RFOs could happen, daily, weekly, monthly or even hourly. Only four of the 18 counties in the traditional Alabama Black Belt were included in this study. The study did not measure the quality of food, which could affect purchases.

Conclusion

Supermarket availability was similar in the counties/cities studied. Convenience stores were the most common type of RFOs audited. However, the convenience stores in the more affluent cities of Shelby County were differently stocked in terms of variety of foods. The predominantly African American county/cities (Lowndes) had the most convenient food shopping options as compared to the predominantly white counties. The question then arises, is it even feasible or cost-effective to have large supermarkets in these small, rural communities? Or is it a better option to retrofit existing convenience stores with healthful food options and decrease unhealthy options through nutrition, cancer and other diet-related chronic disease prevention education programs? These are the questions we are currently attempting to answer in the other phase of our research. Changes in the food environment could be a powerful strategy for cancer prevention. Without access to healthy food choices, individuals cannot make positive changes to their diets.

The ABB embodies an under-represented region in food environment studies. This study provides new data on the food environment in the ABB. Understanding, identifying and disseminating information regarding the food environment in the ABB could help inform future interventions. The in-store audits of the RFOs demonstrated that in the ABB communities, many components included in the dietary recommendations for cancer and other diet-related chronic disease prevention were not readily available. Inclusion and placement of health promotion messages, which could help inform community members to make better choices when shopping were also scanty in the RFOs.
There is need for improvement in this area. Community members in the ABB are presented with challenges regarding meeting dietary guidelines for cancer risk reduction.

Conflict of interest statement

The authors declare that there are no conflicts of interests.

Acknowledgments

The authors acknowledge USDA/NIFA and Tuskegee University's George Washington Carver Experiment Station for the funds to conduct the research. The authors would also like to thank all the owners/managers of the retail food outlets for allowing us to conduct the study.

References

Alabama Demographics, 2013. Get Alabama Demographics. Available at: www.alabamademographics.com (accessed July, 2013).

American Cancer Society Inc., 2015. Surveillance Research. Cancer facts and figures. Available at: http://www.cancer.org/research/cancerfactsstatistics/index (accessed 02/05/2015).

American Planning Association, 2007. Policy Guide on Community and Regional Food Planning.

An, R., Sturm, R., 2012. School and residential neighborhood food environment and diet among California youth. Am. J. Prev. Med. 42 (2), 129–135.

Armstrong, B., Doll, R., 1975. Environmental factors and cancer incidence and mortality in different countries, with special reference to dietary practices. Int. J. Cancer 15, 617–631.

Bowell-Benjamin, A.C., Hathorn, C.S., Ibrahim, S., Gichuhi, P.N., Bromfield, E.M., 2009. Healthy food choices and physical activity opportunities in two contrasting Alabama cities. Health Place 15, 429–438.

Brown-Rodgers, A., Kesler, L.G., Ponnoy, B., et al., 1994. Eat for health: a supermarket intervention for nutrition and cancer risk reduction. Am. J. Public Health 84, 72–76.

Chait, B., Meline, J., Duncan, S., et al., 2013. GPS tracking in neighborhood and health studies: a step forward for environment exposure assessment, a step backward for causal inference. Health Place 21, 46–51.

Chan, Y., Walmsley, R.P., 1997. Learning and understanding the Kruskal–Wallis one-way analysis-of-variance-by-ranks test for differences among three or more independent groups. Phys. Ther. 77, 1735–1761.

Cheadle, A.D., Psaty, B.M., Curry, S., et al., 1994. Assessing the validity of a survey of the restaurant health promotion environment. Am. J. Health Promot. 9, 88–91.

Doll, R., Petro, R., 1981. The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. J. Natl. Cancer Inst. 66, 1191–1308.

Durán, A.C., Díez-Roux, A.V., do Rosário, M., Latorre, D.O., Jaime, P.C., 2013. Neighborhood socioeconomic characteristics and differences in the availability of healthy food stores and restaurants in Sao Paulo, Brazil. Health Place 23, 39–47.

Farley, T.A., Baker, E.T., Futrell, L., Rice, J.C., 2010. The ubiquity of energy-dense snack foods: a national multicity study. Am. J. Public Health 100, 306–311.

Freeman, J.V., Julious, S.A., 2007. The analysis of categorical data. Scope 16, 18–21.

Glaz, K., 2009. Measuring food environments: a historical perspective. Am. J. Prev. Med. 36, 593–598.

Glaz, K., Sallis, J.F., Saelens, B.E., Frank, L.D., 2005. Healthy nutrition environments: concepts and measures. Am. J. Health Promot. 19 (5), 330–333.

Grigsby-Tousaint, D.S., Zenk, S.N., Odoms-Young, A., Ruggiero, L., Moise, I., 2010. Availability of commonly consumed culturally specific foods and vegetables in African-American and Latino neighborhoods. J. Am. Diet. Assoc. 110, 746–752.

He, M., Tucker, P., Irwin, J.D., Gilliland, J., Larsen, K., Hess, P., 2012. Obesogenic neighborhoods: the impact of neighborhood restaurants and convenience stores on adolescents’ food consumption behaviors. Public Health Nutr. 6, 1–9.

Hoeyt, D.I., Xu, J., 2012. Deaths: Preliminary Data for 2011. Natl. Vital Stat. Rep. 61 (6) (October 10, 2012. Available at: http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_06.pdf; accessed 02/05/2015).

Hutchinson, P.L., Bodor, J.N., Swalm, C.M., Rice, J.C., Rose, D., 2012. Neighborhood food environments and obesity in southeast Louisiana. Health Place 18, 854–860.

James, P., Berrigan, D., Hart, J.E., et al., 2014. Effects of buffer size and shape on associations between the built environment and energy balance. Health Place 27, 162–170.

Laraia, B., Siega-Riz, A., Kaufman, J., Jones, S., 2004. Proximity of supermarkets is positively associated with diet quality index for pregnancy. Prev. Med. 39, e785-e800.

Larson, N., Story, M., 2009. A review of the environmental influences on food choices. Am. Behav. Med. 38 (Suppl. 1), 556–573.

LeDoux, T.F., Vojnovic, I., 2013. Going outside the neighborhood: the shopping patterns and adaptations of disadvantaged consumers living in the lower eastside neighborhoods of Detroit, Michigan. Health Place 19, 1–14.

Liao, Y., Greenlund, K.J., Croft, J.B., Keenan, N.L., Giles, W.H., 2009. Factors explaining excess stroke prevalence in the U.S. Stroke Belt. Stroke 40, 5336–5341.

Lucan, S.C., 2015. Concerning limitations of food-environment research: a narrative review and commentary framed around obesity and diet-related diseases in youth. J. Acad. Nutr. Diet. 115, 205–212.

Papas, M., Alberg, A., Ewing, R., Helzlsouer, K., Gary, T., Klassen, A., 2007. The built environment and obesity: Epidemiol. Rev. 29, e143–129.

Richardson, A.S., Meyer, K.A., Howard, A.G., et al., 2014. Neighborhood socioeconomic status and food environment: a 20-year longitudinal latent class analysis among CARDIA participants. Health Place 30, 145–153.

Ries, L.A.G., Miller, B.A., Hankey, B.F., Kosary, C.L., Harras, A., Edwards, B.K. (Eds.), 1994. SEER Cancer Statistics Review. National Cancer Institute, Bethesda, MD, pp. 1973–1991 NIH Publication No: 94-2789.

Saelens, B.E., Sallis, J.F., Frank, L.D., et al., 2012. Obesogenic neighborhood environments, child and parent obesity: the neighborhood impact on kids study. Am. J. Prev. Med. 42, e57–e64.

Story, M., Kaphingst, K., Robinson, O., O’Brien, R., Glanz, K., 2008. Creating healthy food and eating environments: policy and environmental approaches. Annu. Rev. Public Health 29, 253–272.

(WCRF/AICR)/World Cancer Research Fund/American Institute For Cancer Research Food, 2007. Nutrition and the Prevention of Cancer: A Global Perspective. Washington, D.C.

Zeiker, A., 2003. Opinions of EBT recipients and food retailers in the rural south. Southern Rural Development CenterFood Assistance Policy Series 6 pp. 1–8.