

## PEER-REVIEWED ARTICLE

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# Food Safety Knowledge and Behaviors among African Americans of Predominantly Low Socioeconomic Status

## ABSTRACT

Few studies have documented food safety knowledge and behaviors among African Americans. We performed a cross-sectional study to assess food safety knowledge, behaviors, and awareness of food safety educational materials among African Americans of low socioeconomic status (SES). A food safety questionnaire was administered to 200 African American participants of predominantly low SES. A food safety score (FSS) was calculated based on responses to 14 questions, with a higher score implying greater food safety knowledge. The overall mean FSS was 10.2/14 (73%). One hundred ten participants (55%) reported inadequate (< 15 seconds) hand washing, and 107 (54%) reported using one cutting board for both meat and produce. Only 34 (17%) had previously heard of the USDA recommendation “to boil chitterlings for 5 minutes before cleaning,” and only half (108, 54%) had heard of at least one of the food safety programs – FightBAC!<sup>®</sup>, Thermy<sup>™</sup>, and Be Food

Safe. Participants who were unemployed at the time of the survey, had less than a high school diploma, prepared chitterlings, and were receiving food stamp benefits scored a significantly lower overall FSS. Active dissemination of educational materials and improved outreach should be considered for better penetration of food safety information among low SES African Americans.

## INTRODUCTION

One of the goals of Healthy People 2020 is to continue to decrease the number of foodborne illness cases by increasing the proportion of consumers who follow key food safety practices (38). To this end, the United States Department of Agriculture’s Food Safety Inspection Services (USDA/FSIS) has outlined goals in its strategic plan (2011–2016) to enhance public education and outreach to improve food-handling practices among U.S. consumers (37). Data from Healthy People 2010 suggest that overall consumer food safety practices improved significantly between 1998 and 2006, with more consumers following safe food practices

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(39). Some of this improvement may be attributable to food safety educational materials and campaigns that have been developed and implemented to promote food safety among consumers. These include, but are not limited to, food safety mobile programs, the “Ask Karen” program, and campaigns such as FightBAC!<sup>®</sup>, ThermY™, Is It Done Yet?, and “Be Food Safe.” In addition, food safety podcasts and fact sheets (34) have been created with at-risk citizens and specific groups of consumers in mind (e.g., those with limited English proficiency). However, there are no data demonstrating the awareness and reach of these food safety educational materials and campaign among various U.S. populations in order to assess implementation success.

Data from FoodNet and the U.S. National Notifiable Diseases Surveillance System (4) indicate that rates of foodborne illness among African Americans and Hispanic populations, compared with Caucasians, vary by pathogen. Compared with Caucasians, these minority populations suffer from greater rates of illness due to several pathogens (*Salmonella*, *Shigella*, *Listeria monocytogenes* and *Yersinia enterocolitica*) (7). For example, FoodNet data from 2010 to 2012 indicate that incidence of foodborne illness associated with *Salmonella* and *Shigella* are highest for African Americans, compared with Caucasians, Hispanics, or Asians (4). A study of trends in incidence of *Yersinia* infections indicated that African American children, < 5 years old had the highest rates of infection (41.5 per 100,000 persons) between 1996 and 1999 (25). This trend among young African American children significantly declined to 3.5 cases per 100,000 persons in 2009 (22), although the incidence was still higher in winter among African American children. A multi-state analysis of laboratory confirmed cases of yersiniosis from nine non-FoodNet-participating U.S. states during the period 2005–2011 observed a similar and statistically significant decreasing annual trend of yersiniosis incidence among African Americans under 5 years of age ( $P = 0.01$ ), compared with whites and Hispanics (6). The analysis also revealed increased number of cases in winter months among African Americans, compared with whites. Overall, among children, < 5 years, African Americans had an average annual incidence of yersiniosis nearly 2.5 times higher than that of whites (6).

Food preferences (2, 3, 21, 40) and disparities in educational opportunities (30, 31) may partly explain foodborne illness risk among socioeconomically disadvantaged minority populations such as African Americans. In addition, poor urban African Americans have been hard hit by the AIDS epidemic and so have a disproportionate percent of their population with this immunocompromising illness, which may adversely affect foodborne illness outcomes (5). Smaller studies have described lower compliance with four recommended behaviors of consumer food safety (cleaning, separating, cooking and chilling) and little use of cooking thermometers among African American minority consumers

(13, 16, 17, 29). A study of food safety behaviors among 153 middle-income African American churchgoers also highlighted improper thawing, refrigeration of leftovers, reheating, and microwaving (28). However, to date no published study has documented food safety practices and behaviors in a large sample of low socioeconomic status (SES) African Americans, exclusively.

The primary objective of this study was to assess meat and poultry food safety knowledge, behaviors, and awareness of food safety educational materials among African Americans of predominantly low socioeconomic status. Our hypothesis was that study participants would answer about 70% or fewer questions correctly on a food safety survey.

## MATERIALS AND METHODS

A questionnaire was developed to obtain information about food safety knowledge and behaviors among African Americans of low socioeconomic status (SES). Focus groups conducted prior to the study provided input regarding the survey questions (10). Additional questions were adopted from tools used in previous food safety studies conducted among urban African Americans and Hispanics living with AIDS (8, 9). Finally, feedback was obtained from two community nutrition peer educators working closely with the community. The survey included standard demographic information such as race, gender, and income, and then asked specifically about handling and consumption of raw meats and chitterlings (a popular holiday food made from pork intestines) (40), cooking, refrigeration, cross-contamination, and hand hygiene practices. These items were followed by questions about the awareness of currently available national food safety education materials. The questionnaire was pilot tested among 10 participants, randomly selected at the participating locations.

Since our target population was low SES African Americans, participants were recruited via fliers and intercept communication at two public health clinics in the metropolitan Chicago area predominantly serving people of color with gross income levels at or below 130% of the federal poverty guidelines. Participants were excluded if they could not consent for themselves, did not speak English fluently, were younger than 18 years, or were not primarily responsible for preparing food in their homes.

Informed consent was obtained from each participant. Compensation of \$15 was offered for participation. Approval from the Institutional Review Board for Protection of Human Subjects was obtained for each participating site before initiation of the study.

Statistical analysis was performed using SAS<sup>®</sup> 9.3 for Windows. Frequencies of socio-demographic variables were calculated. A variable called the food safety score (FSS) was created on the basis of the number of knowledge, belief, and behavior questions that were answered correctly. These 14 questions addressed risky food-handling and food consump-

tion behaviors, knowledge regarding safe food-handling and preparation, and knowledge regarding food temperatures. The maximum FSS was 14. While scientific literature did not provide guidance on what constituted a low food safety score in this population we defined it as < 70% to explore risk factors associated with this outcome. This number was based on food safety scores reported in a previous study that included urban African American patients living with AIDS in Chicago and New Orleans (8, 9).

A response of “Not sure” was categorized as an incorrect response. In the case of belief and behavior questions, responses that would place the patient at lower risk for foodborne disease were considered correct. We compared mean FSS between categories of socio-demographic variables, using *t*-tests and analysis of variance. We calculated frequency of correct response to each of the questions. We compared food safety scores and frequency of correct response to food safety knowledge, belief, and behavior questions between those who cook/prepare chitterlings and those who do not. We also calculated prevalence ratios and 95% confidence intervals to compare frequency of correct responses to questions on selected food safety related behaviors that involved a quantitative response among participants by level of education.

## RESULTS

The demographics of our study population (*n* = 200) are reported in (Table 1). Forty (58%) of these participants reported an annual household income of less than \$30,000. The average number of members in these households was 2.8 (Standard Deviation [SD]:  $\pm 1.4$ ) placing them at or below the federal poverty guideline level for families (32). Therefore, we estimate that at least 156 (78%) of our study participants either were unemployed or had income but were at or below the federal poverty line for families. Fifty-seven (29%) reported that either the respondent or a member of the respondent's immediate family had become ill from food.

Many participants reported eating at a sit-down restaurant at least once per week (2% 5 or more times a week, 5% 3–4 times a week, 40% 1–2 times a week, 37% less than once a week, and 16% never). Many participants ate take-out or drive-through food at least once per week (4% 5 or more times a week, 14% 3–4 times a week, 42% 1–2 times a week, 28% less than once a week, and 13% never). Most participants had more than half of their meals prepared at home every week (35% all of their meals, 44% more than half of them, 15% about half of them and 8% less than half).

The frequency of correct responses to the 14 food safety knowledge and behavior questions used to calculate the FSS varied widely (Table 2). Overall, participants had particularly low knowledge regarding food temperatures and storage times. Although 172 (86%) knew where to place a meat thermometer, only 59 (29%) reported owning one. Two-thirds of study participants did not respond with the

safest behavior concerning a hypothetical scenario in which raw chicken juice was splashed on ready-to-eat produce. Additionally, about half of the participants (54%) reported using one cutting board for both meat and produce.

Fifty-six (28%) consumers cooked or prepared pork chitterlings. Only 32 (57%) of them knew to lather their hands with soap for at least 15 seconds during hand washing. Among these chitterling food handlers, 34 (61%) did not boil the chitterlings for 5 minutes before cleaning them (a recommendation of the USDA), and only 17 (30%) had heard of this recommendation. Ninety-one percent of those who did not boil chitterlings (*n* = 34) did not know about the USDA recommendation.

One hundred eight participants (54%) had heard of at least one food safety education program – FightBAC!® (49%), Be Food Safe (14%), or Thermy™ (6%). There was no significant association between Internet use and awareness of any of these food safety programs (*P* = 0.11).

Overall, the mean food safety score (FSS) was 10.2 out of 14 (72.8%, SD:  $\pm 2.03$ ). Participants who were employed at the time of the survey (10.6 vs 9.9, *P* = 0.02), and those with access to the Internet (10.4 vs 9.7, *P* = 0.04) had a higher mean FSS than those who were unemployed or had no Internet access (Table 3). Those who were receiving food stamp/ SNAP benefits had a lower mean FSS than those who were not (9.8 vs 10.6, *P* < 0.01). Participants with a higher educational level had a higher prevalence of correct responses in general.

Those who did not cook or prepare chitterlings had a significantly higher mean FSS than those who did (10.4 vs 9.7, *P* = 0.02). We explored the data for evidence that chitterling preparers might have poorer knowledge of any individual questions; however, there were no statistically significant differences in frequency of correct response to individual questions between these two groups.

## DISCUSSION

Overall, participants scored 72.8% on the educational food safety survey, a result in accordance with our study hypothesis. We consider this figure neither alarmingly low nor satisfactory, given the availability of food safety educational materials and the serious outcomes of foodborne illness. Our findings support reports of suboptimal practices that have been documented in smaller qualitative studies (less than 25 participants) among similar populations in Miami and Philadelphia (13, 29). Such practices include thawing frozen meats on counters or in the sink, not adhering to the “2-hour” rule of consuming or chilling cooked meat, not using a cooking thermometer, incorrect knowledge regarding reheating temperatures of leftover meats, and using color of meat as an indicator of doneness. These findings are especially relevant to persons who cook and prepare chitterlings or any high-risk meats and those with immunocompromised family members.

**Table 1. Characteristics of the population of low SES African Americans who participated in the survey (n = 200)**

Demographic characteristics	n (%)
<b>Gender</b>	
Female	125 (62.5)
Male	75 (37.5)
<b>Age categories*</b>	
18–30 years	21 (11)
31–49 years	62 (31)
50–64 years	94 (47)
65 or more years	22 (11)
<b>Employment status*</b>	
Currently employed	74 (37)
<b>Type of residence*</b>	
Apartment	109 (55)
House	90 (45)
Ever worked as a food handler	78 (39)
<b>Income category (n = 70)</b>	
Less than \$10,000	11 (16)
\$10,000 to less than \$15,000	9 (13)
\$15,000 to less than \$25,000	11 (16)
\$25,000 to less than \$30,000	9 (13)
\$30,000 to less than \$35,000	3 (4)
\$35,000 to less than \$40,000	6 (9)
\$40,000 to less than \$45,000	7 (10)
\$45,000 to less than \$75,000	10 (13)
\$75,000 or more	4 (6)
Receive food stamp/SNAP benefit	78 (39)
Access to a computer with Internet access	141 (71)
*Data missing for 1 participant	

Cross-contamination behaviors during preparation of chitterlings, and poor handwashing practices while handling pacifiers, have been identified as key risky behaviors in outbreaks of *Yersinia enterocolitica* among African-American infants (2, 3, 13, 15, 18). Forty-five percent of our study participants (including chitterling preparers) reported inadequate handwashing (< 15 seconds), and about half of the participants (54%) reported lack of compliance with the USDA recommendation to use separate cutting boards for meat and produce (35). Therefore, preventing cross-

contamination and improving hand hygiene knowledge still remain important educational targets for this group.

In addition, another potential target for education is the importance of heating ready-to-eat deli meats, especially among those with weakened immune systems due to a variety of conditions, including disease and pregnancy. One in 6 participants thought it was “okay” to eat expired meats, or eat hot dogs without heating them first. Such a practice can allow for infection with *Listeria*. A 1998 US outbreak of at least 50 cases of listeriosis, including 6 deaths, was



**Table 2. Responses to 14 food safety knowledge, attitudes, and behavior questions that were used to calculate the food safety score (FSS)**

Question Number	Food Safety Knowledge and Behavior Questions <sup>†</sup>	Number (%) of respondent with correct response (n = 200)
<b>Risky food consumption behavior</b>		
1.	Is it okay to eat meat past its expiration date if it looks or smells fine? <input type="checkbox"/> Okay <input checked="" type="checkbox"/> Not okay ✓ <input type="checkbox"/> Don't know	175 (88)
2.	Is it okay to eat a pork chop that is rare? <input type="checkbox"/> Okay <input checked="" type="checkbox"/> Not okay ✓ <input type="checkbox"/> Don't know	192 (96)
3.	Is it okay to eat store-bought hot dogs w/o heating them first? <input type="checkbox"/> Okay <input checked="" type="checkbox"/> Not okay ✓ <input type="checkbox"/> Don't know	166 (83)
<b>Risky food-handling behavior</b>		
4.	Is it okay to put meats next to fruits/vegetables in grocery cart? <input type="checkbox"/> Okay <input checked="" type="checkbox"/> Not okay ✓ <input type="checkbox"/> Don't know	152 (76)
5.	If raw vegetables for salad are accidentally splashed with a few drops of raw chicken juice, should you rinse the vegetables in water, throw the vegetables away, or are you not sure? <input type="checkbox"/> Rinse <input checked="" type="checkbox"/> Throw away ✓ <input type="checkbox"/> Don't know	66 (33)
<b>Risky food-handling/preparation knowledge</b>		
6.	Is it okay to thaw ground meat on the counter? <input type="checkbox"/> Okay <input checked="" type="checkbox"/> Not okay ✓ <input type="checkbox"/> Don't know	144 (72)
7.	Is it okay to use color of beef as a reliable indicator of doneness? <input type="checkbox"/> Okay <input checked="" type="checkbox"/> Not okay ✓ <input type="checkbox"/> Don't know	132 (66)
8.	How should cooked and ready-to-eat foods be stored with raw meat, poultry, seafood and their juices? <input type="checkbox"/> Stored together <input checked="" type="checkbox"/> Stored separately ✓ <input type="checkbox"/> Does not matter <input type="checkbox"/> Don't know	185 (93)

(Continued on next page)

**Table 2. Responses to 14 food safety knowledge, attitudes, and behavior questions that were used to calculate the food safety score (FSS) (cont.)**

9.	How should packaged meat be bagged with other cold items? <input type="checkbox"/> Bagged together <input checked="" type="checkbox"/> <b>Bagged separately</b> ✓ <input type="checkbox"/> Does not matter <input type="checkbox"/> Don't know	175 (88)
10.	Do you boil chitlins or chitterlings for 5 minutes before cleaning and cooking? <input checked="" type="checkbox"/> <b>Yes, boil chitterlings before cleaning and cooking</b> ✓ <input type="checkbox"/> No, don't boil chitterlings before cleaning and cooking <input checked="" type="checkbox"/> <b>Don't cook chitterlings</b> ✓ <input checked="" type="checkbox"/> <b>Buy pre-cooked chitterlings</b> ✓ <input type="checkbox"/> Don't know	166 (83)
<b>Time and temperature knowledge</b>		
11.	How hot should leftover meat be reheated before serving? <input checked="" type="checkbox"/> <b>Reheated until steamy hot</b> ✓ <input type="checkbox"/> Reheated until warm but not hot <input type="checkbox"/> Not reheated <input type="checkbox"/> Don't know	92 (46)
12.	In order to check if the meat is done, where would you put the meat thermometer? <input type="checkbox"/> Stick a meat thermometer in the thinnest part of the meat <input checked="" type="checkbox"/> <b>Stick a meat thermometer in the thickest part of the meat</b> ✓ <input type="checkbox"/> Put a meat thermometer under the meat <input type="checkbox"/> Don't know	172 (86)
13.	How long can cooked meat be left safely at room temperature? <input type="checkbox"/> More than 4 hours <input type="checkbox"/> Between 2 to 4 hours <input checked="" type="checkbox"/> <b>Less than 2 hours</b> ✓ <input type="checkbox"/> Don't know	111 (56)
14.	Number of seconds someone should lather hands with soap while washing their hands. <input type="checkbox"/> _____ Seconds* <input type="checkbox"/> Don't know <input checked="" type="checkbox"/> <b>*15 seconds or more considered correct</b> ✓	110 (55)

†responses that were considered correct for the purpose of calculating the food safety score in our study are marked with a check.

traced back to contaminated hog dogs and possibly deli meats (12). In 2008, 23 deaths in a multi-province outbreak of listeriosis, in Canada were linked to deli meats (1). In 2015, three recalls due to *Listeria* contamination occurred with ready-to-eat meat products (19). While listeriosis has been strongly implicated as a cause of sepsis and death, it is likely also an underreported cause of diarrheal disease. For example, in 2008 an outbreak of gastroenteritis occurred in Austria in which 80% of 15 persons who ate platters of mixed cold cuts developed symptoms of febrile gastroenteritis within 1 to 2 days (23). Similarly, in 2001 an outbreak of

febrile gastroenteritis was reported from Los Angeles County among healthy, mostly young, attendees of a catered party where the implicated food was pre-cooked sliced turkey (11). In the absence of routine public health surveillance for gastroenteritis caused by *Listeria* spp., the extent of risk to the general consumer from deli meats and hot dogs is unquantifiable but, we believe, should be a consideration given the reported outbreaks.

About a third of our study participants reported that it was “okay” to eat raw salad vegetables that were splashed with raw chicken juices. It is unclear if this behavior is related to food

**Table 3. Comparison of food-safety scores (FSS) by selected characteristics (n = 200)**

Category	Mean score (SD)	P-value
Gender		
Male	10.1 (2.1)	0.62
Female	10.2 (2.0)	
Age category		
18–30 Years	10.7 (2.3)	0.14
31–49 Years	10.5 (1.8)	
50–64 Years	9.9 (2.2)	
65 or More Years	10.1 (1.9)	
Employment status		
Employed	10.6 (2.1)	0.02*
Not employed	9.9 (2.0)	
Type of house		
Apartment	9.9 (1.9)	0.04*
House	10.5 (2.1)	
Education categories		
Less than high school diploma	9.6 (2.0)	0.02*
College	10.1 (2.1)	
Bachelor’s or more	11.1 (1.4)	
Receive SNAP benefit/food stamp		
Yes	9.8 (1.9)	< 0.01*
No	10.6 (2.0)	
Ever worked as a food handler		
Yes	10.2 (1.9)	0.80
No	10.2 (2.1)	
Has Internet access		
Yes	10.4 (2.0)	0.04*
No	9.7 (2.1)	

insecurity or lack of awareness. Quinlan et al. suggest that lack of knowledge regarding food handling and consumption could be influenced by low SES status, since such persons might be reluctant to discard food, may have limited access to resources (i.e., cutting boards, paper towels, disinfectants, and thermometers), or may be unable to make purchases considered discretionary (24).

Our data support a poverty, education, and food safety nexus alluded to in other research that focused on handling of foods by consumers of minority and low-income populations (13, 16, 20, 24, 29). Participants in our study who were unemployed at the time of the survey, had less than a high school diploma, prepared chitterlings, and were receiving food stamp benefits scored a significantly

lower overall FSS. The majority of participants in our study resided in neighborhoods recognized as “food deserts” (33, 36). For example, low microbial quality and improper food holding temperatures of perishable food products have been documented in retail stores present in low SES census tracts, compared with those in high SES neighborhoods (27). Therefore, these low SES consumers may have less access to safe foods.

To our knowledge, this study is the first to examine the extent of penetration of national food safety education materials among African Americans of predominantly low SES. Although 70% of the study participants had access to the Internet, nearly half had not heard of any food safety education materials or campaigns, and more than 70% of chitterling preparers had never heard of the USDA recommendation “to boil chitterlings for 5 minutes before cleaning.” Although this is a key message in the “Be Food Safe” fact sheet (34), the fact sheet does not include information about risks of yersiniosis associated with improper handling of chitterlings. Additional information on penetration of food safety education materials beyond Chicago are necessary to assist with planning of food safety programs among African Americans and other populations.

Trepaka et al. identified two important barriers to following food safety recommendations among low SES African American women enrolled in the USDA Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). The first was the perception that foodborne illnesses were associated with food prepared outside participants’ homes, rather than with food prepared at home. The second was that participants reported their food-handling practices were hard to change because they had been learned from their mothers or other family members (29). It may be worthwhile to take materials from programs such as FightBAC!® and Be Food Safe and explore them with focus groups of sub-populations of the U.S., such as low SES African Americans, to determine if they would benefit from being revised to make them more culturally sensitive. Such changes might improve penetration and awareness. For example, materials might acknowledge that Grandma’s advice is important while reminding readers that the food supply and its risks have changed since Grandma learned about food safety.

USDA funds have supported the development of a number of important community-developed food safety educational materials. These include an educational photonovella for African Americans of low SES, derived from

these data (8) and created by two of the authors of this paper (Dworkin and Pratap). Dissemination of such materials could be incorporated into community networks and local clinic-based nutrition education programs to broaden outreach. Future study designs should consider literacy of the population and methods that impact dissemination among low SES populations.

### Study limitations

Limitations of this study include generalizability, since it was conducted at two healthcare facilities in Chicago. Also, the survey gathered information about self-reported behaviors, without direct observation of in-home practices; therefore, there may have been a reporting bias. Although self-reported behaviors in surveys may seem high, observed data (via video monitoring) depict an even higher prevalence of high-risk food handling and hygiene practices among consumers at home (14, 26). Finally, our study design did not include a control group, and data regarding access to specific food safety educational materials/campaigns among other minority populations, or the general population, are lacking, which further limits our ability to compare the results.

### CONCLUSIONS

These data demonstrate important gaps in meat and poultry food safety knowledge and behavior among African Americans of predominantly low SES. Specific areas to emphasize in educational materials for this population include hand hygiene, use of separate cutting boards, and use of meat thermometers. Given the vulnerability of African Americans to yersiniosis related to cross-contamination during chitterling preparation, special attention should be paid to improving awareness of USDA recommendations to boil chitterlings before handling.

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